

ARCHITECTURE FOR DISASTERS:  
UTILIZING ARCHITECTURE TO EFFECTIVELY PROVIDE  
DISASTER RELIEF:  
A CASE STUDY ON POVERTY IN THE DOMINICAN  
REPUBLIC

by

KAELI NOLTE

A THESIS

Presented to the Department of Architecture  
and the Robert D. Clark Honors College  
in partial fulfillment of the requirements for the degree of  
Bachelor of Architecture

Fall 2014

## An Abstract of the Thesis of

Kaeli Nolte for the degree of Bachelor of Architecture  
in the Department of Architecture to be taken Fall 2014

Title: Architecture for Disasters:  
Utilizing Architecture to Effectively Provide Disaster Relief:  
A case study on Poverty in the Dominican Republic

Approved: \_\_\_\_\_



Brook Muller

*“The world is changing rapidly. The scope and scale of connectivity and related insecurities are accelerating, as are the threats of contagion and exposure to natural disasters and violent conflict. National policy space to enhance coping capabilities is becoming more and more constrained as globalization deepens. In an increasingly interconnected world what was once local is often now global as well, due to international trade, travel and telecommunications. Globally integrated supply chains, for instance, have brought efficiency gains. But disruptions at one point of the chain can trigger serious local problems elsewhere. The types of public goods, both natural and global, that are needed to build long-term coping capabilities and resilient societies are underprovided. Across the world people feel insecure.”<sup>1</sup>*

What type of system can create “long-term coping capabilities and resilient societies”<sup>2</sup>? As the damage created by natural and human caused disasters increases every year, there is an urgent need to begin creating lasting solutions. The current systems of aid relief must adapt to meet these growing challenges. Current aid rarely extends beyond immediate relief and often leaves areas vulnerable after intervention. When aid does focus on long term built development, the methods used “tend to prevent

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<sup>1</sup> Malik, Khalid. Human Development Report 2014 (HDR 2014). *Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience*. United Nations Publications. New York, NY. 2014. pp2

<sup>2</sup> Malik, pp 2

the accommodation of needs when they are known: people are seldom given a chance to participate in design and places are not evaluated after they are built.”<sup>3</sup>

This thesis proposes a shift in disaster relief thinking from an individual resiliency focus to a community resiliency focus through architectural intervention. There are currently many types of aid relief, and architectural approaches to aid relief utilized. Several will be reviewed in this thesis. The adoption of architectural and community focused aid creates opportunities for participatory decision making, appropriate design solutions, and long term capacity building. The best way to achieve long term resilience is through development phases that create needed resources and establish sustainable construction techniques in disaster areas. A case study in the town of La Ermita in the Dominican Republic will be used to demonstrate the phase system through four phases and show how this system can create long term resilience through full fruition of the design process.

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<sup>3</sup> Kleinsasser, William. *Synthesis 9: Comprehensive and Integrative Design: Place Making; A Theory Base for Architecture*. National Endowment for the Arts. Washington DC. 1999. pp 11

## **Acknowledgements**

I would like to thank the many people that helped me through the thesis process and contributed to its production.

A huge thank you to my advisor Professor Brook Muller, who has patiently read every draft, reviewed every idea and completed any new and strange protocol with which I approached him. Brook helped me focus my ideas, respond to the big and sometimes scary problems I grappled with and was ever flexible in the face of the craziness that accompanies the thesis process.

I would like to express my sincere gratitude to my other thesis committee members, Professor Ron Mitchell and Professor Helen Southworth for their support, guidance and superb editing help throughout the long process of this thesis and my undergraduate career.

An incredible thank you to Pastor Osvaldo Vilorio, Penny Deihl, The First Presbyterian Church of Arlington Heights Mission Team, Leo Amaro Garcia, and the wonderful community of the Iglesia Evangelica Dominicana de Gaspar Hernandez and Professor Hajo Neis, without whom the design portion of this project would not have been possible.

Thank you to all of my friends and classmates for listening to my rants, trading critiques and constantly being a source of inspiration and support.

Last but not least, I would like to thank my mother, who has been my editor, guidance counselor and an unwavering source of support through thick and thin. I could not have done this project without her.



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Detail Model  
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## Terms and Definitions

**Adaptive Capacity:** the process by which a group makes an adjustment in light of experienced or anticipated negative events or crises, so that vulnerability is reduced.<sup>4</sup>

**Adaptive Response:** relief efforts geared towards increasing the adaptive capacity of an area.

**Basic Needs:** resources that are fundamental human rights. i.e. the essentials needed to live healthily. (See Figure 1)

**Community:** a group of people that relate to each other through daily interaction, a common goal, or physical ties.

**Community-Focused Design:** design focused on solving the problems that a group of people experience by creating spaces that specifically focus on meeting the groups cultural, educational, emotional, economic and/or spiritual needs. Often this is encouraged by user participation throughout the design process.

**Normality:** a situation in which a disaster no longer poses an extreme risk to life for a population that has experienced a disaster.

**Poverty:** a lack of command over commodities in general (often measured by income) or a lack of access to specific commodities often described as the basic resources considered to be fundamental to human survival

**Resilience:** “the capacity to effectively influence and adapt to change”<sup>5</sup>.

**Vulnerability:** the probability of an area to undergo adverse events due to climate or social conditions. The concept of vulnerability is used to describe exposure to risk and risk management, including insuring against shocks and diversifying assets and income”<sup>6</sup>

**Relief:** providing assistance in a time of need from an outside source.

**Whole System Design:** design that uses the surrounding environment, passive heating/cooling strategies, water processing, energy production, food generation to accommodate all of the buildings utility functions.

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<sup>4</sup> Lahsen, Myanna, Roberto Sanchez-Rodriguez, Patricia Romero Lankao, Pauline Dube, Rik Leemans, Owen Gaffney, Monirul Mirza, Patricia Pinho, Balgis Osman-Elasha, and Mark Stafford Smith. “*Impacts, Adaptation and Vulnerability to Global Environmental Change: Challenges and Pathways for an Action-oriented Research Agenda for Middle-income and Low-income Countries.*” *Current Opinion in Environmental Sustainability* 2, no. 5–6 (December 2010): 364–374. <<http://dx.doi.org/10.1016/j.cosust.2010.10.009>>. pp. 364

<sup>5</sup> Ecotrust. *Resilience & Transformation: A Regional Approach*. Portland, Oregon. 2012. <<http://www.ecotrust.org/>>. pp 2

<sup>6</sup> World Bank 2013c. *World Development Report 2014: Risk and Opportunity—Managing Risk for Development*. Washington, DC. 2013. pp 1

## Introduction

# 危机

“The Chinese symbol for crisis is comprised of two characters: one indicating “danger,” the other, “opportunity.”<sup>7</sup>

Current systems of disaster relief fall short of returning a community to normality after a disaster event. They fall even shorter in helping a community establish a path towards long-term resilience. What sort of aid-relief can effectively help a community recover from disaster? The problem addressed in this thesis is how to utilize architecture as a system of aid that can organize resources, create local solutions and ultimately create long-term resilience at the site of a disaster. The hypothesis of this thesis is that the best way to provide both immediately needed resources and generate long-term resilience is through a community-focused relief system aimed at establishing architectural interventions; which can be implemented through phases of development. These phases begin with the development of a building that can help a community organize resources, provide education and gather the local community (i.e. community focused design). The following phases work up in scale, generating needed resources that support the development of a community's resilience. This thesis proposes a four phase process focused on community participation and the creation of community focused buildings.

Several forms of aid relief that utilize architecture will be discussed to show how these systems fall short of resilience building and how systems that facilitate community participation are ultimately more effective. Community-focused design not

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<sup>7</sup> Frederick, Matthew. *101 Things I Learned in Architecture School*. Cambridge, Mass. MIT Press, 2007. pp 98

only helps create spaces that a community wants and needs, but also provides an opportunity for empowerment through education and trust-building with the sources of incoming aid support. These two elements (community-focused design and community involvement) are viewed as key components for increasing adaptive capacity in vulnerable locations and for laying the groundwork of resilience building. Community-focused design aimed at resiliency building “is not only a matter of enlarging people’s critical choices and their ability to be educated, be healthy, have a reasonable standard of living and feel safe. It is also a matter of how secure these achievements are and whether conditions are sufficient for sustained human development”<sup>8</sup>, or resilience.

The architectural system proposed in this thesis will be applied to the community of La Ermita, Dominican Republic. La Ermita was selected because like 80% of the world’s population, this community struggles from an extended impoverished condition. Additionally, like so many other low lying lands which face impending disaster from sea level rise, La Ermita is at risk of inundation. The church community of La Iglesia Evangelica Dominicana de Gaspar Hernandez will be the primary organizational force utilized for this example. Christianity in the Dominican Republic is not only a religious practice, but also a very important cultural and social part of day to day life. The church perpetuates the shared values of the community and is an organization that has the capacity to engage the population of La Ermita in resilience building. This particular church has worked with the community to create educational programs for youth and provide assistance to families in need. La Ermita is

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<sup>8</sup> Malik, pp 1

very connected to the church, and due to this pre-established connection and trust it is the ideal group to lead this design typology.

**Problem:**

Disasters do not discriminate. They can occur in any place, at any time. Disasters are the result of conflict among humans and between nature and human development. In 2013, over eight hundred eighty naturally caused disaster events occurred (see Figure 2). Worse, the crisis of disasters extends far beyond the causal event. In a disaster situation, “for every person that dies, some three-thousand are left facing terrible risks.”<sup>9</sup> When the unpredictable effects of climate change and human-caused disasters (including “political threats, community tensions, violent conflict, neglect of public health, environmental damages, crime and discrimination”<sup>10</sup>) are added, the number of disaster events and people affected becomes overwhelming. Together, these events create “individual and community vulnerability”<sup>11</sup>, and encompass the most daunting challenges humanity faces today. In the last decade “two hundred million people (that’s two thirds the population of the United States)” have been directly affected by climate change and natural or human-caused disasters, with “ninety-eight percent of these victims... in the developing world.”<sup>12</sup>

Eight hundred eighty events would be a tremendous number for countries that have a high level of resilience, however most of these disasters occurred in areas with low resilience. But, what is resilience and why is it so important? Human resilience is

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<sup>9</sup> Aquilino, Marie Jeannine. *Beyond Shelter: Architecture for Crisis*. London: Thames & Hudson, 2011. pp7

<sup>10</sup> Malik, pp 1

<sup>11</sup> Malik, pp 1

<sup>12</sup> Aquilino, pp 7

“the capacity to effectively influence and adapt to change”.<sup>13</sup> It is the key defining factor in disaster recovery. “Resilience underpins any approach to securing and sustaining human development”<sup>14</sup> as well as creating effective relief. By focusing on creating resilience, disaster relief can ensure “that state, community and global institutions work to empower and protect people”.<sup>15</sup> Areas with high resilience are able to absorb disaster events and return to being functional and productive within a short time-span (averaging from 1 week to 1 year). They often have good access to resources like medical assistance and education, some type of effective governmental support system usually with high levels of citizen equality and a strong sense of community.<sup>16</sup>

Although a strong society is a good marker for identifying a resilient society, typically, resilience is determined by a region’s adaptive capacity and vulnerability. Adaptation is the process by which an adjustment is made in light of experienced or anticipated negative results, so that vulnerability is reduced.<sup>17</sup> Adaptation relates to the techniques used to mitigate a situation. Adaptive capacity refers to the ability of an area to complete the needed actions. Some examples of direct adaptation include mitigation techniques of building dikes, adjusting agricultural practices and relocating vulnerable populations. Indirect adaptations include such activities as capacity building and research.<sup>18</sup> Recognizing and utilizing the type of adaptation most suited for a vulnerable population determines the strategies and scale needed for a successful outcome.

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<sup>13</sup> Ecotrust. pp 2

<sup>14</sup> Malik, pp5

<sup>15</sup> Malik. pp5

<sup>16</sup> Richard Wilkinson, Kate Pickett. *The Spirit Level: Why Greater Equality Makes Societies Stronger*. BloomsBury Press. New York. 2009. pp 3-114

<sup>17</sup> Lahsen, et al. pp. 364

<sup>18</sup> Lahsen, et al. pp. 364



Typically, “the concept of vulnerability is used to describe exposure to risk and risk management, including insuring against shocks and diversifying assets and income”<sup>19</sup>. In regards to disasters, vulnerability refers to how susceptible an area is to experiencing a disaster event. Regardless of scale, an individual or entire country is considered “vulnerable when there is a high risk of future deterioration in circumstance and achievements”<sup>20</sup> of that entity. Vulnerability does not mean “a lack or want but [instead] defenselessness, insecurity and exposure to risks, shocks and stress”.

The worst post-disaster situations often share fundamental similarities in that before the event, they had a low adaptive capacity and unfortunately were located in areas of high vulnerability to natural disasters (see Figure 3 and 4). Areas with low adaptive capacity often have the lowest GDP levels internationally. Although GDP refers to the Gross Domestic Product of a whole country, areas with low GDP also experience mild to extreme levels of poverty. Despite this concerning correlation, high levels of vulnerability do not indicate that an area experiences poverty.<sup>21</sup> Poverty does, however, often correlate with a low adaptive capacity. Where pervasive poverty is present, that ability to adapt is unlikely. This is key, because the major problem of a disaster is often not just the disaster itself, but the conditions that persist post-disaster, especially in areas unable to introduce adaptive solutions.

For vulnerable areas, poverty decreases a society's resilience by reducing their ability to adapt. Although it is not an instantly traumatic event like many disasters,

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<sup>19</sup> Malik, pp 1

<sup>20</sup> Malik, pp 15

<sup>21</sup> Chambers, Robert. *Vulnerability, Coping and Policy (Editorial Introduction)*. IDS Bulletin 37(4): 33–40. 2006 pp 33

poverty is a human caused problem that creates as much or more difficulty for a community.

For this thesis, poverty is defined as an acute lack of access to basic resources needed for survival. At least eighty percent of the world's 6.4 billion people live on less than ten dollars a day and are impoverished as defined by the World Bank.<sup>22</sup> Fifty percent of the world population lives on less than \$2.50 a day.<sup>23 24</sup> As climate change increases the number of natural disaster events each year, many of these 6.4 billion plus people fall into greater risk categories. When a disaster occurs in an area of poverty, not only is the quantity of loss greater and more difficult to rebound from, but levels of poverty also increase, creating a double disaster. Often, areas affected by a disaster which did not fall into this broad spectrum of poverty before an event, experience residual poverty after the event. Poverty, being a prolonged problem rather than an instant one, means that the majority of people experiencing poverty have lived with poverty as their daily normal. For the purpose of this thesis, poverty will be categorized as a disaster in and of itself because of its "stable" nature, the breadth of its global reach and the frequency with which it accompanies other disaster events.

There is currently not a system robust enough to deliver lasting aid to the quantity of people with low resilience affected by disaster situations. Creating a process within the community that generates long-term solutions is needed. This process needs to be a systemic process that builds upon itself. Methods for keeping "vulnerable

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<sup>22</sup> Chen, Shaohua and Martin Ravallion. *The Developing World is Poorer Than We Thought, But No Less Successful in The Fight Against Poverty*. World Bank, August 2008

<sup>23</sup> Malik, pp 3

<sup>24</sup> World Bank 2013, pp 3

populations from falling back into extreme difficulty and deprivation”<sup>25</sup> and becoming more resilient are essential. It is imperative that the systems which are developed are general enough to be implemented in any situation, but flexible enough to adapt to local conditions creating long term resilience. Exploring techniques which address the disaster of poverty will lead to the creation of a universal system approach for other disaster events. For example, “more and better job opportunities provide the most powerful way out poverty”<sup>26</sup>; but creating job opportunities also provides both economic and personal stability<sup>27</sup> for a community which is essential after any disaster. In addition to being able to respond to multiple disaster situations, focusing on reducing poverty (i.e. increasing an areas adaptive capacity) before a disaster leads to more efficient relief after an event.

Disaster relief has taken on many different approaches. Some of these have proven more effective than others. This thesis discusses the vital role of architecture in successful, resiliency building. To design a comprehensive system of disaster relief, it is important to understand current systems of relief. This thesis will present the different methodologies used in current aid based architecture and relief projects. First, these different methodologies will be described and reviewed for effectiveness. The majority of projects focus on providing facilities for one main need of a population (education, medical facilities, economic stimulus, housing, etc). This thesis will assess whether facilities which allow full community participation and address more than one type of

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<sup>25</sup> Malik, pp4

<sup>26</sup> The World Bank. *Poverty Overview*. World Bank IBRD, IDA, n.d. Web. 08 May 2014.  
<<http://www.worldbank.org/en/topic/poverty/overview#1>>

<sup>27</sup> Max-Neef, Manfred A., Antonio Elizalde, and Martín Hopenhayn. *Human Scale Development: Conception, Application and Further Reflections*. New York: Apex, 1991. Print. See Figure 1.

need are more effective in providing long term relief than the other projects which only focused on one.

The second chapter will show how the proposed system has been derived from positive aspects of the previously mentioned and reviewed projects. Following this section, the next chapter will further discuss the problems of poverty, the history of poverty and oppression in the Dominican Republic and the methodology used to address this problem. Chapter Four will explain the design process and solutions created for La Ermita. Final thoughts on the implications and challenges of this system will then conclude this thesis.

## Chapter 2: Disasters, Disaster Relief, and Architecture

“Why are we so underprepared after every disaster? Our reaction is more surprise than readiness. Bad construction can worsen the crisis. Survivors and well meaning volunteers need experts to guide them toward safe, long-term, locally appropriate solutions. In the future we must do much, much more with much, much less.

- Bryan Bell, founder, Design Corps

### Overview:

The extent to which people are affected by disasters depends upon several factors. Recent models of climate change and disaster impact focus on how much and how quickly a climate or culture will be altered and the number of people affected. From this data, vulnerability is deduced. To measure what areas are most vulnerable, many experts believe climatic change models also need to include a scale of how resilient a country is (how affluent they are and how much they have invested in protection against events) and what their adaptive capacity is (how willing or easily could the country implement adaptive strategies both socially and fiscally).

Vulnerability has been a defining factor of how risk has been analyzed and interpreted<sup>28</sup>. However since some countries are already being affected by climate-related and disaster-related problems, discussion about regional reaction “has recently shifted from vulnerability to adaptation”.<sup>29</sup> This means that instead of only talking about the fact that nations will be affected, discussions have shifted to look at “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities”.<sup>30</sup> This shift in analysis is important because it highlights the importance of creating resilience through

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<sup>28</sup> Ribot, Jesse. *Vulnerability Before Adaptation: Toward Transformative Climate Action*. Vol. Volume 21, chap. Issue 4 in *Global Environmental Change*, Pages 1160-1162. October 2011. pp 1160

<sup>29</sup> Ribot, pp 1160

<sup>30</sup> Ribot, pp 1161

human action before a possible event. Essential pre-disaster action is centered around education and community cohesion.<sup>31</sup> A building that acts as a community center, as proposed later in phase one, would be able to function as a source of education for pre-disaster awareness and preparedness.

The countries that have very high levels of climatic vulnerability, and very low adaptive response capacity are obviously at higher risk than those that are vulnerable but have a high adaptive response capacity. Many countries that are “at risk” for the same event, are not equally vulnerable because they have a multi-level governmental system that allows them to create opportunities for mitigation and identify recovery strategies. The consideration of vulnerability and subsequent action creates specific solutions in adaptive regions. An excellent comparison is the Netherlands and Bangladesh. Both countries contain large areas of low-lying land that will be or already is below sea level. Climatic sea level rise could be devastating to both countries based upon geography. The key difference is that the Dutch have integrated adaptive strategies (like dikes) into their culture, are highly educated on the issues of climate change, and maintain a high level of affluence. This permits them to negate many of the increasingly harsh effects of climate change and allows them to be proactive in the face of increased vulnerability. Bangladesh struggles to initiate any capacity building programs or structures. The Dutch would still be devastated if their city was inundated by the sea, but they have a higher ability to return to a state of normality, making them markedly more resilient. When appropriate, adaptive action by more resilient countries can be used as case studies for the areas that do not have comparable capacities. Many

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<sup>31</sup> Malik, pp 1

solutions for more vulnerable populations, however, require the adoption of very different solutions and strategies than would be applied or acceptable in resilient countries.

Adaptive capacity is extremely important for all societies in the face of a disaster. Planning for these types of events is rooted not only in a strong understanding of the local resources, but also in the general education of the public. When people know how to react to a natural disaster, more lives are saved and recovery occurs more quickly.

After human caused disasters, like war, pollution, and poverty, international and local aid reaction time is usually much slower since the problem is a sustained one and not an extraordinary one. Sustained and prolonged disasters become increasingly complicated over time, both in terms of acquiring the most basic resources\*<sup>32</sup> to reach 'normality' and to create local resilience. For this thesis, 'normal' or 'normality' characterize the situation in which a disaster no longer poses an extreme risk to life for a population that has experienced such a disaster. Further, the affected population is able to create a structure of organization where future challenges can be discussed and preliminary planning accomplished. An important feature of 'normality' is a community's ability to wean off of the immediate emergency aid and develop a sense of connectedness of purpose (see Figure 5). Another challenge that often persists with low adaptive capacity areas is that they are subjected to the highest number of human caused

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<sup>32</sup> \*The Basic Resources refer to the fundamental needs of any individual human to live a full life. Access to each is considered a basic fundamental right. See Figure 1 generated from Max Neff's definition of fundamental needs.

disasters. Pervasive poverty often accompanies low adaptive capacity within the majority of these areas.

Many governments create legislation that attempt to improve the adaptive capacity and relieve the impact of disasters on their countries. These actions rarely make it past the legislative process to implementation, or create notable change. Rarer still is for a country to ask for assistance from an external source, receive it and have it create a rippling impact of resiliency beyond the original level of normality. The majority of aid relief is an external afterthought. Instead of preemptively working with regions to prepare for potential disasters, international aid generally reaches out after devastation has already occurred.

Distributed Aid after a disaster event usually is very narrowly targeted. Basic medical assistance, water, shelter, and food are the fundamentals that organizations try to provide. Depending upon the organization, culture and situation, different basics are selected, to address immediate needs. Rarely do organizations choose to cover all of the human needs in long term, sustainable ways. This troubling gap between the short-term, immediate response and long-term lasting solutions became glaringly apparent after the Oceanic tsunami in 2004. Humanitarian aid rushed in after the event that killed more than 200,000 people. Primarily targeting short-term solutions, international aid did not succeed in replacing destroyed communities with safe communities. This failing is glaringly apparent, even ten years later<sup>33</sup>. In the last ten years however, progress towards narrowing this disparity between intervention and resiliency-building has been a focus of several aid agencies. Unfortunately, their explorations and strategies for

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<sup>33</sup> Aquilino, pp7



providing aid have not become standard practice within many large and small aid agencies. Aid relief techniques have not changed dramatically from the methods used in 2004.

There are two primary paradigms when it comes to governmental and external aid relief. One is the total support and outreach of Humanitarian Intervention. The other is Self-Help Aid. With total support, basic supplies coupled with on-ground Humanitarian Intervention assistance are provided as soon as a disaster site is reachable. This process is so common that, “humanitarians work on the frontlines of every emergency in support of more than 100 million people whose lives have been torn apart by war or natural disasters”. This approach is becoming more difficult however, because “2013 set a new record for violence against civilian aid groups in the number of attacks. The first half of 2014 has also seen a rise in the number of targeted attacks on humanitarian workers”.<sup>34</sup> Current techniques for providing aid are proving to be hazardous, and as previously mentioned, disasters are becoming more complicated and prevalent. These, combined, lead to a greater need for humanitarian time and resources. Most projects span well beyond the short-term targeted duration, and many projects are “implemented under funding cycles of less than one year”<sup>35</sup>. Limited aid timeframes and insufficient funding are common contributors to the problems with aid focused on ‘short term’ solutions. In both short and long-term Humanitarian Intervention support as well as Self-Help Aid, relief either becomes part of an ongoing effort (with little

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<sup>34</sup> "World Humanitarian Day: More People than Ever Need Help." *United Nations News Center*. United Nations, 11 Aug. 2014. Web.

<[http://www.un.org/apps/news/story.asp?NewsID=48461#.U\\_I6NbxWYU](http://www.un.org/apps/news/story.asp?NewsID=48461#.U_I6NbxWYU)>

<sup>35</sup> Ashmore, Joseph. *Shelter Projects, 2010*. Nairobi, Kenya: UN Habitat, 2012. Print. pp xi

progress) or part of a forgotten emergency<sup>36</sup> that is no longer receiving enough support to reach a state normality let alone resiliency.

Self-Help Aid often takes the form of ‘market-based assistance’<sup>37</sup>. Since the 1970’s, the World Bank has led this type of relief through cash interventions and remittance for specific goods<sup>38</sup>. These programs constitute a major part of a response effort, since they radiate beyond the established international relief system into local markets<sup>39</sup>. The primary focus of this cash system is to encourage reconstruction of the disaster area by locals in a way that also reinvigorates the local economy. A problem that often evolves pertains to the selection of the beneficiaries of aid. This selection process is often unclear, causing ‘jealousy and resentment from community members who’<sup>40</sup> do not receive assistance. This was apparent in the 2010 Earthquake in Chili with the cash card system<sup>41</sup>, the 2008 Cyclone Nargis in Myanmar<sup>42</sup>, the 2009 Earthquake in Sumatra<sup>43</sup>, and 2005 Hurricane Katrina in the New Orleans.<sup>44</sup>

This system of intervention still heavily advocated by the World Bank\*<sup>45</sup>, was based on observations made by English architect John Turner. Fascinated with the

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<sup>36</sup> Ashmore, pp vii

<sup>37</sup> Ashmore, pp vii

<sup>38</sup> Ashmore, pp x

<sup>39</sup> Ashmore, pp x

<sup>40</sup> Ashmore, pp 6

<sup>41</sup> Ashmore, pp 6

<sup>42</sup> Ashmore, pp 61

<sup>43</sup> Ashmore, pp 44

<sup>44</sup> "Musicians' Village - About Us." *Musicians' Village*. Habitat for Humanity, n.d. Web. 2014. <<http://www.nolamusiciansvillage.org/about/>>

<sup>45</sup>\* “Lending for urban development by the World Bank increased from a mere 10 million dollars in 1972, to more than 2 billion dollars in 1988.# And between 1972 and 1990 the Bank helped finance a total of 116 sites-and-services and/or slum-upgrading schemes in 55 nations.# In terms of need, of course, this was a mere drop in the bucket, but it gave the Bank tremendous leverage over national urban policies, as well as direct patronage relationships to locate slum communities and NGOs; it also allowed the Bank

ingenuity of resourceful structure design he “stressed a ‘sites-and-services’ (provision of basic ‘wet’ infrastructure and civil engineering) approach to help rationalize and upgrade self-help housing”.<sup>46</sup> In other words Self-Help Aid is a bottom-up approach that advocates privatization and improvement rather than introduction of culturally irrelevant buildings. This system of aid uses architecture as a primary marker of success.

An architectural process can be a primary contributor to a disaster but also can provide meaningful solutions and significantly impact the overall effectiveness of aid relief. In recent years, there have been multiple tragedies resulting from poorly built or under-supported structures. Bangladesh, Haiti, and China provide three different examples of how architecture destroyed by earthquakes and decay were primary contributors to the number of fatalities. In 2008, buildings were responsible for killing more than 100,000 people in China alone.<sup>47</sup> Not only can a structural system have a tremendous effect upon its inhabitants, but the composition of a built space also has a dramatic effect on the health and welfare of its inhabitants. Cramped, unorganized

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to impose its own theories as worldwide urban policy orthodoxy. Improving rather than replacing slums became the less ambitious goal of public and private intervention. Instead of the top-down structural reform of urban poverty, as undertaken by post war social democracy in Europe and advocated by revolutionary-nationalist leaders of the 1950s generation, the new wisdom of the late 1970’s and early 1980’s mandated that the state ally with international donors and, then NGOs, to become an ‘enabler’ of the poor... By the late 1980s, however, the World Bank was championing privatization of housing supply across the board and soon became the most powerful institutional megaphone for the schemas of Hernando de Soto, the Peruvian economist who advocates micro-entrepreneurial solutions to urban poverty.” - Davis, Mike. *Planet of Slums*. London: Verso, 2006. Print., pp 70

<sup>46</sup> Davis, pp 70-71

<sup>47</sup> Aquilino, pp 7

spaces often prohibit sanitation services and, as in the current health epidemic of Ebola in western Africa, this congestion can prove deadly.<sup>48</sup>

This vulnerability, created by poor building quality, as well as the often failed success of architecturally driven self-help programs, creates skepticism and blame towards architects.<sup>49</sup> Currently architects are actually only responsible for “three percent of the world’s built environment”.<sup>50</sup> So, if architects and planners focused on resilience building, are not integrally involved with these and new buildings then “who is in charge of rebuilding towns and villages leveled by earthquakes and cyclones? The answer is disquieting: no one is in charge.”<sup>51</sup> Generally speaking, external aid organizations and internal governmental forces partner with only a few residents to implement miniscule and random infrastructure. The people implementing these building changes depend on whether a non-profit or local group is in charge. In neither case are builders or volunteers screened for expertise or “have the capacity to judge the quality of experts they employ”.<sup>52</sup> In large disasters, this process becomes even more chaotic and less effective. Architectural involvement and representation throughout a community are essential elements for the optimal utilization of incoming aid and well planned, sustainable rebuilding. Further, architectural planning provides forethought of

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<sup>48</sup> Silver, Marc. "Reporting On Ebola: An Abandoned 10-Year-Old, A Nervous Neighborhood." *Morning Edition*. NPR, 20 Aug. 2014. Web.  
<<http://www.npr.org/player/v2/mediaPlayer.html?action=1&t=1&islist=false&id=341705940&m=341826205>>.

<sup>49</sup> Aquilino, pp 7

<sup>50</sup> Aquilino, pp 8

<sup>51</sup> Aquilino, pp 8

<sup>52</sup> Aquilino, pp 8

needs, project management, sustainable development and a wider vision for an area, which inspires both efficiency as well as hope within a community.<sup>53</sup>

Both forms of aid, on-ground Humanitarian Intervention and Self-Help Aid, apply architectural interventions to their programs. Buildings are one of the most concrete ways to mark success or improvement within a disaster area. This is why construction is typically supported by both large scale NGO's (like Oxfam, UN-Habitat, Care, Red-Cross Societies, and Caritas) and small scale organizations (like personal donations from the Brad Pitts Make It Right Project, Pre-fabricated shelter designs like Michael McDaniel's Exo emergency shelter, missionary groups and other voluntourism ventures). Aid organizations often view architecture as a major benchmark of their successful intervention. However, their accomplishment often falls short of creating long-term resilience through these buildings.

Architectural Humanitarian Intervention follows the same rationale as other aid in this category. The goal is to reach a disaster area and, quickly and efficiently, establish necessary shelter and infrastructure. There is a wide range of techniques to accomplish this. Many larger humanitarian organizations and governmental organizations have a simple system of shelter or rely on external donations. The majority of shelters resemble tents, being constructed out of a durable tarp like fabric with prefabricated or local supports. Often they are set up by the aid organization in arrangements that resemble military camps, again focused on efficiency rather than culture or important infrastructure. Often these 'tent cities' remain for months, and even

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<sup>53</sup> Aquilino, pp 9

years. Inhabitants eventually replace the tents with more durable materials that they are able to find or make, as needed.<sup>54</sup>

This system, intended as a short-term intervention, is very effective for short-term needs. However, these temporary shelters are commonly developed into more permanent shelters by their inhabitants. Locations that receive only short-term shelter aid are usually the most vulnerable populations. That is, they physically cannot or will not be supported in returning to their initial homes or receive sufficient governmental help to rebuild. Often these groups also fall into the category of forgotten disasters. Several recent examples include Afghanistan and the mass exodus seen in Syria, where families have been forced from their lands into “temporary” camps. These camps are “established as a short term fix, [but] may well become a permanent settlement. Initial land allocation and site layout therefore has a long term impact upon the families at the site<sup>55</sup>.” In Afghanistan during the return to Sozma Qaia camp, 379 families of refugees were able to go home after 23 years<sup>56</sup>. Their ‘new’ home resettlement was unable to meet the needed accommodations of the returning population since the group numbers had grown over the 23 years. As a result, the settlement was very congested. Due to its temporary intent, vital community resources like public open space and adequate infrastructure were absent. Rather, only a basic water system was provided. Another failing was that the tents provided were not meant to be inhabited during winter months. Although some of the residents upgraded their shelters with mud blocks (leading to more durable long-term shelters), overall the layout of this settlement and the lack of

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<sup>54</sup>Ashmore, pp 3

<sup>55</sup>Ashmore, pp 3

<sup>56</sup>Ashmore, pp 3

education provided regarding how to transition from tent city to a community, left this population extremely vulnerable and without the means for developing greater resiliency.<sup>57</sup>

### **Examples of Architectural Solutions to Disasters**

This section describes several different types of architectural intervention through example projects. The projects in this section are typical of architectural aid not only in their approach, but also in their focus on creating buildings for individuals eventually leading to the creation of community rather than focusing on community first. Although these projects follow a different focus than what is proposed in this thesis, it is important to understand the architectural methods and practices in current aid design to identify the most effective. Each project will discuss the trend that drives the methods, what challenges each faces, how each example was executed and the strengths and weaknesses observed for each. The first projects will begin with prefabricated architectural solutions and transition in typology, ending with personal construction through community support programs.

#### *Prefabrication:*

Systems that are more durable like prefabricated housing intend to bridge the gap between short and long-term relief. As Michael McDaniels mentions in his TED presentation, “there's typically about an 18-month time frame to ...start the recovery process, but what most people don't realize is that on average it takes 45 to 60 days or more for ... FEMA trailers to even begin to show up. Before that time, people are left to

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<sup>57</sup>Ashmore, pp 4

their own devices.”<sup>58</sup> This gap, as well as the durability that a solid object can provide for displaced people after initial intervention, is often the focus of prefabricated structures. However this same durability can be the downfall of these structures.

A common trend seen in the last ten years is to try to convert shipping containers into housing. This is an innovative design for an area that is not experiencing the results of a disaster because these volumes of space can be designed to fit the specific individual needs of its occupants and the singular sites they occupy. In a situation where mass shelter is needed, shipping containers only work well when they are designed into a building, like the Salam Medical Center in Soba, Sudan (see Figure 6).<sup>59</sup> Shipping containers fail as aid when attempts are made to implement them on a smaller scale necessary to create a successful urban fabric and provide shelter on a massive scale. They are extremely hard to modify or move once placed, and often are hard to make climatically comfortable or aesthetically responsive culturally. They do not adapt gracefully in an environment with little technological or electronic support. Shipping containers have their flaws, but due to their transportability, are often adopted by ideological designers for short term solutions.

Michael McDaniels explored a similar obsession with transportability in his shelter, the Exo. Like a stack of disposable coffee cups, the Exo can stack together for “extremely efficient transportation and storage” so much so that “15 Exos can fit on a single semi truck... [which] means the Exo can actually be transported and set up faster

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<sup>58</sup> McDaniel, Michael. "Cheap, Effective Shelter for Disaster Relief." *TED*. Transcription. Joseph Geni. Ed. Morton Bast. TedxAustin, Feb. 2012. Web. 09 Oct. 2014. <[https://www.ted.com/talks/michael\\_mcdaniel\\_cheap\\_effective\\_shelter\\_for\\_disaster\\_relief?language=en](https://www.ted.com/talks/michael_mcdaniel_cheap_effective_shelter_for_disaster_relief?language=en)>.

<sup>59</sup> Aquilino, pp 213



than any other housing option available today”.<sup>60</sup> The Exo is able to house four bunks, which can be replaced with other furniture like desks or shelving. Different environmental changes can be made as well by switching out the doors for windows (see Figure 7). Several organizations like the United Nations, mining camps, mobile youth hostels, the World Cup and the Olympics have shown interest in this design because it offers a full and secure housing system, units are easily deployed, and they are light and therefore capable of being moved into any position<sup>61</sup>. This is a brilliant system for situations that need a “modular housing system that can react to any situation or disaster immediately”.<sup>62</sup> However, much like tents, the Exo is still a temporary solution.

Although Exos provide needed shelter and supplies, they do not help a community progress to stabilization or resilience. Exo’s do not provide needed motivation, programming or education to help communities rebuild after an event. Much like tents, it is likely that Exos will remain on sites as shelter for years after they are deployed, as opposed to the intended few months. Although climatically they are adjustable, unlike tents, it is much more difficult to modify Exo’s to meet different cultural and societal needs. Their design is generic, and is not tailored to any specific vernacular currently in the world. Since Exo’s will probably not be the ultimate remedy to this short term to long term solution, some aid groups have focused on a different implementation technique: create long-term housing as quickly as possible. Much like

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<sup>60</sup> McDaniel

<sup>61</sup> McDaniel

<sup>62</sup>McDaniel

on ground, short-term Humanitarian Intervention solutions, these houses are often ‘Gifted Architecture’.

*Hurricane Katrina:*

Musician’s Village:

In 2006, the Habitat for Humanity Musician Village was established in New Orleans’ Upper Ninth Ward. As of February 2007, the Musicians' Village was "the largest-scale, highest-profile, and biggest-budget rebuilding project to have gotten underway in New Orleans post-Katrina".<sup>63</sup> This village, like the Make it Right project which will be discussed next, was initiated by a select few and used the planning resources of Habitat for Humanity to create a community as well as preserve a culture<sup>64</sup>. Planned with a central community teaching center, this village was created for artists and musicians who lost their homes in the disaster. Focused on preserving the culture that these people contribute to, 72 homes were built in a suburban fashion around the Ellis Marsalis Center for Music (see Figure 8). This center provides musical training for both the local community as well as the larger musical community of New Orleans. By 2010, the community was completed. With this accomplishment, the New Orleans Habitat for Humanity claimed they had provided an example of “how a meaningful vision and focused efforts could provide immediate relief as well as long-term hope for the survival of a great city and many of its most essential citizens”.<sup>65</sup> This project was successful for its target population in its targeted location. Suburbs have an established

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<sup>63</sup> Kamenetz, Anya (May 2006). "Note From New Orleans; Sweet Sounds of Home; Bringing musicians back to New Orleans". The Village Voice. Retrieved 2006-05-05.

<sup>64</sup> Musicians’ Village

<sup>65</sup> Musicians’ Village

place and function in American society. This vernacular coupled with the reality that the majority of New Orleans was undamaged from the hurricane, contributed to this project's success. The integration of a community center was a very important step in reaching the goal of resilience.

The homes were very uniform and did not provide opportunities for individual adaptation or future developments. A majority of people affected by the hurricane were not musicians. Since the housing was completely funded by and supported by Habitat for Humanity, the aid provided for this targeted community stayed internal and did not provide support for the many other affected community members outside of the musician's community. Often when people do inherit 'Gift Architecture', the end result is something less than desirable for the larger community.

#### Make It Right:

After Hurricane Katrina, New Orleans was a site of many different types of 'Gifted Architecture'. One of the more famous of these, the *Make it Right* project (also known as the Pink Project), adopted the following goals:

- To create sustainable homes and build with clean materials for the best quality of life.
- To create homes that would not contribute carbon but could operate pollution-free.
- To build homes and storm resiliency.
- To create new jobs in the process

- [achieving] all of this affordably.<sup>66</sup>

The Make It Right Project wanted to create an example for future relief projects, but their interest, response, and design were very much exclusive to New Orleans. They selected the Lower Ninth Ward from the greater New Orleans area, because it was the area most in need. In order to become a role model for the community of New Orleans (as well as the global community), the Make It Right Project decided not only to build for future flooding disasters, but also aimed to create some of the most advanced green urban fabric in the country. They enlisted some of the best civil engineers and landscape planners to create an urban terrain that not only withstood the disastrous effects of flooding, but also actively worked towards the collection, retention, circulation, and productive dispensation of the excess water. The different designs utilized the most advanced sustainable and 'green' technologies that were available; creating a prototype for low income housing everywhere (see Figure 9). To achieve the desired community vitality, the Make It Right team decided to work with an international community of architects. This design team (both architects, engineers and community) was elected from fifty architects selected for their "prior interest or involvement in New Orleans, preferably post-Katrina and/or experience with disaster relief, familiarity and interest in sustainability, experience with residential and multi-family housing, proven to be skilled innovators on low-budget projects, experience dealing with structures that have to successfully address water-based or low-lying

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<sup>66</sup> Feireiss, Kristin, and Brad Pitt. *Architecture in times of Need: Make It Right: Rebuilding New Orleans' Lower Ninth Ward*. Munich: Prestel, 2009. Print. pp 44

environments".<sup>67</sup> They used the sites as a unique testing ground for implementing new construction techniques, technologies and materials. These tests allowed for the creation of sustainable, storm resistant homes that are affordable and broadly available to working families in communities across America. The different teams extensively researched the history of New Orleans, the different prototypes of houses traditionally found within the area, and what would respond best to the climate and natural weather challenges of the area. Hence, the buildings were designed to fit their area very well. By the time that all of the houses are completed, the Make It Right Project will be the largest and greenest neighborhood of single family homes in America, with LEED Platinum certification.<sup>68</sup>

The employment of architects and the combined efforts of the Make It Right project led to the project developing a long term trajectory, involving planning, fund raising, testing and editing, before anything was built. The Make It Right project is unique from other ENGO's (Environmental Non-governmental Organization) or Humanitarian Intervention aid in that it is not just designed to raise money or build a specific 'first world' idea. Rather, it is focused on making a strong long-term concept, a complex operational process, and an ambitious design strategy. The team found it very important to create a unique and dignified community, one worthy of the lands' history instead of implementing suburbs. By following the re-imagined housing ideals of eco-architecture, it took the team extra time to design not only the prototype but the various systems of the houses like gray water storage, permaculture, carbon-neutral status, and

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<sup>67</sup> Feireiss, pp 121

<sup>68</sup> Feireiss, pp 109

LEED certification. Although their methodology resulted in a two year process before implementation, it capitalized on the unique opportunity to rebuild a community from scratch while also involving the members of the community.

Resident involvement was also atypical of other 'first world' projects where there is a distinct line between the client and the designer, in its participatory/self-build approach. The project worked to delineate political units, establish neighborhood identities, engineer topography, legislate racial geography, and create overall community renewal. The team wanted to raise awareness for the global relevance of their project, showing how knowledge of history and understanding responses to location were important both from a professional context and local context. However, once the design firms had been selected and had finished their designs, they allowed eligible homeowners to review the designs and select the project that they liked the best, instead of designing with individuals or teaching them how to design for themselves. The residents' budget then became the deciding factor for the final construction of the houses. Their design followed the guidelines of an 'affordable, sustainable prototypical single-family home with the highest design ambition of integrating a new quality of life for the families and communities'. This is a very universal design concept for 'first world' disaster relief. The Make It Right project set up an excellent framework and standard for other international projects that are looking to build low income housing. However this type of house, both in style and the materials used, would be extremely impractical in most of the world. Although the ideals behind the project are very pertinent to quality relief design, the Make It Right design system functions best as a case study rather than as a paradigm for disaster relief.

Make It Right's primary goal was to create a project that would be accessible and inspirational for community planning and disaster relief worldwide. While they succeeded in creating a project that was potent enough to resolve local problems and create a national resonance, the project did not create a design or material palette that would be well suited, or feasible for most disaster locations. Hiring fifty of the world's most innovative architects is not something that every 'need project' could manage.

One of the greatest flaws, however, of the Make it Right project is that the buildings within the community were gifted. Although selected community members were able to choose different designs and modify them slightly to their own needs, other community members who did not receive a house had to raise their own \$340,000 and hire experienced builders and designers to create a new home for themselves. This created a neighborhood with a few sparse monolithic architectural houses in an area that previously thrived with community. While the constructed houses did help a few select families regain their lives, they did not help increase the area's resilience beyond these individuals. Further, due to the expense and technicality of the designs, the likelihood of this system being replicated in New Orleans or elsewhere is very low.

#### *Whole System Design:*

In contrast to the Humanitarian Intervention aid of 'Gifted Architecture', much of Self-Help Aid focuses on helping individuals rebuild their community. However, supplying only cash or supplies sometimes is as ineffective as providing only short-term housing. In Haiti, after the 2010 earthquake, 500,000 people were relocated from damaged neighborhoods to available space. Once in these locations, "the initial response provided emergency shelter support through provision of basic materials

(tarpaulins), fixing and other non-food items to a maximum number of people. This was to supplement and weatherproof the large number of self-made shelters built from salvaged materials”<sup>69</sup>. The outcome of this was the development of spontaneous camps. Although materials were provided, instruction on creating shelters and guidance in placement of shelters to develop functional utility systems, was only introduced as an afterthought by separate aid organizations. This latter intervention was only provided to a select few.<sup>70</sup> A plan to promote reconstruction and rehabilitation was developed shortly after the disaster, but was not implemented for one year. Over the course of two years, few improvements were instituted. The extreme need in Haiti did ultimately lead to the inclusion of ‘experienced shelter team members’<sup>71</sup> and the ability of many different types of shelter aid to be deployed.

One such team was the Earthship Biotecture Group from Taos, New Mexico.<sup>72</sup> Earthships are a type of off-grid housing, developed by Mike Reynolds. The first design started with the initial intent of creating a home that would be sustainably constructed, be completely self sufficient with regards to water and electrical needs, and would be feasible for a person with very limited fiscal resources and no specialized building skills to construct. Over the past forty years, Earthships have taken on many different shapes and responses. They have been designed to manage all of the basics

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<sup>69</sup>Ashmore, pp 14

<sup>70</sup>Ashmore, pp 14

<sup>71</sup>Ashmore, pp 17

<sup>72</sup> Reynolds, Michael E. "Sustainable Green Buildings | Earthship Biotecture." Sustainable Green Buildings Earthship Biotecture. Earthship Biotecture, LLC. Web. 05 Mar. 2012. <<http://earthship.com/>>.



needs of humans: food, water, shelter, clean air and clean energy. This framework allows the Earthship concept to be universally advantageous<sup>73</sup>.

To build the systems quickly, it is necessary to have multiple hands working upon the job. However, it is possible to construct an Earthship in eight days with a small workforce of 12 people. By incorporating a community to build the different houses, not only are community bonds strengthened but it spreads the knowledge of how to build the systems and improve them as each system is built. The involvement of the community in the initial stages of the Earthship design is imperative in determining the best possible design for each system. The design or appearance of each Earthship can also be decided by a community to reflect the rhythm of their environment and cultural values.

Most follow a U shaped design that is partially buried in earth. The walls are made of local (soil, trees or rocks) or recycled materials. Cultivating a relationship to the plant is emphasized within the concept of Earthships. Earthships are typically made of materials such as tires, rammed earth, cans or bottles, mortar, wood or other beam-like material, windows and solar panels. They are usually built up with one side lodged within the earth and the other facing south and completely glazed. Because each house is off-grid and made of available materials, this facilitates quick construction. The Earthship is designed on an individual scale, but it is the end goal of an Earthship to provide housing beyond the life of the builder. The hope is that the Earthship not only provides for the current occupant but evolves, getting better over time.<sup>74</sup>

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<sup>73</sup> Reynolds, Michael E. *Earthship: How to Build Your Own*. Taos, NM: Solar Survival Architecture, 1990. Print.

<sup>74</sup> Reynolds 1990.

Most Earthships are not relief structures but function as homes for somewhat affluent people. Reynolds suggests that maybe the people of the *'first world'* need to adapt their lifestyles to one that would be synonymous with more minimalistic Earthship dwelling, instead of people always trying to create a *'first world'* standard of living. However, many of the pieces require *'first world'* access to construct easily. Because of this, there are some variants to this system when used as disaster relief housing. Disaster relief housing systems are less complex in design and system. In extreme disaster events, even the reduced complexity of an Earthship system can prove too complex to create on site. The correct quantity of materials must be present to make sure the systems work and to complete an Earthship quickly. The different materials used are relatively accessible in every country and could be adjusted as needed to provide very quick housing that would last. Collecting the magnitude of supplies does however take time and organization. Another difficulty of the Earthship is that designing a full life-support system takes time, and these systems need to be redesigned to adapt to the climate they are built in.

After the earthquake in Haiti, the Earthship team initiated HELP (Haiti Eco Living Project). After creating a preliminary design that is adapted to the Haitian climate and building a prototype, they focused on creating a central communal utility hub that multiple houses would cluster around (see Figure 10). These eight house facilities could then be accompanied by other such nodes to create a larger community. The team traveled to Haiti to demonstrate how to build these homes from recycled and other materials found around the disaster area. Instructing community members on how to create safe houses that collected and cleaned rainwater from the rubble of their cities

was an extremely empowering teaching tool. Although Earthship design does account for systems like food security by establishing local gardens, simplified disaster models do not provide many resources beyond the big three: food, water and shelter.

Earthships, although extremely empowering and simple to construct, do not include larger scale planning with results that radiate throughout a community<sup>75</sup>.

*Vietnam:*

Vietnam provides a similar example of design intervention in self-help construction. After the 2009 typhoons Ketsana and Mirinae, trainings were given within each province to describe the process and guidelines for receiving cash support and building instruction.<sup>76</sup> Surveys were conducted, and house designs were created to match “Vietnamese national and government standards, taking into account culture, geography and exposure to hazards<sup>77</sup>”. Three primary designs were developed for selected families. These families were then provided the cash support and ongoing engineering advice throughout the construction process<sup>78</sup>. This participatory approach allowed for the development of a strong sense of ownership. The limited design selection was not acceptable culturally for several ethnic minorities, however (see Figure 11). There was also a “disparity between provinces regarding the availability of local labor and prices for material and transport.”<sup>79</sup>

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<sup>75</sup> Reynolds, Web

<sup>76</sup> Ashmore, pp 98

<sup>77</sup> Ashmore, pp 99

<sup>78</sup> Ashmore, pp 98

<sup>79</sup> Ashmore, pp 98

### **Collective Thoughts:**

Each of these systems offers solutions that are contextually savvy. However, all have problems that prevent them from being universally applicable. These systems have some major flaws when thinking about creating a framework for projects worldwide, but they do have many wonderful ideas that could be better synthesized. By combining multiple examples, a very good and adaptable methodology for long-term building in a relief situation can be developed. There are several things that can be taken away from these case studies when thinking about disaster relief or poverty alleviation design. At the core of any or all projects a high quality of life should be the goal. Because sustainable material use promotes the preservation of local resources and utilizes less energy, this quality of life should be obtained through the use of sustainable material, systems and composition.<sup>80</sup> People should be provided the education to create needed resources and should be given a chance to self-construct their community and their lifestyle. There are organizations and projects that do just that. These will be discussed in the next section.

The proposed synthesis of this thesis begins with The Pink Project as an excellent example of a solid starting point. Art and informational activities raises awareness, which leads to social connections and creates a wide basis of support. From there, the next step needs to resemble a process more like an Earthship, determining the exact needs of the people. This requires the teamwork of both experts in several fields as well as the community that will be occupying the area. Once extremely legible design perimeters are created, the construction process should only take two to twenty

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<sup>80</sup> Feireiss, pp 109

people to complete. The different building systems should support all aspects of life, through flexible spaces and provided resources. As many green technologies as possible should be implemented. The design team could suggest several designs to start with, and should aid in the construction of a production facility that provides jobs. Then the design and governance should be put within the hands of the community members. Whether they decide to build singularly or densely, the systems should be off-grid so as to provide quicker rejuvenation if faced with another disaster.

There is no one system which addresses all of the problems that people face following disasters. A new paradigm combining different techniques utilized by Humanitarian Intervention, ('Gift Architecture') and Self-Help construction can create new methodologies to create a framework for effective aid relief practices and goals.

### 3. Proposed Theory: A Hybrid System of Design Relief

"Too often non-governmental organizations fail to engage and support the local business sector, instead building only homes, schools and clinics. To rebuild holistically after a disaster it is imperative to have a series of strong economic anchors in the community. Quite often, these small businesses are the heart of the community. Without them you are putting the community at risk of becoming a future slum beset by unemployment, violence and social ills. The number one request we get from clients is a job, often before housing. No one is looking for a hand out."<sup>81</sup>

There are many different types of architectural intervention. As described in the previous chapter, many of the current typologies have beneficial features that are quite effective in disaster situations. These examples, however, have been unable to create universal architectural techniques that could be adopted in any aid situation. This section will introduce projects that utilize community focused design and will synthesize the most effective techniques discussed throughout this thesis into a proposed system of design. The proposed system suggests four phases of development based upon general scale of needed projects. This system can be adjusted to have as many or few phases as are necessary to achieve different benchmarks established by a community.

Disaster relief has taken many different forms. Some have proven more effective than others. As was discussed in the previous chapter, architecture is a vital part of successful aid. However, despite the many different methods of architectural aid which exist, very few buildings are planned out by architects or by trained community members. Although buildings designed without planners can help alleviate some situations, rarely does this lead to long term resilience within a community. The involvement of architects and planners often results in better buildings and the

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<sup>81</sup> Aaronson, Deborah. *Design like You Give a Damn 2: Building Change from the Ground up*. New York: Abrams, 2012. Print. pp 39

implementation of methods that create more resilient communities. Architects, beyond “their ability to erect secure, durable structures, ... are expert contract managers capable of calculating needs, resources and budgets through the arc of a program,... architectural expertise can promote public health, encourage investing in new skills and environmental awareness and advocate for mitigating risk.<sup>82</sup>” Most importantly, “architects working in close collaboration with communities can help them act on their own behalf... represent[ing] community consensus on viable projects to intransigent or indifferent governments, and this in turn, promotes local independence”.<sup>83</sup>

### **Examples:**

Several aid organizations deliver aid to promote the goal of local independence. Mercy Corps works with bottom up aid, combining techniques of Humanitarian Intervention and Self-Help Aid. This organization recognizes that:

- **Communities** are the best agents of their own change.
- **Local markets** are the best engines of sustainable recovery.
- Success is built on the foundation of **good governance**.<sup>84</sup>

It is through this recognition that they are able to pair “local expertise with creative thinkers from the private and public sectors to identify breakthrough opportunities and new technologies”<sup>85</sup>. To work towards resilience, not only do they need to provide physical aid, but they also need to help the community rebuild and create innovative long-term solutions.

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<sup>82</sup>Ashmore, pp 9

<sup>83</sup>Ashmore, pp 9

<sup>84</sup>"Vision for Change." *Mercy Corps*. N.p. Web. <<http://www.mercycorps.org/>>

<sup>85</sup> Mercy Corps, Web

The architecture firm MASS Design was founded to explore the possibility of a partnership in Rwanda. After approaching Paul Farmer and Partners in Health, Alan Ricks and Michael Murphy set out to fill the large need for both a medical facility as well as resiliency support in the district of Burera. They focused their efforts on something they termed ‘dignity design’. ‘Dignity Design’ is a building process “leveraged for community impact, serving as an engine of education, training, and job creation [ . Its impact] reverberates far beyond the structure itself.”<sup>86</sup>

MASS Design worked to create a series of impactful strategies. Strategy one, patient-centric design, focused on the user experience, what was currently missing from local care facilities and how healing spaces could best be created. Strategy two, environmental approach, worked to enhance the hospital’s relationship to the landscape and the users’ experience. Strategy three, appropriate technology, integrated local assets as well as sustainable principles into the design of the buildings to make them accessible for local replication. Strategy four, master planning and siteing, like strategy two, focused on the composition of the building and the significance it has upon the community socially. Strategy five, measured outcomes, included steps for resiliency like preventive care and making sure that the intentions of the building truly functioned. (They accomplished this via post occupancy surveys). The sixth and final strategy, community engagement, was a vital part of their process. They executed trainings in construction and design focused on future job creation. This created new economic stimulus in the building sector and also gave the community a sense of ownership over the structure they had helped build (see Figure 12).

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<sup>86</sup>MASS Design Group. Empowering Architecture. Boston, MA: MASS Design Group, 2011. pp 31



Another example of excellent community engagement is found in the 'Housing Systems for Sustainable Development' (HSSD) envisioned by the System for Maximum Building Potential. They began their process by providing a workshop for community stakeholders. Much like Earthships and MASS design, the HSSD focused on teaching how to build rather than providing new structures and non-local construction workers. However, unlike MASS and Earthships, the HSSD worked with locals and scaled models to arrive at major design decisions. Their process provided guidelines for construction, but allowed individuals creative initiative to determine the design. Through community engagement, the HSSD system created educational empowerment and generated feasible material resources locally.

### **Synthesis:**

This thesis asserts that it is this level of community engagement and technical training that is the cornerstone of a successful architectural intervention. When combined with a tactful application of sustainable resources the effectiveness of aid relief can be dramatically improved. This combination has the potential for becoming a code of conduct for resiliency building in disaster situations. The system proposed in this thesis synthesizes the following:

- The creation of an impactful architectural system<sup>87</sup>
- A system that is both universally applicable as well as uniquely local.<sup>88</sup>
- A high quality of life as a core goal of all projects.<sup>89</sup>

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<sup>87</sup>MASS, pp 31

<sup>88</sup> The Center for Maximum Potential Building Systems. *Housing System for Sustainable Development: A Building System Using Micro Industrial Manufacturing Processes for First World Revitalization and Third World Development*. Austin, Texas. October 1991. pp 3

- Use of sustainable materials, systems and composition.<sup>90</sup>
- Access of basic resources for all people.<sup>91</sup>
- Empowerment of community<sup>92</sup>
- Supports a community's culture and lifestyle.<sup>93</sup>
- Clearly defined phases, or achievable benchmarks measuring effectiveness<sup>94</sup>
- A steppingstone structure of small focused goals to guide the community to resiliency.<sup>95</sup>

To create a system that is so diversely applicable but follows consistent methods and steps however, a level of stabilization close to 'normal' must be reached within a community.

When an area has reached a level of 'normality', the first phase of this process is to identify a primary source of organization within the community. This could be a governmental, cultural or religious group that is able to motivate, encourage and organize the majority of people within a community. The external aid group's first goal should be to work with this community group to understand, through a series of observational and interactive tests, what the basic needs, the essential cultural demands and the available resources of the community are. Once these are fully understood, a facility that acts as a primary center for the community should be developed. The

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<sup>89</sup> Mass, pp 36

<sup>90</sup>The Center for Maximum Potential Building Systems. pp 12

<sup>91</sup> Malik, pp 2

<sup>92</sup> Mass, pp 127-131

<sup>93</sup> Kleinsasser, pp 9-21

<sup>94</sup> Ecotrust, pp 38

<sup>95</sup> Ecotrust, pp 38

primary center is the essential component of this method. As a shared facility, the aid provided helps heal the community before focusing on individuals long-term resilience. The center provides an area to distribute needed aid if populations are still in a critical state. It allows for a meeting location, where essential needs can be analyzed and future key development can be planned. As the first building, the center will test new resilient building technologies and typologies, establishing the technical framework needed for future buildings. Along with the development of a building, a series of principles (like the ones developed by MASS Design for the Butaro hospital) need to be developed and applied. This process should actively elicit community participation and feedback, and be heavily guided by an architect or planner to make sure that there is very little waste, and that assembly is executed properly. This first phase is essential for forecasting different difficulties that may arise, during the design, construction and community education portions.

Resiliency requires a network of buildings and facilities to meet complex needs. Designing in phases creates achievable benchmarks for construction that involves the creation of multiple buildings. By ordering the design and construction of different facilities based on their determined architectural program complexity and scale, a comprehensible ‘building block’ process is created (see Figure 13). Working up from buildings that have simple architectural programs to ones that address more complicated problems or are more complicated in nature, creates, “an emphasis on the similarities between what are usually thought of as separate processes and separate issues.”<sup>96</sup> Addressing a community’s issues by using building systems that “are basically the

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<sup>96</sup> The Center for Maximum Potential Building Systems, pp 12

same... instills in the user the idea of problem solving through the use of components that provide for further creativity through further adaption”<sup>97</sup> post completion of each facility; thus creating better facilities each time. Phase design focuses on introducing an adaptation that is digestible in size, but is large enough so as to educate community members in how new systems function. Phase one is a building that could be accessible to the entire community to learn about and plan new projects kinetically through participation and observation.

Once this first facility is complete, Phase Two begins. The focus of Phase Two is on creating a second building which addresses the most essential need within the community. This building ideally has an educational aspect, but overall, is focused on alleviating the major obstacle preventing the community from reaching resiliency. For example, if a community’s major problem was health, a preliminary building to better understand and meet the medical needs would become the essential building. (In Phase Three, this might develop into a full functioning medical clinic as was designed by MASS.) If a lack of food resources was the most critical need, creating a facility that educates community members about a new type of agricultural production might be the developed. Once the Phase Two building is complete and generates the needed information or output for a larger scale facility, Phase Three can be initiated.

Phase Three focuses on developing a larger scale building that expands the progress made in Phase Two. It provides for the resource lack that the community had. This building is also a catalyst generating solutions for other needs to be met — ultimately generating other resources. As in the first two phases, the theme of both

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<sup>97</sup> The Center for Maximum Potential Building Systems, pp 12

external support as well as community participation must be maintained. For the community, this building is essential to long-term resilience because it teaches skills that are lacking in an area beyond construction and organization. Exterior support during this phase should include not only architectural assistance to help plan these more complex projects, but also professionals from the targeted resource areas. By the time this phase has been completed, community members should have a kit of methods, through scale and typology that helps them understand the new technologies introduced and can now develop individual projects without external assistance.

Phase Four is characterized by the initiative that residents take from information gleaned in the first three phases. One of the guaranteed results will be an increase in skilled builders and developers who will then be able to help create other buildings such as housing, and other essential facilities. Returning to MASS Design, Phase Three would be the fully functioning medical clinic they designed and Phase Four would be the housing for doctors and other buildings in town that developed after the hospital's completion. Additionally, Phase Four focuses on improvements to the community's infrastructure, planned in Phase One. This phase can be governmentally generated or locally supported. Although infrastructure will need to be upgraded throughout the process, much of the work for these cannot (practically) be implemented until Phase Four. Unless infrastructural upgrades were a primary focus for initial resource creation, having a complex built fabric takes a lower priority than the basic needs for survival. By Phase Four, any other buildings that had been established by community members along the way should have followed the long-term plan established in Phase One, making infrastructural introduction seamless.

While the most elaborate construction will occur during Phase Four, private buildings can begin construction as soon as Phase One is completed. Once people either have access to resources or are provided support to purchase building supplies, work to generate housing should be spontaneous. The public building targets of this system are designed to provide support for the community, not just individuals. They provide an essential framework to ensure continual progress within the community. Although housing is an essential part of reestablishing a society, focusing on public architecture can create both better networks as well as a focused goal for the community. The hope that is generated by working as a community builds resilience and provides psychological support. Disasters, which rip lives apart, wear down both physical and mental reserves. As was shown in Max Neef's chart (see Figure 1), resilience requires mental or emotional reserves. Architecture can be the heart of empowerment, acting as a recovery tool through the collaborative planning for a stable future, and participation that keeps people busy. It gives power of reconstruction back to community residents. This four phase systemic design strategy thus provides responsive and adaptive architectural solutions.

The community of La Ermita in the Dominican Republic was selected to test the proposed system. Phase One the design is to develop a church that will also function as a community center. The church is a binding factor for the community. It is a small, generalizable space that can accommodate community gatherings and planning. It is a project that many people in the community support and want to participate in its creation. The church is also an organization that has a wider network beyond the immediate community. This means that not only do they have access to more external

resources beyond La Ermita, but also that the ideas propagated in La Ermita are able to be utilized in other locations; creating a systemic network of resilience design. Whether or not this project is actually built, real problems and real solutions are proposed while following this new design system. The next section will discuss the goals of this community, the methods and application of the design system, and resulting structures. Without physical manifestation, the design will remain theoretical because it has not been able to deliver the intended assistance to the community. This design typology is dependent upon local knowledge, local participation, group cooperation and physical manifestation. The theoretical model in this these captures the tremendous organizational and functional potential of community design.

## 4. Concentrated Problem: Poverty and the Dominican Republic

“part of our goal in building a sustainable model for our long-term rebuilding centers is to eventually transform them into local economic development corporations.”<sup>98</sup>

### **Poverty:**

In 2000, the World Bank defined “poverty [as a] pronounced deprivation in well-being”<sup>99</sup>. ‘Well-being’ is a vague term, but there are generally two accepted descriptions. The first or, ‘the most conventional’, is a lack of command over commodities in general (often measured by income)<sup>100</sup>. The second is access to specific commodities often described as the basic resources considered to be fundamental to human survival<sup>101</sup>. When identifying levels of poverty, it is important to use both descriptions, as access to resources varies dramatically in different areas. However, one of the most common interpretations of these definitions, and the most common way to measure poverty numerically, is through income. Looking at income statistics internationally quantifies the scale of poverty in the world relatively accurately.

Poverty is split into two categories, poverty and extreme poverty. The extreme poverty line was set at \$1.25 in 1990, and the more general poverty line was set at \$10<sup>102</sup>. According to the 2010 World Bank report, the number of people living on less than \$1.25 dollars per day averaged about 1.22 billion. This was approximately 21% of our world population in 2010. While the report shows a decrease in extreme poverty

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<sup>98</sup> Aaronson, pp 46

<sup>99</sup>Lipton, Michael, and Martin Ravallion. *Poverty and Policy*. Policy Research Department. World Bank. April 1993. pp 1

<sup>100</sup>Lipton, pp 1

<sup>101</sup>Coudouel, Aline, Jesko S. Hentschel, and Quentin T. Wodon. *Poverty Measurement and Analysis*. World Bank. Ch 1. pp 29

<sup>102</sup>Ravallion, Martin, Shaohua Chen and Prem Sangraula, *Dollar a day revisited*, World Bank, May 2008.



from the 41% reported in 1990, it does not take into account the dramatic population increase or the effects of inflation during this time period. More specifically, the extreme poverty line has remained at \$1.25/day over these years, instead of increasing with inflation. However, when inflation is taken into account, the number of people living on or below the poverty line has increased. That \$1.25 in 1990 would equate to \$2.14 in buying power in 2010.

By increasing the poverty line to \$2 per day, the number of people in the extreme poverty bracket doubles to 2.4 billion. This comprises 34% of the population in 2010. Although the percentage is lower, the number of people living in extreme poverty in 2010 is DOUBLE the number living in extreme poverty in 1990<sup>103</sup>. The World Bank's calculations for people living in poverty (\$10 or less per day) is even more concerning. The number of people living under the \$10 line in 2012 was 5.6 billion people, or 80% of our world population (see Figure 2).<sup>104</sup>

The alleviation of poverty does not mean raising the 80% to the same patterns of consumption as is characterized by the other 20%. This would require approximately 3.5 Earths to sustain our current population\*<sup>105</sup>. Rather, poverty alleviation first and foremost focuses on improving livelihoods by creating access to the fundamental resources required to live as a human in the 21st century. To better understand these

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<sup>103</sup>"Poverty & Equity Data." *Poverty & Equity Data*. World Bank IBRD, IDA, n.d. Web. 2014.

<sup>104</sup> Chen, 2008

<sup>105</sup>"Current global population of over 7 billion is already two to three times higher than the sustainable level. Several recent studies show that Earth's resources are enough to sustain only about 2 billion people at a European standard of living." "Current Population Is Three Times the Sustainable Level." *World Population Balance*. N.p., n.d. Web. 2014.

<[http://www.worldpopulationbalance.org/3\\_times\\_sustainable](http://www.worldpopulationbalance.org/3_times_sustainable)>

To calculate your carbon footprint

visit:<<http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>>

needs, Manfred Max-Neef developed a theory of human scale development that defines what the resources are that humans fundamentally need.<sup>106</sup> These needs can be placed into the following: subsistence, protection, affection, understanding, participation, leisure, creation, identity, and freedom. (see Figure 1) Many of the categories laid out by Max-Neef can be accommodated through architectural intervention. Despite the acute needs an affected area may have, affected areas often exist in a ‘normal’ state. Poverty is an easy to reach, widespread problem; making it the perfect disaster for which to apply the proposed four phase system of design.

The community of La Ermita, part of the city of Gaspar Hernandez in the Espalate region of the Dominican Republic, is not only a good example of an impoverished area, but an impoverished rural area becoming more urban. Two thirds of the world’s poor live in rural areas and depend on agriculture. Thus, when working towards solutions for poverty, it is important to understand the challenges that people in impoverished rural areas versus impoverished urban areas face. Interestingly, the majority of aid relief focuses on urban areas (areas with high population density or the ‘ever feared’ urban slums). Comparably, very little aid has focused on rural areas, where the problem of slums often originates. The city and its urban philosophies of planning often become the solution for every situation, rural or urban. This creates a “fusion of urban and regional development in which the distinction between what is urban and rural becomes blurred... thereby the presence of urban characteristics in rural areas and of rural traits in urban context”<sup>107</sup> has increased exponentially. While the

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<sup>106</sup> Max-Neef, pp. 18.

<sup>107</sup> Davis, pp 11

introduction of rural aspects, like urban farming, can prove to be beneficial to urban areas, an urban solution imposed on rural areas often acts like a bulldozer, creating developments that hope to generate profit. There is a severe misunderstanding of rural areas in aid relief, and many of the potential sources of resilience are overlooked in this tendency to impose urban solutions only.

### **History:**

It is estimated that people migrated to the isle of Hispaniola (now the countries of Haiti and the Dominican Republic) from South America around 3000 BC<sup>108</sup>. These people, the Arawaks, primarily migrated from Venezuela and the Guianas. The Arawak cultural traditions eventually evolved to become the Taïno people.<sup>109</sup> The Taïno had a well established and flourishing culture, based in fishing, hunting and agriculture with a population estimated around 400,000. Until the invasion of the Spaniards, the Taïnos were resilient and lived a very high quality of life.

In 1492, Christopher Columbus arrived on the island of Hispaniola. Determined to find gold for the Spanish throne, Columbus quickly enslaved the Taïno people, thus beginning the long era of oppression and economic disparity on the island of Hispaniola. In the course of 26 years, the former thriving population of about 400,000 Taïnos dwindled to only 60,000. In 1511, a census showed the population “had decreased further to 33,523 individuals”.<sup>110</sup> This is attributed to diseases and the continuation of harsh working conditions. Queen Isabella of Spain sent the Church to

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<sup>108</sup> Pons, Frank Moya. *The Dominican Republic: A National History*. Princeton, NJ: Markus Wiener, 1998. Print. pp 17

<sup>109</sup> Pons, pp18

<sup>110</sup> Pons, pp 24

Hispaniola during this period, to help the Taino convert to Christianity. Thus began the Church's presence and organizational power on the island. This presence is still an essential part of island culture today. Unfortunately, this early attempt by the Church to bring Tainos into equal society increased their susceptibility to disease like smallpox and by 1519, only 500 pure blood Tainos survived.<sup>111</sup> The genocide of the Taino people combined with the depletion of gold mines caused a major socioeconomic transformation in Hispaniola. The Spanish began to import slaves from Africa to fill labor demands. Simultaneously, there was a sharp decrease in Spanish settlers which led to an increase of mixing, but not marriage, between Native, African and Spanish peoples.\*<sup>112</sup> It is these combinations of ethnicities that make up the majority of the Dominican Republic's population today.

From the 1500's to the 1800's, quarrels between European powers caused multiple land trades to occur, giving the island creating years of governmental instability and little economic investment.<sup>113</sup> Eventually, in 1844 the Haitian and Dominican people took the island from the European powers and the first independent government was formed.<sup>114</sup> Unfortunately, this new government quickly became a dictatorship and even after the split into two countries (Haiti and the Dominican

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<sup>111</sup> Pons, pp 37

<sup>112</sup> \*"children of white and Indian parentage were generally called mestizos; of indian and Negro parentage, zambos; of white and Negro parentage, gente de color. In French-speaking America these last were known as gens de couleur or mulatres. In English-speaking America, they were called coloured people or mulattoes. It was not uncommon to assert that children of mixed parentage 'had the vices of both parents and the virtues of neither' ... "Indians and mestizos in general were considered to be on a higher plane than Negroes and mulattoes.

-Logan, Rayford Whittingham. *Haiti and the Dominican Republic*. New York: Oxford UP, 1968. Print. pp 10-11

<sup>113</sup> Logan, pp 31

<sup>114</sup> Logan, pp 32

Republic) the government continued its dictatorship until 1961<sup>115</sup>. Through the conflict and corruption that the island experienced, little was invested in the education system, religious organizations or long term economic prosperity of the island; resulting in the low resilience levels that both countries still experience today.

The Dominican Republic continued to struggle economically and with political corruption until the 21st century. In 2000, the Dominican Republic, joining with “189 nations, made a promise to free people from extreme poverty and to extend hope and opportunity to millions across the developing world. This pledge evolved into the eight Millennium Development Goals (MDGs) with an ambitious path to reach them by 2015.”<sup>116</sup>

These goals included:

- End extreme poverty and hunger;
- Achieve universal primary education;
- Promote gender equality,
- Reduce child mortality;
- Improve maternal health;
- Combat HIV/AIDS, malaria and other diseases;
- Ensure environmental sustainability; and
- Develop a global partnership to create achievable resilience<sup>117, 118</sup>.

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<sup>115</sup> Pons, pp 336

<sup>116</sup> "Millennium Development Goals." *U.S. Agency for International Development*. U.S. Agency for International Development. 23 Sept. 2014. Web. <http://www.usaid.gov/mdg>

<sup>117</sup> "Millennium Development Goals."

Beginning with the Spanish in 1492, the people of the Dominican Republic suffered a long history of oppression and debt due to colonialism and dictatorship. By 2006, they were able to break from this history and “made an exceptionally promising start”<sup>119</sup> on the MDGs. Despite this progress, the country today is still characterized by a tremendous level of poverty. The government’s recent willingness to work towards resilience, combined with the persistent and severe problem of poverty made the Dominican Republic a perfect location for testing the ability of a phased architectural system intended to strengthen resilience. (see Figure 14 for full historic timeline and history)

#### **Sense of Place: Methods:**

Although the Dominican Republic is not in the lowest tier of poor countries, its people are still quite poor. Seventy-five percent of the population is unemployed. The country’s average income is \$5,240 (about \$14/day). Gaspar Hernandez is a typical Dominican city with colorful unfinished buildings, dozens of speeding motorcycle taxis and innovative individual alterations to life’s everyday problems. Gaspar Hernandez currently has a population of approximately 60,000 people. For the purpose of this thesis, a smaller population of 500 people was chosen as the primary focus community. The proposed architectural intervention is both more difficult and less effective when applied to serving a larger population such as Gaspar Hernandez. Although it is possible to provide for larger populations with the proposed system, it is

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<sup>118</sup> "Dominican Republic’s Work to Reach Anti-Poverty Goals Inspiration to International Community” Secretary-General in Santo Domingo Address. *UN News Center*. UN, Aug. 2006. Web. <<http://www.un.org/press/en/2006/sgsm10587.doc.htm>>

<sup>119</sup>Secretary-General in Santo Domingo Address

unreasonable to attempt a test of this system at that scale for this thesis project. La Ermita is located near the ocean, and has a population of approximately 500 people (see Figure 15-17 for maps).

Gaspar Hernandez has several church communities that are functioning as separate smaller community networks (see Figure 18). Religion is a primary unifying factor for the people of Gaspar Hernandez, and provides a niche community that is sized appropriately for the proposed project. These churches already function somewhat as community centers. Although the churches provide gathering spaces, they are architecturally unsuitable to house many of the resources they attempt to provide or could provide. These churches have established strong community support that will be emulated in the proposed design. For the initial analysis phase, the functions of these churches within the community's culture and resources currently provided to their members were closely examined.

In a country where roads are only paved as a political tool, it is nearly impossible to accomplish the betterment of the general population through government aid. This church community in Gaspar Hernandez is unique in that they have received aid from an outside (NGO) church for over 16 years. The difference that they have made in the community has been substantial, but is only just now starting to take root.

The church community of the Dominican Evangelical Church of Gaspar Hernandez (La Iglesia Evangélica Dominicana de Gaspar Hernandez) that is collaborating on this project is the community of La Ermita. This community consists of about two hundred adults and three hundred children. The site in La Ermita, was purchased by the church in hopes of building a new, more responsive church facility.

The site is less than a quarter mile from the beach, and is located on a small residential and commercial street.

Ten interviews (see Figure 19) and 17 questionnaires (see Figure 20) were completed. From this initial input and direct observation of the local area, the community's most pressing needs were determined. The overall consensus of the 27 primary stakeholders in these initial assessment, was that water, medical aid, and education were not areas of need for their communities. They believed their access to food, building facilities (shelter), and electrical access to be tolerable, but problematic. What universally was identified as major areas of need were the economy and two categories that were not originally asked about, drugs and crime (see Figure 21). The younger generation is experiencing an increase in drug use and subsequently an increase in crime has been committed stemming from the overarching feeling of discontent with the current status of their country.

During a second visit, several community design charrettes were conducted, generated a more comprehensive needs list (see Figure 22) provided important cultural preferences and provided the community's perspective on what functions the buildings should fulfill (see Figure 23). Following these charrettes, intense documentation of local building typology and failings, as well as comprehensive environmental research were completed (see Figure 24).



## ***5. Applied Design: La Iglesia Evangélica Dominicana De Gaspar***

### **Hernandez in La Ermita**

“Design is important to every aspect of our lives. it Informs the places in which we live, work, learn, heal and gather.”<sup>120</sup>

This section will describe the overall design strategies, issues needing resolve, resources and design solutions. To build a system of design for various disasters, the environment, culture and resource pool within the area must be fully considered. Introducing an innovative or new type of construction and building strategy requires an understanding of why and how the present systems work and the failures that led to a present need for architectural intervention.

The organization of this section reflects the importance of first understanding the universal challenges unique to an area and then creating a building solution that synthesizes this understanding. First, current building technology will be discussed and critiqued. Then, options for addressing the problems inherent in this technology will be discussed. Finally, the four phases of design methodology herein advocated will be presented.

The primary problem in La Ermita is poverty. This necessitates a system that is very affordable, flexible and one that performs efficiently. Another problem is the trend of not finishing buildings, either because of limited resources or to avoid taxes. Builders often “hope” to continue increasing the building size over time. However, often leave the building unprotected in ways that quickly erode the portions of the structure that have been built (see Figure 25). In the Dominican Republic there is an almost universal

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<sup>120</sup> Aaronson, pp 331

cultural desire to create buildings one story at a time; to build when any funds are available as opposed to all at once.<sup>121</sup> This creates a hope and promise for expansion. Third, La Ermita receives around 183 inches of rain per year (see Figure 28-29). This extreme amount of water increases the community's vulnerability both because of poor construction techniques and the inadequate management of standing/ground water. Water damage is the primary culprit of cement decay (see Figure 26-27).

A primary trend evident in Dominican Republic construction, as in many impoverished places, is cheap '*first world*' technologies, such as CMU construction. Proper utilization of these building techniques did not come with the new construction material. While socially these technologies for creating comfortable spaces are preferred to the more traditional palm wood construction, CMU buildings can look like ruins within a year's time because of the shoddy construction knowledge by the Dominican's building laymen. Further, the CMU buildings become hot boxes without proper lighting or cooling systems, and do not work well with the pervasive moisture. Traditional palm wood houses are both cool and well lit, but need frequent repairs and are not secure against theft. They have also become associated with being lower on the societal hierarchy. As previously stated, the problems of not finishing the buildings and a lack of providing protection from exposure, also contribute to the erosion of CMU buildings.

As a result of these variables, a majority of buildings in the Gaspar Hernandez region experience some level of water damage. Many buildings, as mentioned before, literally look as if they are melting from the exposure to water (see Figure 25-27). The destruction by water is due to several common design factors. Within the vernacular of

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<sup>121</sup> Research results from interviews in the Dominican Republic

Gaspar Hernandez, there are many buildings that have ledge protrusions on the second floor level. Most often these ledges are left exposed and collect water (see Figure 27). The water stays on the ledge until it eventually seeps through the structure, causing structural and aesthetic damage. Another common problem is leaving unfinished building elements exposed for extended periods of time. This problem is due to the relaxed tempo of building in the Dominican Republic and the common opposition to completely finishing a building. CMU walls are often left to the elements for periods ranging from six months to several years.

Rebar is left exposed and other unfinished materials are allowed to sit exposed (see Figure 27). Not only does this destroy the materials visually, but it also corrodes their structural integrity. Since there are very few building codes accessible to the individuals building these structures, this is a particular safety concern. Both of these human caused moisture issues can be remedied by more efficient designs and more aware building practices. The third common moisture problem is humidity, which is less a human error and more consequential of the environment. Being a humid climate, moisture often sticks to the cool concrete surfaces inside buildings. This erodes paint and causes mold to form around the baseboards and rafters of buildings. The fourth issue that the Dominican Republic, and La Ermita in particular, faces is the predicted sea level rise of 9 feet over the next 100 years<sup>122</sup>. The highway that intersects La Ermita is approximately 9ft in elevation. The majority of the town is located between the highway and the ocean, and will be completely inundated if climate change predictions prove accurate (see Figure 53).

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<sup>122</sup> Harmeling, Sven. “*Global Climate Risk Index 2011: Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2009 and 1990 to 2009.*” Germanwatch E.V. (2011).

### **Potential Solutions:**

The design proposed in this thesis was created during the University of Oregon, Portland's architectural thesis design studio "RE-GENERATIVE DESIGN: Redesigning and Rebuilding Cities, Towns, Neighborhoods, Streets, Buildings and Gardens, Destroyed by Natural Disaster, and/or Catastrophic Human Failure. The building system, like the larger phase system reflects the process of creating very specific solution designs to mitigate direct, local problems. The building system shows the thinking and application of a building block system on the smallest scale and deepest level.

Many of the techniques proposed are not currently typical in La Ermita. The reason for this was not explored directly for this thesis. Many current construction practices follow a design system established in other areas, whereas this system has been designed for very specific local use. This local specificity may be a contributor to the rarity of the proposed system. Research for this project did focus on solutions derived from current building analysis. This research included local environmental analysis (Figure 28), local interviews (Figure 21) and extensive exploration of local vernacular (Figures 24-27). From these observations, new resources for construction needed to be created because the current practices were not helping the community work towards resilience, but vulnerability. From existing building practices and issues observed, a building system was created that could be easily incorporated into La Ermita. The following explained type of construction utilizes locally available resources to create robust, sustainable and replicable buildings.

Taking these cultural and environmental factors into consideration, the focus for the design worked to create systems that could be built over time, but would also be protected and layered. An important asset of the area is that, like much of the northern portion of the island, there is a consistent temperature averaging 88 degrees, a prevailing wind from the north, and a constant level of high humidity. This temperate and consistent climate allows for a passive system of heating and cooling to be employed (that is, using appropriate levels of sunlight and wind throughout the year will keep the building comfortable using little to no electronic or forced systems) (see Figure 29).

The human caused moisture issues described in the last section can be remedied by more efficient designs and more awareness of building practices. The use of materials that are mold resistant and can withstand water condensation, like colored concrete, could both increase the health and life of the building by reducing painting as well as mold growth.

To deal with the preferred piecemeal process of construction along with the threat of moisture, a poured concrete frame that acts as a skeletal structure with thorough covering against moisture is required (see Figure 30). The goal of this first step is to establish shelter from water damage. To quickly erect a structure that can support a roof, the footings on the building for the primary columns of the structure need to be dug and poured after the site is prepared. Next, the columns need to be erected. These columns need to have a measurement of 2 feet by 2 feet to support future floors. This is the primary structure of the building, and is sized to accommodate for second and even third floor construction at a later time. This is accomplished by

creating silicone plugs in the top of the structure instead of leaving the rebar exposed, as is currently typical in the region. Once poured, girders need to be attached with future fittings. These fittings allow for the roof to be attached temporarily to the frame at any stage.

After the frame is completed, the roof must be fitted onto the structure. The final roof or a temporary roof would be acceptable. The roof can be either wood or metal. The Dominican Republic has been very proactive in conserving their forests, so they have a very healthy supply of both hard and soft woods. Iron work is also very common in nearby cities and is a very important part of the building typologies. The truss system is flexible in aesthetics and could either be constructed of wood or metal. For aesthetic reasons, this system will be created with wood. The flexibility of wood allowed the beams to mimic the pattern of a fishing net (see Figure 31). A pitch in the roof allowed for airflow as well as light to flood the central aisle and reduce the amount of electrical lighting needed (see Figure 32). Ideally the roofing will be made with metal but tile would also be sufficient, as long as an appropriate overhang is included. However if tile was used, there will need to be extra materials for the decking to support the tiles. Another possible alternative would be to model the roof in the traditional fashion with palm boughs.

Once the primary concrete frame has been completed and the roof has been properly fashioned to protect the structure from falling water, the flooring and the rest of the foundation can be established. Since CMU construction is less than ideal for these building climates, but is the preference, I explored the use of local and cheaper options that will work better with the climate.

Sandbag construction is a viable alternative to CMU construction in La Ermita. La Ermita being a fishing town, has unlimited access to sand, and the bags needed to hold the sand can be obtained from reusable bags commonly used for other commodities such as sugar or rice (see Figure 33). Sandbag construction is very strong in compression yet very flexible in form, allowing for more natural shapes to be integrated into the vernacular. This system works by filling bags with sand from the beach, and is then stacked with barbed wire in between as mortar. Rebar is added to the sides along with chicken wire to add form and tensile strength to the wall system (see Figure 34). The foundation for this wall type is a trench filled with rubble to allow proper support, grip and permeation of moisture. The chicken wire ties into the poured concrete frame for added support.

To prepare for these walls after the roof construction, this trench will need to be dug between the established columns just above the footings. A drainage channel will also be added at this time. Chicken wire will line the trench before the rubble is added. Once the foundation has been built up 6" above the soil level, the inner slab can be poured. Once this has settled, the walls can be constructed (see Figure 35).

This proposed system allows for windows to be framed as the walls are erected and for boards to be placed to support a vent that will run along the top of the system (see Figure 36). Creating venting at the top of the wall is important for two reasons. A vent allows for airflow on the upper portion of the wall to be controlled depending upon which side of the building the vent is located. First it allows for wind flow from lower windows on opposite walls through the spaces (see Figure 32 and 37). Second, to calculate the window openings on each wall, the prevailing winds in the area need to be

studied. In the Dominican Republic, there is very little need for glazed windows unless a separate indoor environment is being maintained (air conditioned). Screen windows with exterior protection to prevent burglary and provided natural lighting (see Figure 36) are adequate. Since the winds blows consistently from the north, to create a passive and more comfortable space, the building directs wind through from the northside to southside. To accomplish this, the window openings on the southern facade were 30% greater than the north to force wind through the building. Upper vents with insertable panels (see Figure 36), as well as the roof's shape also help with this wind movement. Because there is both a consistent temperature and humidity level, the systems can be open to allow airflow when hot, and closed to hinder air flow when brisk outside. To create some control over the movement of air, fans are installed as a part of the minimal MEP (mechanical, electrical and plumbing) system.

The final construction detail, the finishes, allow for the most diversity in this building system. The sandbag walls, on both the interior and exterior, will be coated in a thick layer of cement plaster. This plaster can be finished with any type of texture and any color added. This along with added wood framing will create a crisp finish. Another detail that can be added for window treatments is the use of glass bottles within the walls (see Figure 38). A local method of building with 'coral rock' will be used as base board on both the interior and exterior of the building (see Figure 39). Since a large majority of mold damage occurs at the base of the walls, the coral border will prevent both damage and growth of mold from water marks on the walls. On the exterior this trim can be raised to 2'6" to 3' to create garden beds and seats at different intervals along the building.



This wall design can be utilized for all building typologies within the area of La Ermita and Gaspar Hernandez proper. Buildings in other positions and locations in La Ermita the climate changes in other areas this system will need to be adjusted. Utilizing these detailed steps to design the wall system creates a doable design that will perform exceptionally well for the area addressing. The system is created in a manner that any person involved in constructing the building can learn and replicate, but has the technologies embedded in the style to prevent many of the current problems that occur with CMU construction. Designing a robust system for buildings to function efficiently within their environment is a fundamental first step to increase the resilience of an area.

**Overall Plan:**

There are four phases of development proposed with this model. Design decisions for the first phase of the project function as an educational tool as well as a springboard for future development against poverty. As mentioned previously, the church is the primary binding force in the community of La Ermita and the surrounding areas within Gaspar Hernandez. Again, the first phase of design is not focused on relieving the disaster at hand, but on creating an area for organization.

The design for the church began with the intent of making a space for the community. During the design charrettes, church members emphasized that they wanted to bring the spirit of evangelism to the community and world. They wanted to create places for church functions such as church services, bible groups and missionary work. They also wanted to incorporate spaces where the youth could play, people could gather, groups could meet, and individuals could learn marketable skills (see Figure 22 and 23).

The site that is owned by the congregation is very small (only 30 by 120 feet) (see Figure 40). However, the list of functions they wished to include on the site were very large. It was therefore imperative to create as many multi-purpose spaces as possible. Top priorities for the congregation were the chapel space and having 2 bathrooms. After hearing the community's input regarding resource needs and aesthetic preferences, the information was sorted into essentials for phase one and program elements for phase two. For phase one, the only space included is the chapel.

This site is unique in that both phases one and two will be located in the same small space. The design decisions for phase one must therefore be considered along with the decisions for phase two since they inform each other. To create a chapel of useable size, placement was a critical decision because of the size of the lot. The primary choices that emerged were to place it on the major street, or to place it further back on the property. While placing the chapel along the street would create the most publicity for this primary community space, pulling it back creates a stronger opportunity for the site to interact with the community. Setting the church back allows the front yard and entrance to become a room for the community. Setting it back emphasizes that this site is a space to enrich the whole of the community regardless of belief, and also create a procession to the church for those who are involved in or are curious about joining the parish.

The congregation wanted to include a functional educational space, both indoors and outdoors. They hoped to have a place to store books, have a computer, host all types of classes and provide a location for job training. Eating and specific holiday gatherings were also identified as major events for the church, so they also wanted to

have a cafe to create food while also creating revenue for the church's projects. Even though these functions will not be established until phase two, consideration of their location and placement were essential for the long term success of the buildings. Not only did pulling the chapel back prove advantageous for its success, but allowing space for the phase two structures (that are focused upon direct interaction with the community), directly on the main street had additional beneficial results (see Figure 41).

The walkway, and all of the formal choices of Phase two buildings were driven by the environmental forces of the site. Once the location of the chapel was determined, the proportions could be laid out in a plan. Allowing for permeability through the site was an important factor to increase connectivity between primary and secondary routes that existed around the site already. Also by maintaining a path on at least one side of the building insured that in future development, the building's air movement or solar lighting will not be hindered. With the established wall system in place, the base of the building was designed to feel heavy. As a church, it was important to create ways for it to have a sense of lightness. There was also an environmental goal of lightness, since as mentioned before, an underlying goal was to replace the insufficient CMU hot box system and work with limited technology. It was therefore decided that the majority of windows will be along the north façade. A trellised walkway was created to act as a shading device (see Figure 42). This walkway will also function to capture rainwater and clean it using bio-filtration before the water leaves the site. The roof style brings light in through the clearstory openings, flooding the isle with indirect and direct light. The roof beams were designed to mimic the pattern of a fishing net, reminiscing the La Ermita's characteristic trade and also symbolizing the Bible passage "I will make you

fishers of men”<sup>123</sup>. To bring a sense of celebration into the space, several decorative walls were created at the altar and on the sides using bottle construction similar to earthships (see Figure 31 and 38).

The education building developed during Phase 2 will be placed on the street to greet the public and to create a refuge of shade for people passing by. The classroom component of this design is an essential part of phase two. Phase one focused on creating a space for gathering and organization, educating and training participants in construction and planning techniques. Creating a classroom space and a kitchen that can develop into a business creates opportunities for other forms of education beyond construction. The church hoped to have a classroom space that provides for Bible classes, but also medical classes, language classes, craft classes and even computer access that they currently host at other locations. By providing these resources, the church buildings become an epicenter for job training and a diversification of skills that will attribute to the long term health of the economy (see Figure 43).

The buildings on the site frame a courtyard that is large enough for small pickup games like basketball and soccer (see Figure 44). There are planters along the side to border the north edge and create places to grow vegetables for the cafe. The stairway and covered sitting areas are large enough spaces for comfortable observation and/or loitering. As the stairs progress upwards to the classroom space, they extend to a covered porch that looks out onto the street below. The line of the stairs also extends past the church into a trellised walkway on the southern facade of the church. Each space is designed to be used for multiple purposes. There are places to gather inside and

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<sup>123</sup> *Good News Bible: The Bible in Today's English Version*. New York: American Bible Society, 1976. Print. Matthew 4:19

outside, in sun and shade. Many spaces connect visually, creating spaces that are both for movement, but allow for moments of pause (see Figure 45). These features create a unity throughout the spaces established. It is hoped that a sense of adventure also permeates the site.

The third phase of the project design is much more theoretical since it will require a great deal of time, resilience building and community initiative to complete. As a fishing community, exploring the possibility of the town expanding their local economy by creating an extensive aquaculture and fish processing facility seemed like a viable option for La Ermita. Currently, fishermen from La Ermita go out to sea, sometimes for days, and return with hopes that either locals or nearby resort restaurants will purchase their catch. This is a very undependable and potentially treacherous source of revenue. By creating a more predictable income by having a place to bring catches, begin the fish processing for either long term storage or for quick shipping, the facility could provide support for the established fishermen as well as create new roles for others in the community. The church cafe could become the initial site for this production and organization. Here, the concept could be tested while a product network is developed. As this niche is developed, the creation of a more extensive fishing system, allowing for simple systems of husbandry that does not overpower the local ecosystem through over fishing or concentrated over production could be established.

Ultimately, across the highway from the church, a facility to process the fish using both fresh and preserved methods, a place to sell the fish and hatchery facilities could be established (see Figure 46-47). The goal of this facility will be to not only be to increase the production of the town, but also to actively work towards the education

and empowerment of the residents. A library will also be established on the site for continued educational improvement and as a resource for continued job training. Together, the arrangement of these spaces creates a strong public center as well as multiple spaces for gathering and training. The total fruition of a facility such as this will likely take up to 30 years (from the completion of the church) to become fully developed (see Figure 48). Through participating in the creation of this site, those involved will learn new construction skills and be able to apply them to new construction in the area. This major addition to the town will also spark needed infrastructural changes. This will lead to phase four.

A first change that needs to be implemented is the reconfiguration of the town's primary road. The traffic currently zooms around corners throughout the town, and there have been several lives lost in the community as a result. Roundabouts at the entrances to the town area will begin the shift from a four lane road to a two lane road, slowing traffic. This transition will create places for cars and the dominant motorcycle transportation to park. This could also create a wider space for pedestrians along the street. Reinforcing pedestrian paths and creating motorbike lanes increase the ease of traffic movement and encourage safer transportation practices. Where paths cross the main street, a material change to pavers from asphalt could alert traffic to the potential of people crossing the street and further slow traffic. These crossings could also be acknowledged by street plantings. Along the major street, the sidewalks will be expanded. The sidewalks will not be a continuous slab as is typical, but will be made of poured 2x6x4" pieces of concrete that will act as permeable pavers and be both reusable and easy to replace.

The side streets also need to be reconfigured. While some streets will maintain two way access for ease of traffic flow, there will also be streets having only one way vehicular access. (see Figure 49).

Over the next 100 years, the community will need to address an additional significant water concern. Scientists have estimated that within 100 years, the seawater level will rise ~ 9 feet. This means that the majority of the town will be covered in water, possibly within the next 50 years. By using the system of building proposed for the church, the walls will be able to be washed away and either new structures could be built above the water line, or the frames could be used as structure for lower water level aquaculture needed for crustacean growth (see Figure 50 and 51). New development will inevitably occur on the northern side of the road over the next 100 years, but most new construction should be encouraged on the southern side (see Figure 52). Fortunately for the town of La Ermita, there is a 9 foot hill that the primary road rests on. To reinforce protection for the new town/La Ermita, a dike wall will/should be established (see Figure 53). This new seascape could eventually be developed into a lovely beachfront sidewalk.

The creation of this building system embodies techniques for creating more culturally relevant and climatically responsive building typology. This system could be used for the creation of any other building to be constructed in the area. The church, in this case, creates a place for organization and unification, thus beginning a resilience-building process. This allows residents to join in and determine how to best take advantage of their local resources and create sustainable solutions.

It is hoped that this architectural approach will facilitate community empowerment. It potentially provides communities that experience the egregious disparities brought about by disasters, the tools to reestablish their ruptured cultures and lives as opposed to simply receiving a temporary bandage for long term issues.



## 6. Conclusion

“If process and product are equally valued, the systematic and systemic ways in which various groups of people experience exclusion in their daily lives are more comprehensively addressed. Funders should recognize the value that Community Design Centers bring in contributing to design quality within the framework of community organizing, Community Economic Development (CED) and capacity building.”<sup>124</sup>

Many of the needs created by disasters are complex and hard to define, but as Albert Einstein stated, ‘everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted’. Many disasters are no longer a singular event, but hybrids of both natural and human caused events, especially with the increasing effects of climate change. In these and all disaster events, not only are victims’ physical needs tremendous, but their non-physical needs are “so powerful that they become tangible”.<sup>125</sup> People lose their homes, their security and often their cultural grounding and identity that make a vibrant community. However, architectural aid has the ability to create lasting solutions that not only generate physical resources but also provide healing for these non-physical needs.

It is the responsibility of architects to “recognize our obligations and organize our strengths and talents to respond with professional expertise to the constant, urgent crises that confront people displaced by environmental hazards and conflict.”<sup>126</sup> Architects and the design community as a whole need to respond to disasters in a manner that creates lasting solutions. When short term design solutions are employed, this does not provide lasting relief and it tarnishes the idea of architecture as a viable

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<sup>124</sup> Watson, Donald, Alan J. Plattus, and Robert G. Shibley. *Time-saver Standards for Urban Design*. New York: McGraw-Hill, 2003. Print.. ch4.11-1. pp 444

<sup>125</sup> Feireiss, pp 118

<sup>126</sup> Aquilino, pp 287

solution for disasters. Dire global circumstances call for smarter designs. There is a call for designers that “ bring with them what the local people might lack: information and methodology”, including “ways of thinking and doing, or ways of resolving issues, stating problems, and assessing local traditional responses to any set of circumstances.”<sup>127</sup>

There are several pervasive problems within the architectural profession that contribute to the lack of viable aid design solutions. Architects are called upon to create designs for disasters in the same way that they would create a building in a non-disaster event. Although many of the techniques used in everyday practice can be transferred to the disaster process, there are several very important shifts that must occur for resilience-building to be actualized. These are the integration of local technology, simple sustainability, education, and most importantly, a focus on community participation with design.

According to MASS Design, when "the building process is leveraged for community impact, served as an engine of education, training, and job creation, [its impact] reverberates far beyond the structure itself"<sup>128</sup>. Creating community focused buildings allows *communities* to make decisions on how to solve their problems. Community participation in design and construction teaches the community how to build other structures in the future. Participation with aid intake and dispersal teaches many different skills essential to the functioning of a community, (economics, medical, organizational, educational, etc) and creates jobs through training. A community center

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<sup>127</sup> The Center for Maximum Potential Building Systems. pp 4

<sup>128</sup> Mass, pp 151

is a post for other forms of aid to be delivered in an efficient manner and prevents resources from being wasted or imposed. Community design has the potential for becoming the blueprint for the development of a resilient society.

Resilient societies are able to accomplish the following:

- “Plan for change through flexibility, awareness of uncertainties, and functional redundancy,
- Expand opportunities of human potential, leadership, creativity, entrepreneurship, and diversity,
- Develop rich relationships such as social capital, local and regional self-reliance, and rich feedbacks,
- Design for learning by the integration of knowledge and practice, social memory and learning, and continuous institutional innovation,
- Consider multiple scales through system thinking, foresight, and compassion.<sup>129</sup>

The architectural approach proposed in this thesis provides communities that experience the disparities brought about by disasters the tools necessary to reestablish their ruptured cultures and lives as opposed to simply stopgap solutions to the long term issues they face. The system embodies techniques for creating a more culturally relevant and climatically responsive building typology which creates social resilience. In terms of La Ermita, the church provides a place for organization and unification. This allows residents to meet and collaborate regarding how to best take advantage of local resources. This in turn generates solutions for problems identified.

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<sup>129</sup> Ecotrust pp 6

Introducing a new type of construction and building thinking requires an understanding of how and why the present systems work, as well as the failures that led to the present need for intervention. A large amount of preparation for this thesis focused on understanding the Dominican Republic. Research about the history, culture, current customs and building systems helped create initial documents. However, it was not until work was completed on the ground that a truly responsive design could be created. This became obvious in the first interviewing stages of the project. Parts of the study changed dramatically once on site. An example of this was with the simple interview forms. The forms were prepared so that participants that spoke English or Spanish could understand them. There was also a visual explanation so that people who were unable to read were also able to participate. However, what was unanticipated was that many participants did not know how to hold a pen or pencil, and needed assistance to mark their answers.

Another challenge encountered was there were very few resources, like maps, codes and infrastructural information available locally or electronically. Instead of relying on city lot maps and the usual requirements of water and electric companies, measurements of the site and surrounding area needed to be completed by hand and via local knowledge. The codes for the Dominican Republic were also few and far between, so using code standards from areas in the United States similar climatically became necessary. This challenging aspect of design intervention will most likely be true in a majority of disaster situations and was an important realization.

Working with areas that have fewer resources technologically and less education in built design, provided a challenge for communication and required correspondence

after site visits. Communicating with leaders in La Ermita would have gone smoother had pre-training with them about the design process occurred, or if individuals knowledgeable in construction were included in the post site visit correspondence. Identifying local individuals in disaster situations who can act as an architectural communication point people would be helpful. These persons or person would then communicate with leaders about design issues and provide information needed regarding local resources. Without the right leadership both by external and internal players portions of the design process may be overlooked, and this could sabotage the long term success of a project. It is essential that good facilitators and design leaders are active participants in helping the community evolve their ideas into a design plan. The benefit of working with the community in La Ermita is that it allowed methods of community design to be tested. This implementation helped clarify what adjustments would be necessary to create a robust but flexible overall system of design.

This thesis has attempted to demonstrate that an architectural four phase system of relief can create successful long term resilience. This thesis outlines the planning portion of Phase One, and also explains how future phases would be accomplished in La Ermita. In the next step of this project (post thesis) working through any building challenges and problems that arise with the construction system as Phase One is built, will be essential. The phases in this thesis are established to create a clear process for a community to complete the necessary steps achieving resilience. It does not matter how quickly each step is achieved (although a quicker timeline is preferable) or if particular aspects are combined between phases. There could be eight steps or two depending upon the individual nature of a community and its needs. This process is flexible as long

as projects follow the order that the phases in this thesis layout. It is the hope that future disaster projects using this system will complete this initial design phase in a shorter time frame than the two years used to develop this thesis.

Community based participatory design is the key factor for successful architectural intervention in disaster areas. Several aspects of this type of design give it a distinct advantage over common types of architectural aid. Preliminary work in Phase One focuses on understanding the community and working through the development of the buildings with the greater community. This creates not only the beneficial aspect of setting achievable benchmarks for community, but it focuses on community level relief instead of individual relief. Although individual needs must be addressed by separate immediate aid, by planning in advance a built solution that will benefit everyone and allow broad based participation, more people will be able to be reached in the immediate aftermath of a disaster. Community participatory development includes an educational component that helps community members understand a site, how to build responsive technologies, how to build and design spaces and how to organize resources. Through planning, resource utilization and construction, new skills are fostered which can lead to new jobs. This then helps diversify the local economy. Reaching a large amount of people and training them in how to create better buildings provides the opportunity to apply these techniques to other new buildings created by individuals throughout the community. By participating in the creation of the buildings from conception to completion, the community gains a sense of ownership for the building, which is essential for successful use and upkeep of any building. The process of building binds the community together behind a focused goal, generating confidence

that improvement after a disaster is possible. Because of the multiple advantages created by community involvement, all disaster design should include levels of participatory design. This thesis incorporates community design for these reasons.

Two additional essential elements, beyond community involvement, make the proposed system of design universally applicable as a resilience-building tool. The phase system focuses on creating a method that asks questions rather than proposes a singular building type. It is an adaptable system that can be implemented anywhere, and can generate local solutions. By focusing on community buildings instead of housing, like many design solutions, the different phases create group resilience instead of individual resilience. Group or regional resilience is essential for restoring an area's culture and resources<sup>130</sup>.

In all types of disaster situations, the need to establish solutions that increase a community's adaptive capacity and provide for the basic resources of its population is paramount for long term success. Architecture can be an excellent means to a solution that accomplishes just that. The success of an architectural project fashioned to follow this thesis depends on the guidance and involvement of the designers and communities. By increasing collaboration with the community, providing training and creating job opportunities, external aid forces could easily transition from current aid practices to a more effective level of intervention.

Disasters will only increase in severity as climate change increases and conflict grows. Having access to basic levels of resources is a fundamental human right. We do not have enough resources to continue to provide aid as it is currently dispensed. There

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<sup>130</sup> Ecotrust, pp 3

is an extreme need to try out new forms of intervention. The utilization of community design proves to be an effective way to alleviate disaster situations.

“Today’s failures are not isolated, but interconnected. We draw upon the scientific literature on social-ecological resilience and bring a practitioner’s perspective in order to develop an understanding of systemic responses to systemic challenges: a culture of resilience. This culture begins at home, by nurturing the capacities that build resilience and enable transformation. It is a culture that manifests at multiple scales, from the personal to the community and region - on up to the species and planet...human needs for natural resources and services largely rely on regional resilience - ... in many places, effective regional institutions are missing or underdeveloped. It is critical that we start a broader conversation about the role of regions (see Figure 58).”<sup>131</sup>

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<sup>131</sup> Ecotrust, pp 4



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Figure 22: Generated for Thesis by Author and community of La Ermita, Photographs taken for thesis by Author

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Phase Three and Four Model: Generated for Thesis by Author

Building Material Samples from UO Material Resource Library

Pattern Language: Generated for Thesis by Author

Epilog

## Appendix

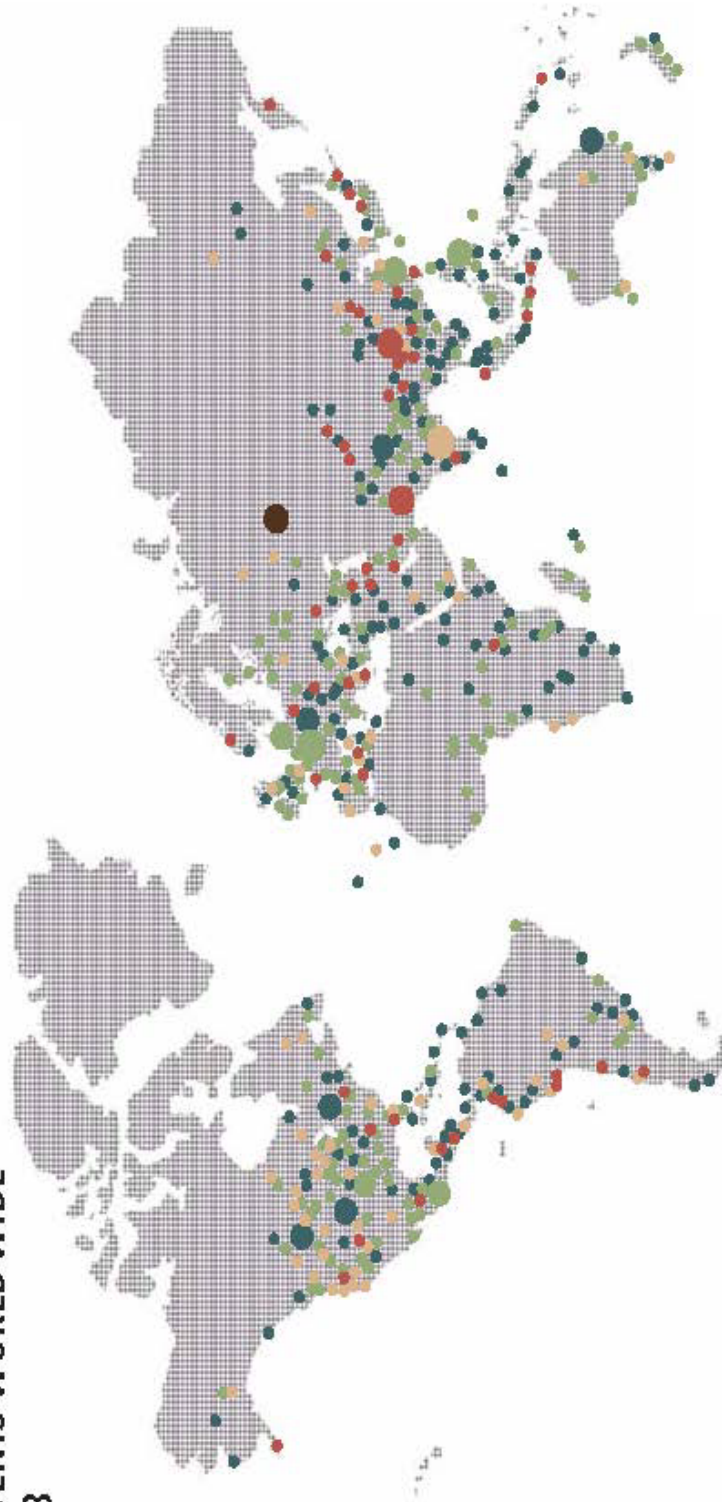
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<b>Need</b>	<b>Being (qualities)</b>	<b>Having (things)</b>	<b>Doing (actions)</b>	<b>Interacting (settings)</b>
subsistence	physical and mental health	food, shelter, work	feed, clothe, rest, work	living environment, social setting
protection	care, adaptability, autonomy	social security, health systems, work	co-operate, plan, take care of, help	social environment, dwelling
affection	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
understanding	critical capacity, curiosity, intuition	literature, teachers, policies, educational	analyse, study, meditate, investigate,	schools, families, universities, communities, associations,
participation	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	parties, churches, neighbourhoods
leisure	imagination, tranquility, spontaneity	games, parties, peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
creation	imagination, boldness, inventiveness, curiosity	abilities, skills, work, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences
identity	sense of belonging, self-esteem, consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
freedom	autonomy, passion, self-esteem, open-mindedness	equal rights	dissent, choose, run risks, develop awareness	anywhere
The architectural process of design includes all of the blue boxes and can generate these concepts				

Figure 1: Chart of the Basic Human Needs by Max-Neef

# LOSS EVENTS WORLD WIDE IN 2013



**880**  
LOSS EVENTS  
REPORTED

+

6.4 billion  
humans  
living on  
less than  
\$10 a day



**80%**

Living in poverty

Figure 2: Loss Events World Wide taken from Munchener Ruckversicherungs-Gesellschaft, Geo Risks Research January 2014

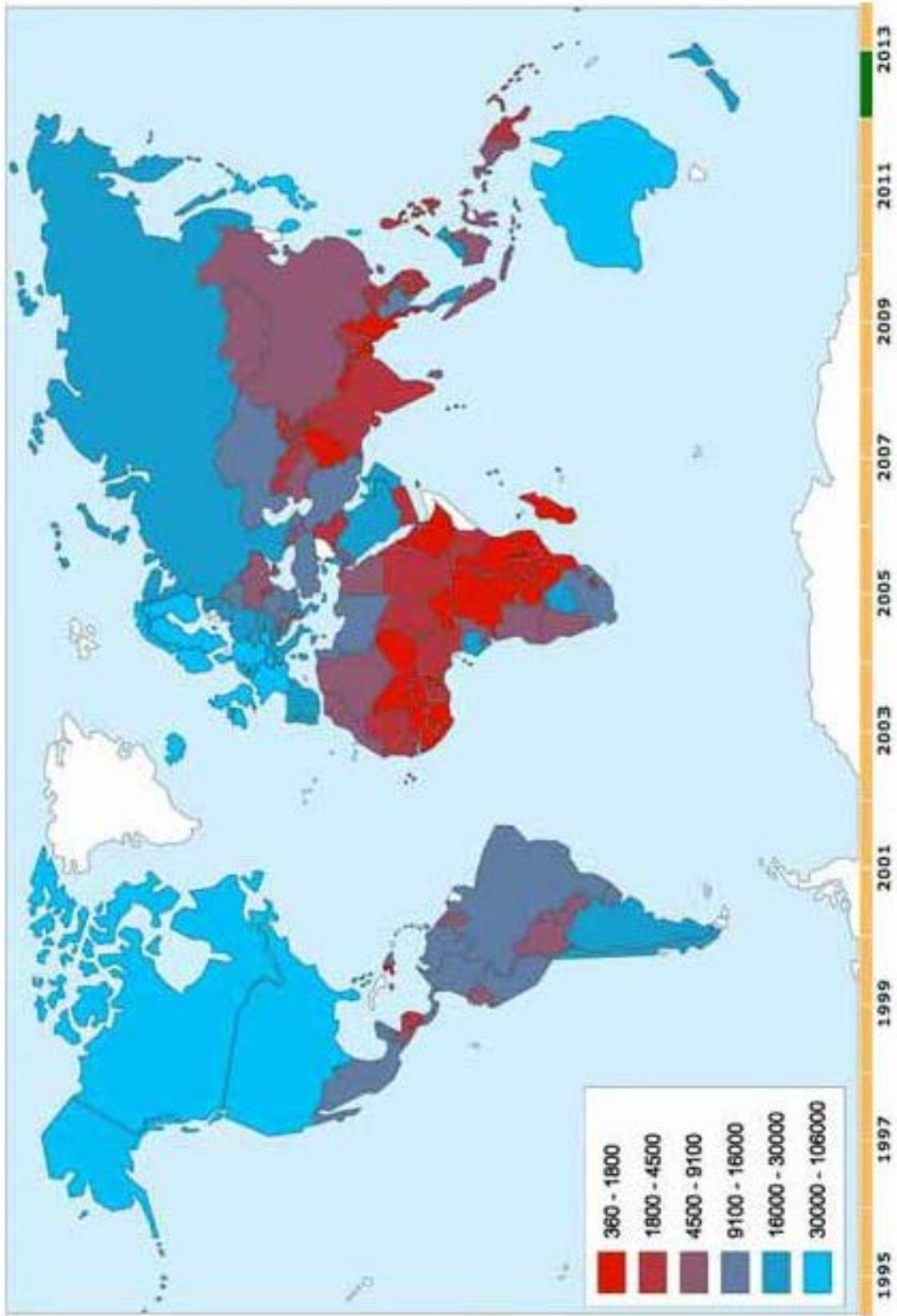


Figure 3: GDP per Capita, PPP dollars; World Economic Outlook, April 2012



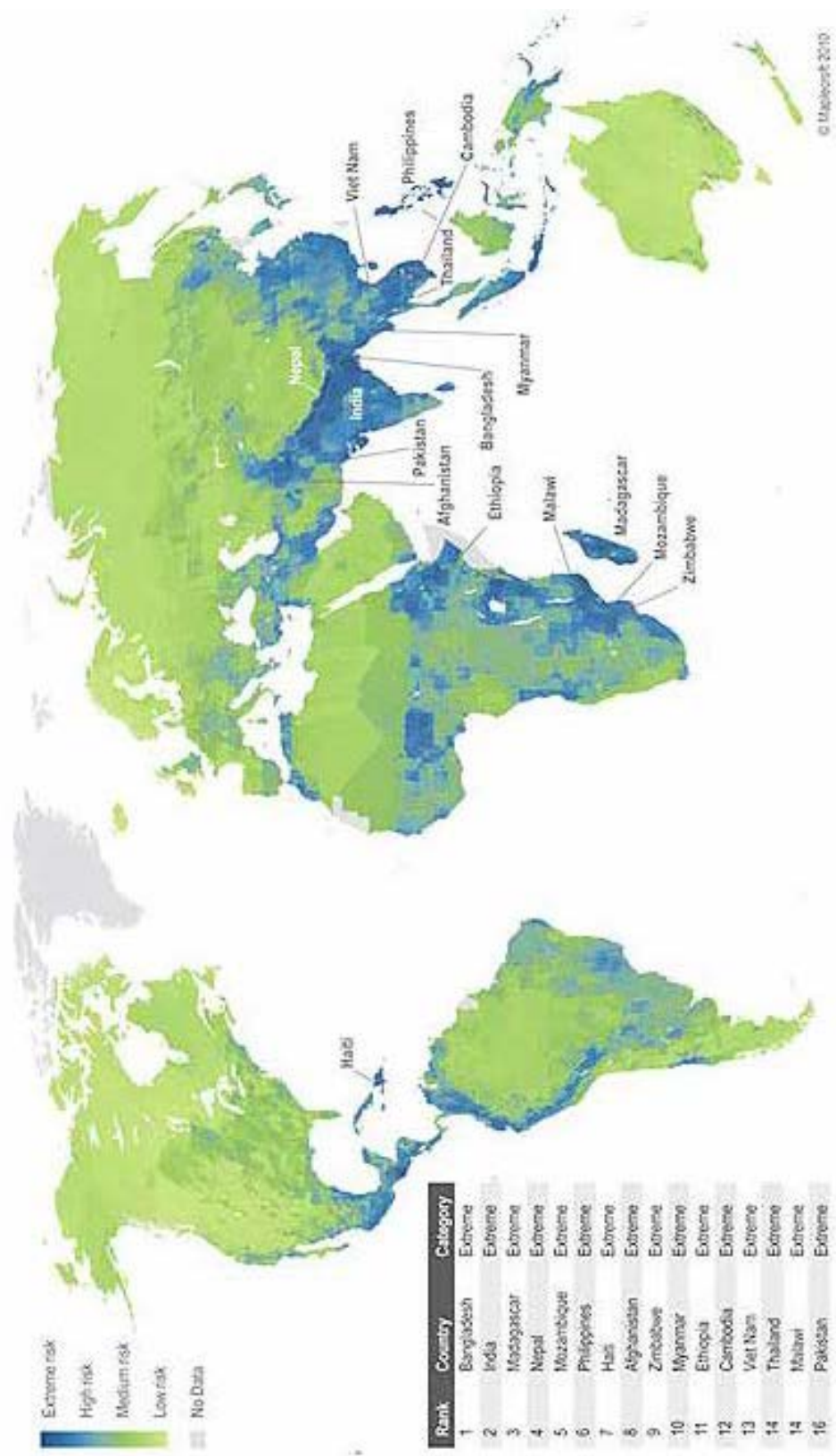


Figure 4: Climate Change Vulnerability Index 2011: Maplecroft

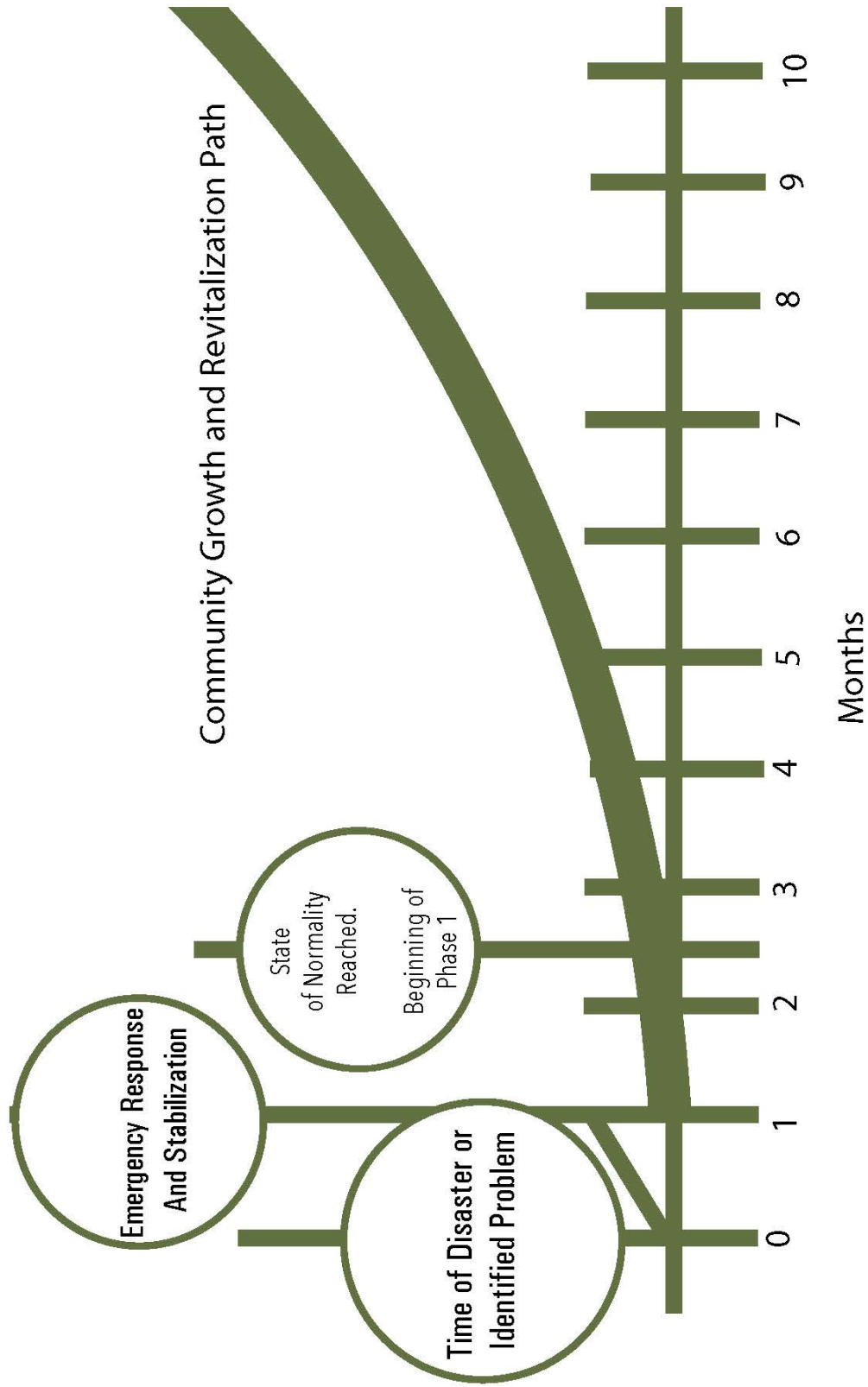


Figure 5: Proposed System Reaction Time After an Event



Figure 6, Salam Medical Center in Sudan

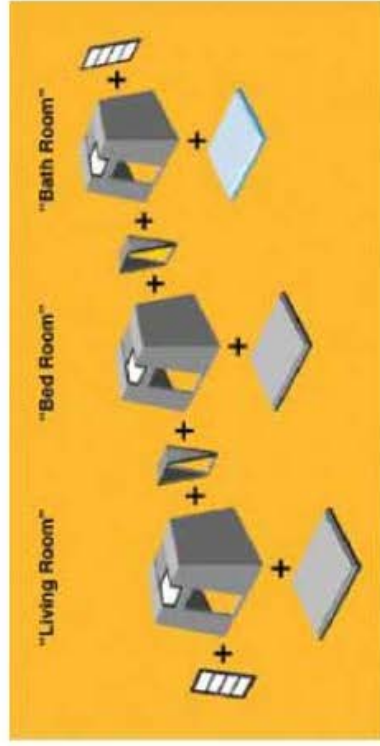


Figure 7, Michael McDaniel's Exo's





Figure 8 : Habitat for Humanity: Musicians Village, New Orleans



Figure 9, Make It Right Building Innovations. These photos were taken on the same street, facing opposite directions.



## 10 days of work

- Shelter:**  
strong, local, sustainable
- Sewage:**  
sanitary flush toilet
- Shower:**  
clean, sanitary water
- Food:**  
grow food
- Electricity:**  
charge a cell phone  
and laptop

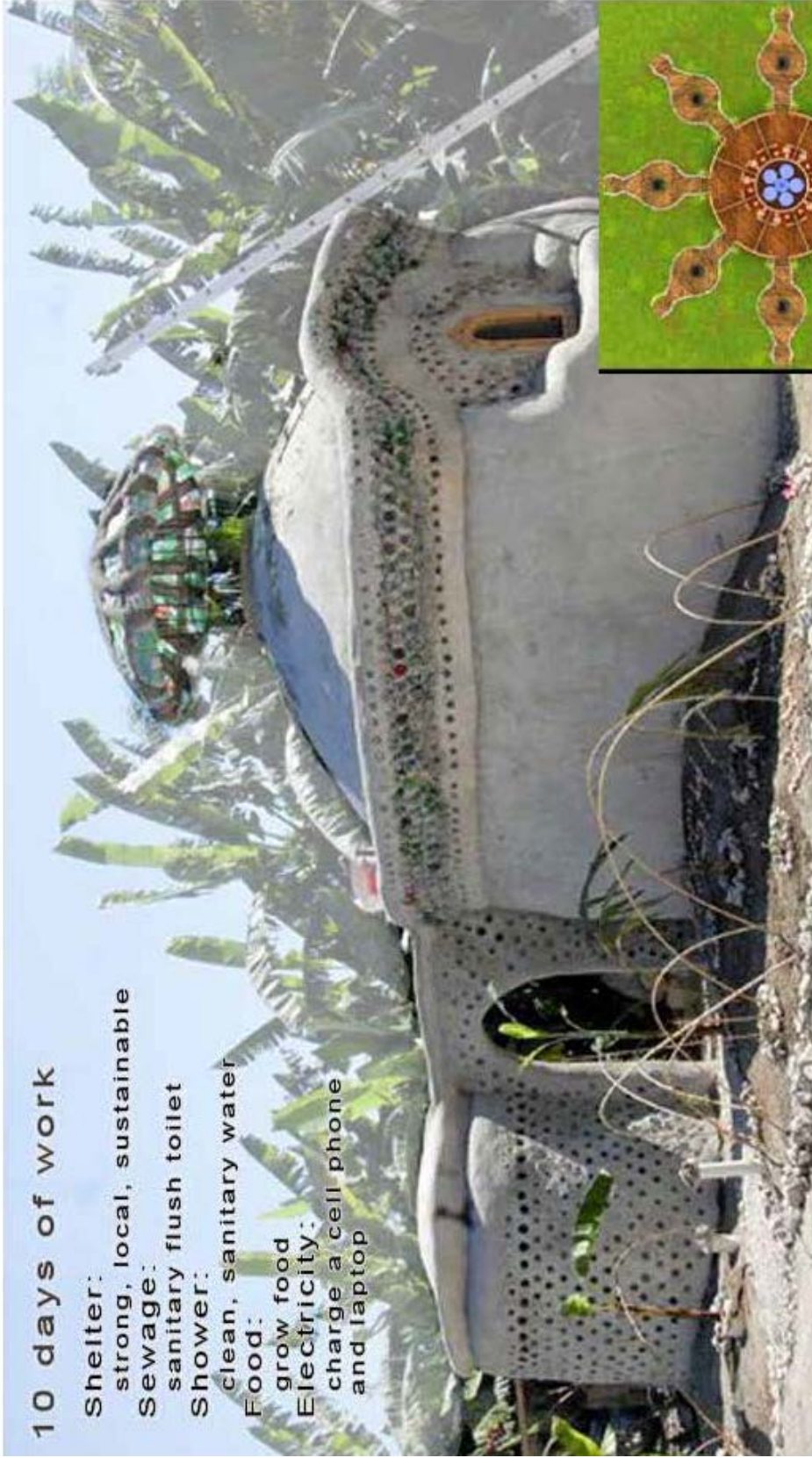


Figure 10: Earthship Design and Implementation in Haiti



Figure 11: Vietnamese Housing designs





Figure 12: MASS Design: New Building Sector and Participation on Construction in Rwanda

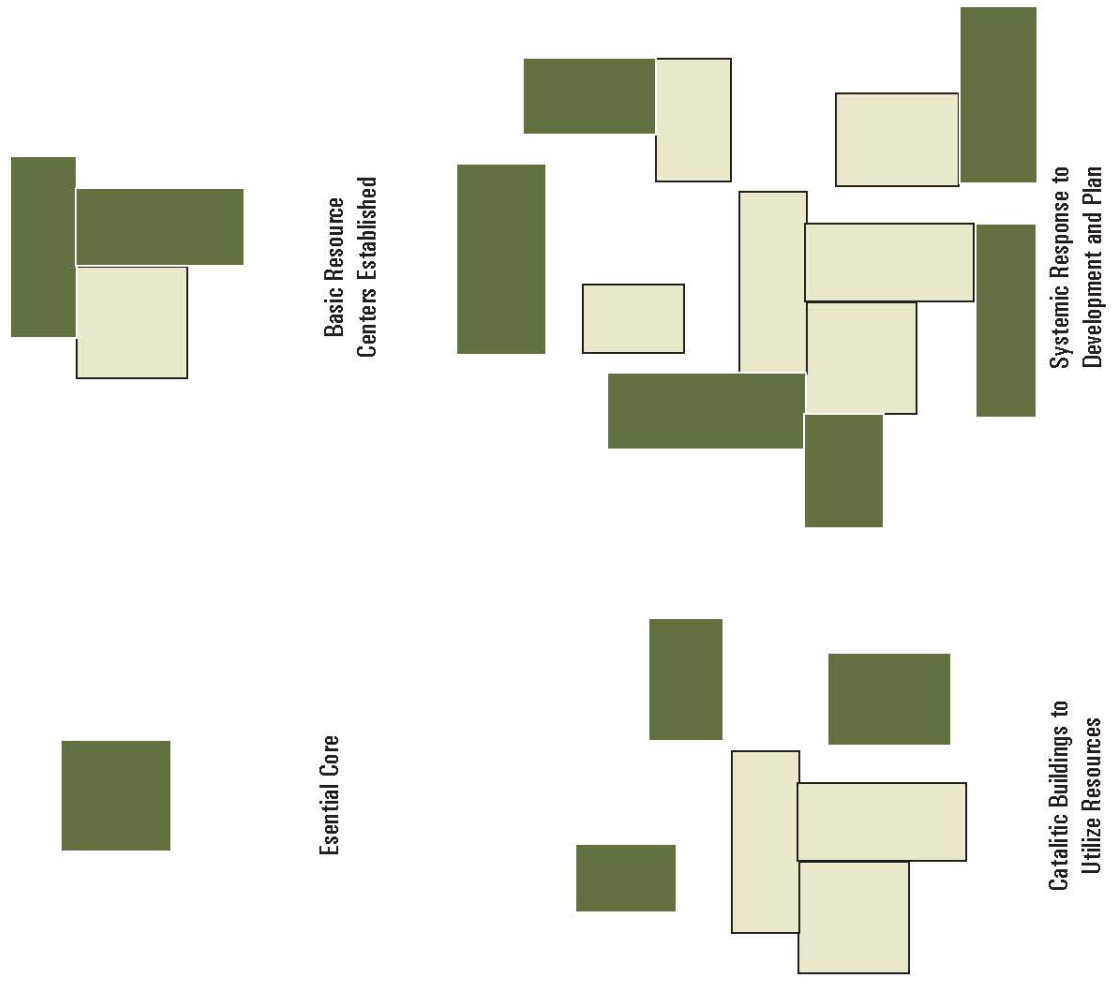


Figure 13: Building Block Diagram

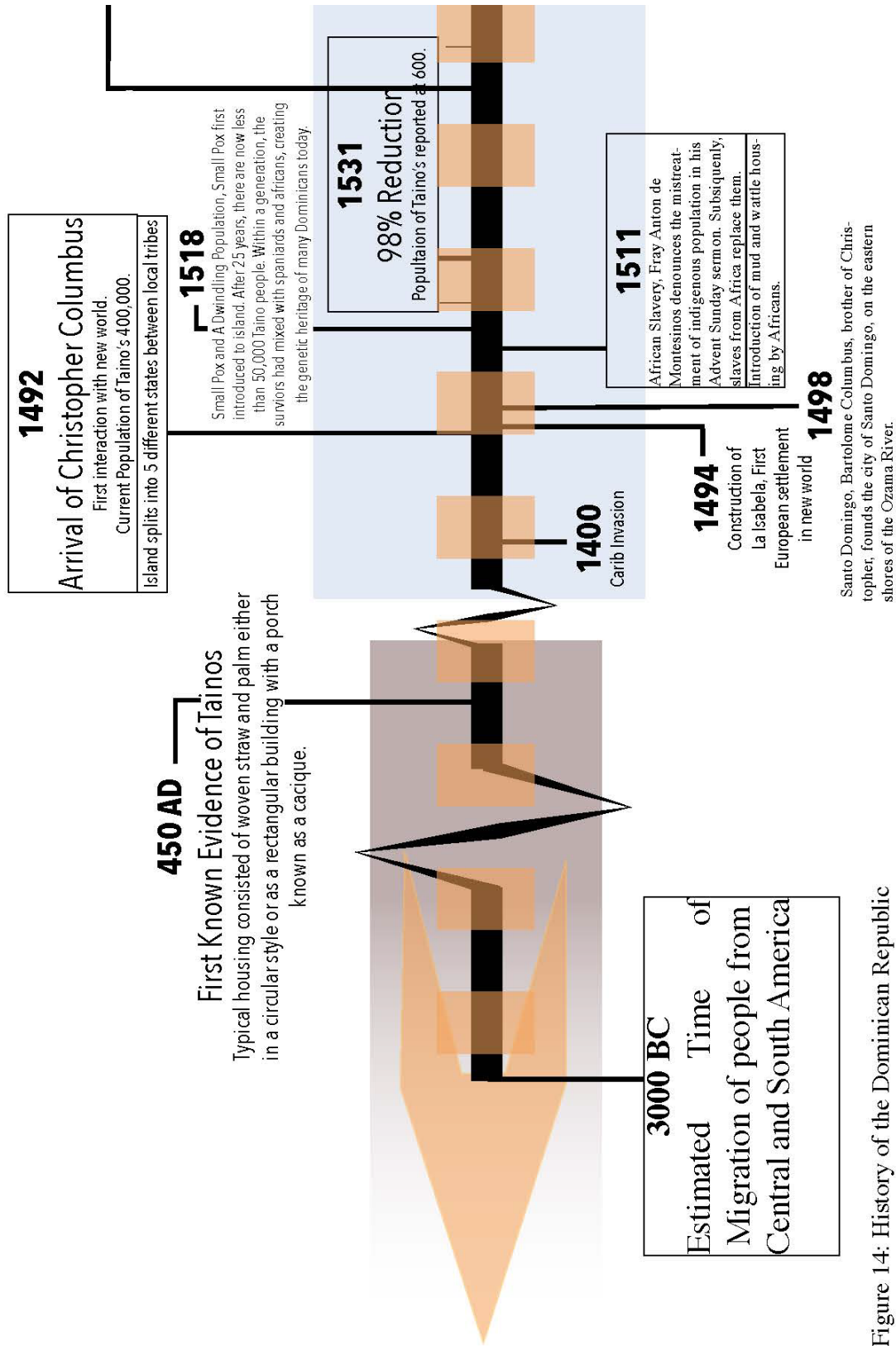
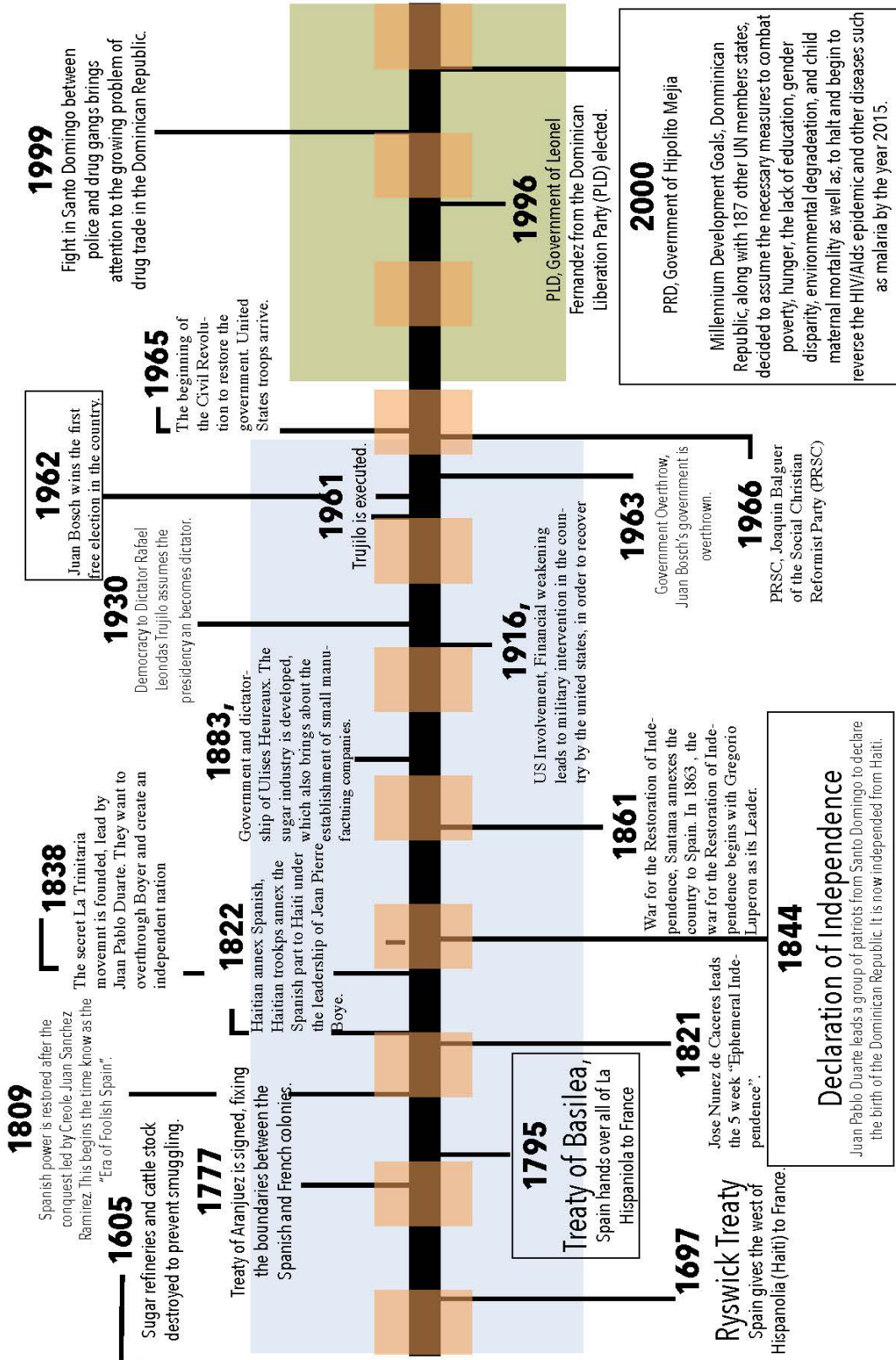


Figure 14: History of the Dominican Republic





## **Full History of the Dominican Republic:**

It is estimated that people migrated to the Dominican Republic from South America around 3000 BC. These people, the Arawaks, primarily migrated from Venezuela and the Guianas. As their cultural traditions evolved, the Taino society appeared". By 700 AD, the Taino had a well established and flourishing culture, based in fishing, hunting and agriculture. They also had an adapted housing type called 'Buhios'. They had clay cooking pots and utensils as well as woven goods. They had strong community values with a high degree of social solidarity. Often high in their leadership was their behique, witch-doctor/religious leader, or caciques, chiefs. At this time in history, until the invasion of the Spaniards, the tainos were resilient and lived a very high quality of life.

In 1492, Christopher Columbus arrived on the island of Espanola. Determined to find gold for the Spanish throne, Columbus quickly gathered any gold jewelry pieces that the Tainos [he met] had accumulated over hundreds of years, and used these finds to validate his mission. Although the first few attempts at colonization failed, resulting in riots by natives and starvation by the colonists, Columbus eventually established a permanent fort and began to enslave the native people. Captured Tainos were "grossly overworked, mistreated and underfed". While native peoples were declared 'free' in 1501, practices of slavery continued well after the declaration. In the course of 26 years, the former thriving population of about 400,000 Tainos dwindled to only 60,000. In 1511, a census showed the population "had decreased further to 33,523 individuals". This is attributed to diseases and the continuation of harsh working conditions. Queen

Isabella sent the Church to Hispaniola during this period, to help the Taino convert to christianity. Thus began the Church's presence and organizational power on the island. This presence is still an essential part of island culture today.

Unfortunately, this early attempt by the Church to bring Tainos into equal society increased their susceptibility to disease like smallpox and by 1519, only 500 pure blood Tainos "survived by fleeing to the mountains". The genocide of the Taino people combined with the depletion of gold mines caused a major socioeconomic transformation in Hispaniola. During this time also a major shift from gold mining to sugar production and business in livestock took place. The Spanish began to import slaves from Africa to fill labor demands. Simultaneously in Mexico, silver mines were becoming very profitable and there were plenty of natives for labor. This spurred many of the Spanish to emigrate from Espanola. The sharp decrease in Spanish settlers led to an increase of mixing, but not marriage, between Native, African and Spanish peoples. These mixes were named based upon their parentage, and later these distinctions determined the level of equality citizens received. It is these combinations of ethnicities that make up the majority of the Dominican Republic's population today.

Throughout the 1600's and 1700's, Spain quarreled with the other colonial European powers. This led to the Ryswick Treaty and eventual Treaty of Basilea in which Spain gave France first half of the isle of Hispaniola and eventually all of the island. Although the island had promising cattle, sugar and tobacco production, financial troubles continued. By 1803, France was forced to withdraw from the island. This gave Haitians the 'legal' basis to proclaim leadership and unify the Eastern portion of the

island under Haitian rule. However, Spanish power was restored in 1809 after the conquest led by Juan Sanchez Ramirez, declaring Spain's King Ferdinand VII as sovereign of Santo Domingo. Only ten years after, President Jean Pierre Boyer of Haiti marched and claimed the Dominican as part of Haiti, beginning the period known as Ethiopianization. Although he abolished slavery, Boyer reintroduced forced labor, closed the university and ignored the needs of many churches.

In 1844, a group of rebels led by Juan Pablo Duarte, created the Trinitaria movement, and declared independence from Haiti. After considerable battle, General Pedro Santana was sworn in as the D.R.'s first president and eventual dictator. Political unrest and severe economic trouble continued for/of the Dominican Republic, and drew attention and support from both the French and United States governments. A petition to join the United States, had considerable support but failed due to the people not being white enough to join. The political trouble combined with the World Wars led to long term occupation of the Dominican Republic by the US Navy, which brought about changes like a highway system and more schools, but created even greater gaps in the political and economic systems. The trend of revolution followed by unbearable dictatorships, continued until Rafael Leonidas Trujillo's was executed in 1961. You might consider carefully what of this directly relates to the argument you are making on disasters, resilience, etc. and then delete the rest. This is all background that shows good research but does not strengthen your argument.

The Dominican Republic continued to struggle with political corruption and its economy until the 21st century. The Dominican Republic continued to struggle with political corruption and its economy until the 21st century. In 2000, the Domini-

can Republic, joining with "189 nations, made a promise to free people from extreme poverty and to extend hope and opportunity to millions across the developing world. This pledge evolved into the eight Millennium Development Goals (MDGs) with an ambitious path to reach them by 2015."



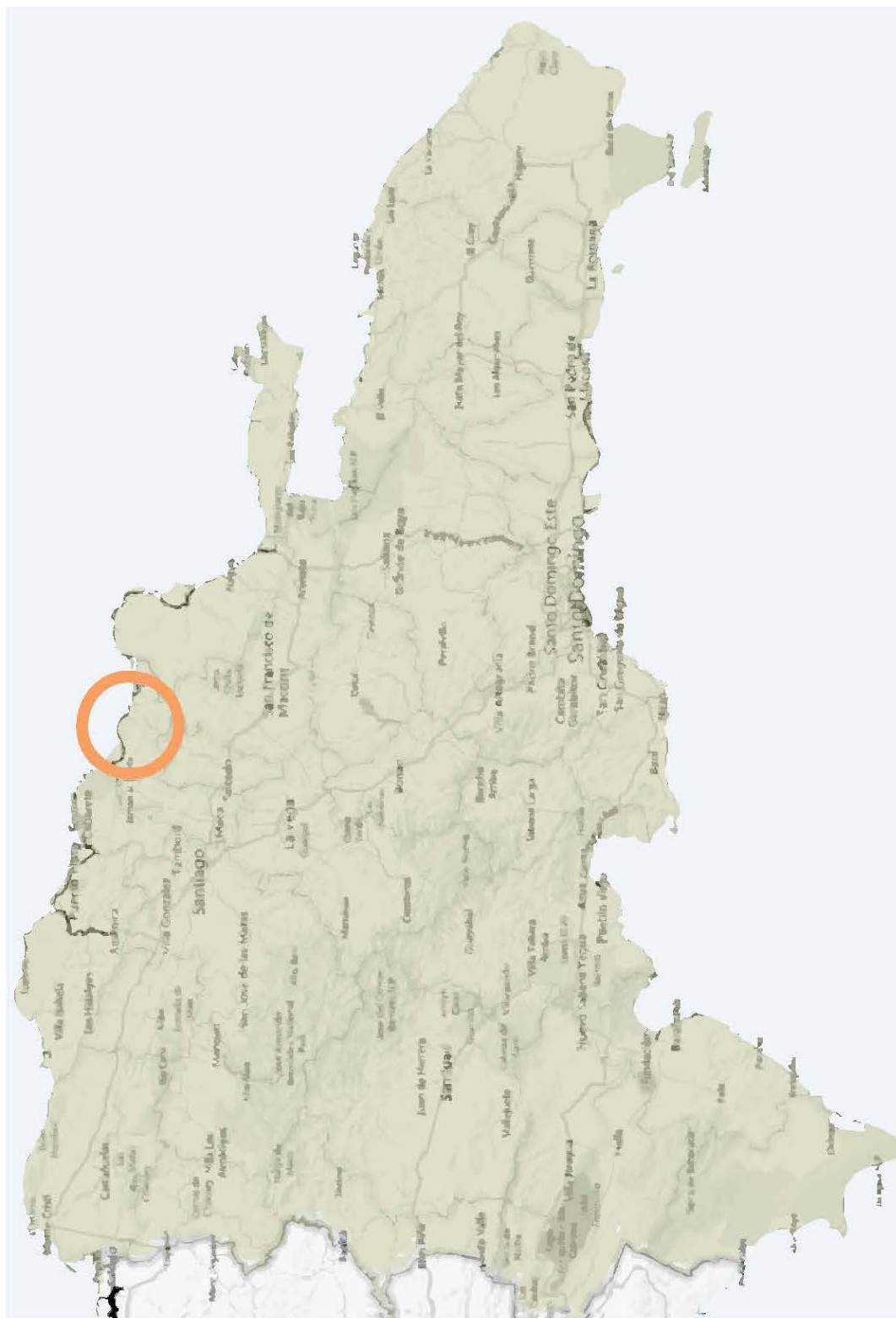


Figure 15: Dominican Republic Map

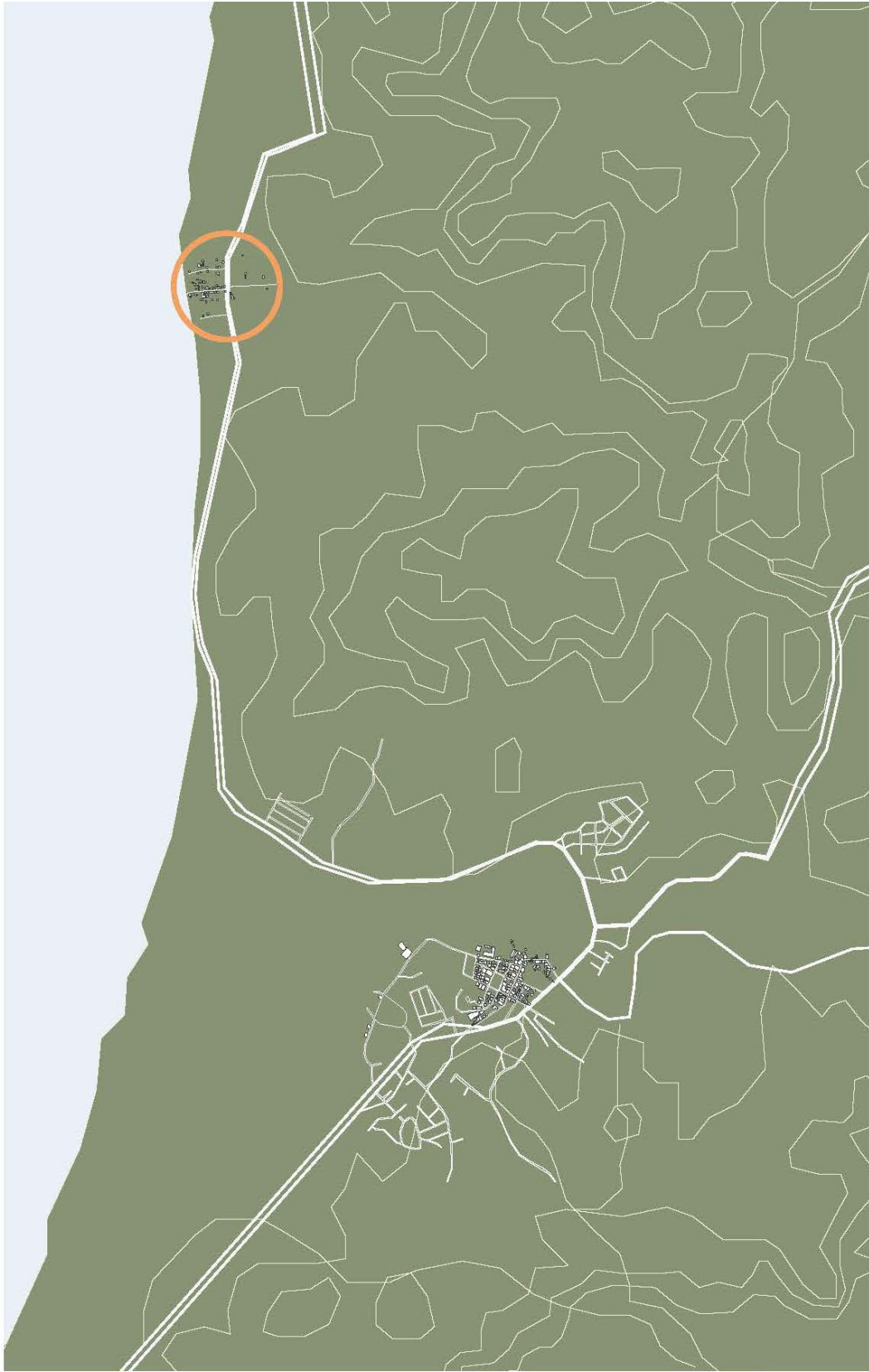


Figure 16: Gaspar Hernandez Map



Figure 17: La Ermita Map



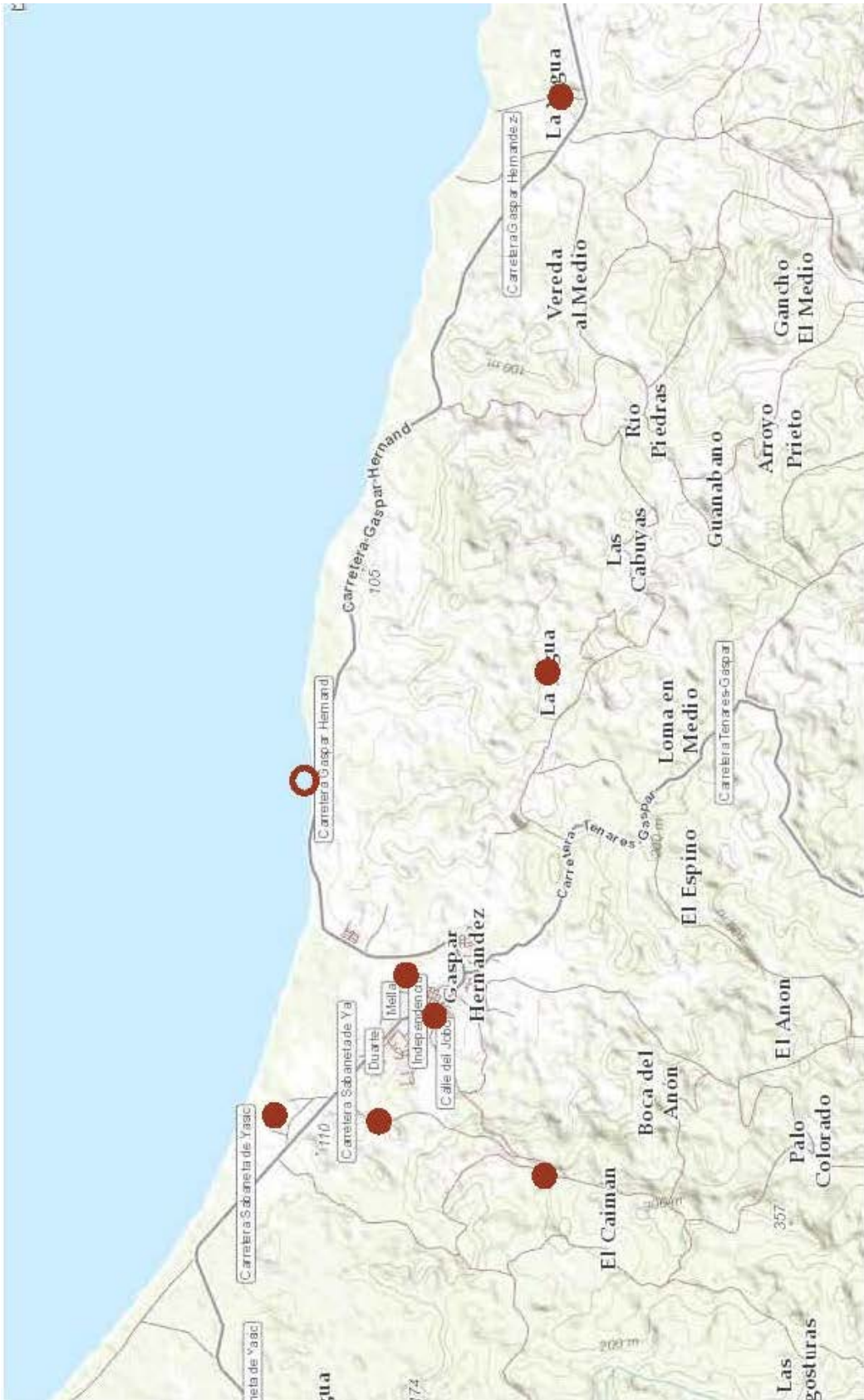


Figure 18: Church locations of La Iglesia Evangelica Dominicana de Gaspar Hernandez in Gaspar Hernandez Region

### Thesis Interview Questions: Gaspar Hamandaz

Mi nombre es Kaeli. Soy un estudiante de arquitectura en la Universidad de Oregon, en los Estados Unidos. Tengo algunas preguntas hoy porque quiero saber cómo diseñar lo mejor soluciones sostenibles para los problemas o necesidades de una comunidad. Tengo estas preguntas para entender mejor su comunidad, cómo funcionar su comunidad ahora, y lo que hizo en el pasado para ayudar las necesidades de su comunidad.

My name is Kaeli. I am an architecture student at the University of Oregon, in the United States. I am asking these questions today because I am studying how to best design sustainable solutions for a community's problems or needs. The questions that I will be asking are to help me better understand your community, how it functions currently, and what has been attempted previously to meet the communities needs.








1. ¿De dónde obtienen su alimento? ¿Qué tipo de comida?  
Where do you get your food? What type of food?
2. ¿De dónde obtiene el agua potable?  
Where do you get clean water?
3. ¿Cómo calificaría la cantidad y calidad de la vivienda en su comunidad?(pobre, adecuada, buena)  
How would you rate the quantity and quality of housing in your community? (poor, adequate, good)
4. ¿Qué servicios médicos tiene usted en su comunidad?  
What medical services do you have in your community?
5. ¿Tiene electricidad? Cuantos por ciento en la comunidad tiene electricidad?  
Do you have Electricity? How many in the community have electricity?

6. ¿Cómo describiría la economía en Gaspar Hamandaz? ¿Cuál es la razón de empleo / desempleo?  
How would you describe the Economy in Gaspar Hamandaz? What is the employment/unemployment rate?
7. ¿Cuáles son los lugares más importantes para usted en su comunidad?  
What are the most important places to you within your community?
8. ¿Qué factores unifican su comunidad?  
What would you say brings your community together?
9. ¿Cómo describiría su comunidad? ¿Cómo describiría el liderazgo de su comunidad?  
How would you describe your community? How would you describe your communities leadership?
10. ¿Cuáles son los mayores problemas de Gaspar Hamandaz?  
What are Gaspar Hamandaz's greatest problems?
11. ¿Que hizo en el pasado para resolver estos problemas?  
How have these problems been addressed?
12. Si estos esfuerzos no han resuelto los problemas: ¿En su opinión, que proviene la resolución de los problemas?  
If these efforts have not solved the problems: What, in your opinion, is preventing lasting solutions from being realized?
13. ¿Cuál sería el cambio más beneficioso para empujar la comunidad?

Figure 19: Long Interview Form

## Encuesta sobre la Comunidad Community Survey

Por favor, marque con una X lo que piensa de cada sujeto y circula lo que necesita el más trabajo para usted o su comunidad.  
Please mark with an X how you feel about each subject and circle the one that needs the most work for you or your community.

<b>Comida</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Agua</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Abrigo</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Electricidad</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Asistencia médica</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Educación</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?
<b>Economía</b> 	<b>¿Problema?</b> Problem?	<input type="checkbox"/> or <input type="checkbox"/>	<b>¿Suficiente?</b> Enough?

¿Comentarios? ¿Hay otros problemas que no están mencionados anteriormente? (por ejemplo: el transporte, comunicación, otros suministros, etc) ¿Algo más que me gustaría saber?  
Comments? Are there any other problems not listed above? (ie. transportation, communication, other supplies, etc.) Anything else you would like for me to know?

Figure 20: Short Questionnaire Form

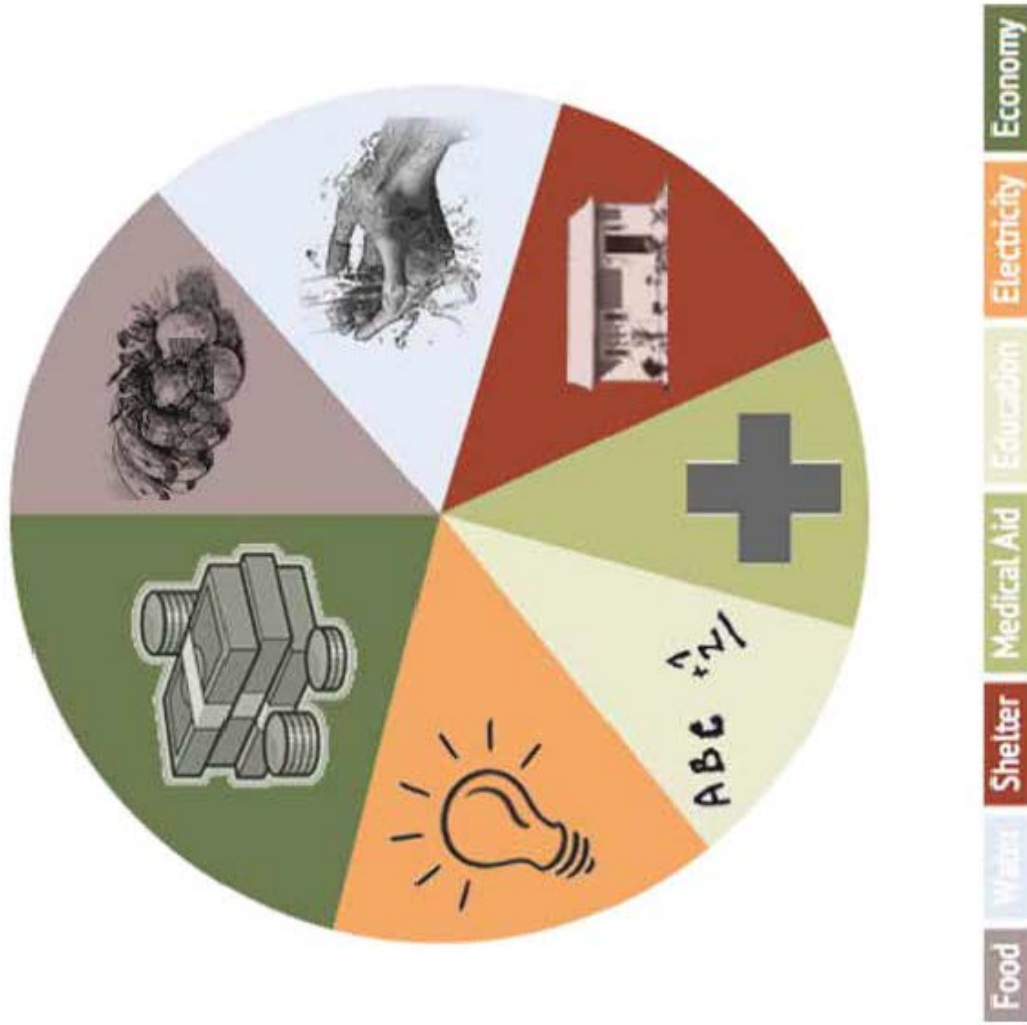


Figure 21: Results of Interviews and Questionnaires



# 1. Religious

- Bringing Evangelicalism to the community house by house
- Preach to the World
- More religious teaching for men and women groups
- Places for educational games and bible school
- Strengthen the evangelical campaign in the town, municipality, country and world



# 2. Educational

- Programs for children and young adults
- Library with internet and computer classes
- Language courses: Spanish, English and French
- Technical/Vocational Training Spaces: Task Spaces



# 3. Community

- More space for music/singing
- More space for dancing and theater
- Sports area and game area
- Places for children
- Places for young adults
- Garden areas

Figure 22: Comprehensive List of Needs





## 4. Built

- Water Services/Access
- Medical Services
- Better Ventilation
- More alter space
- 2 bathrooms
- Fans
- Pointed or Flat roofs
- Concrete or stone construction
- Organic and Linear designs
- Future construction possibility



## 5. Basic Resources

- Economy: Ways to generate funds
- Medical Services
- Water Services
- Electrical services
- Cafe/Restaurant
- Sports Areas: Basket Ball or Volley Ball
- Educational Space
- Gardens for Food production.

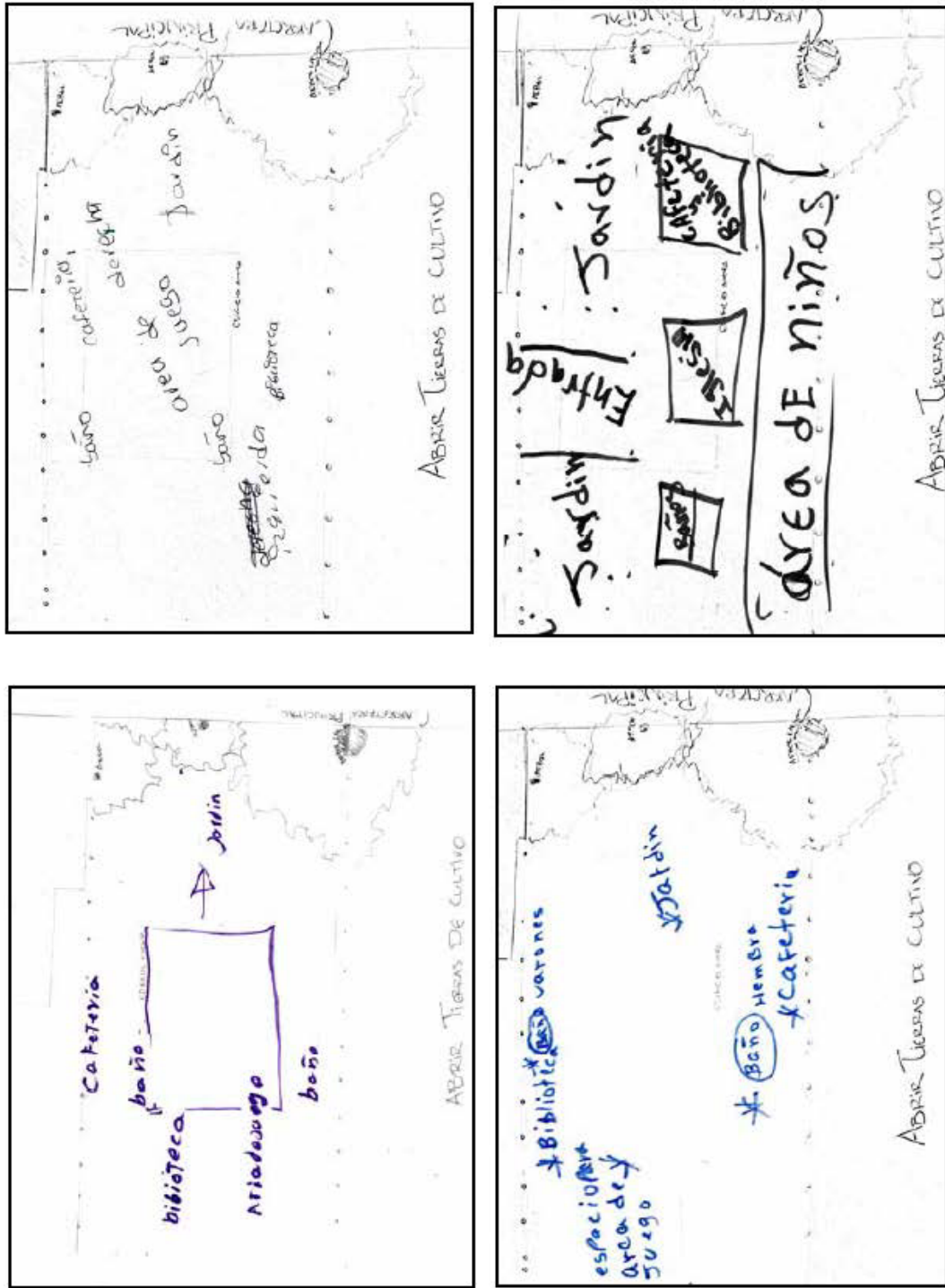
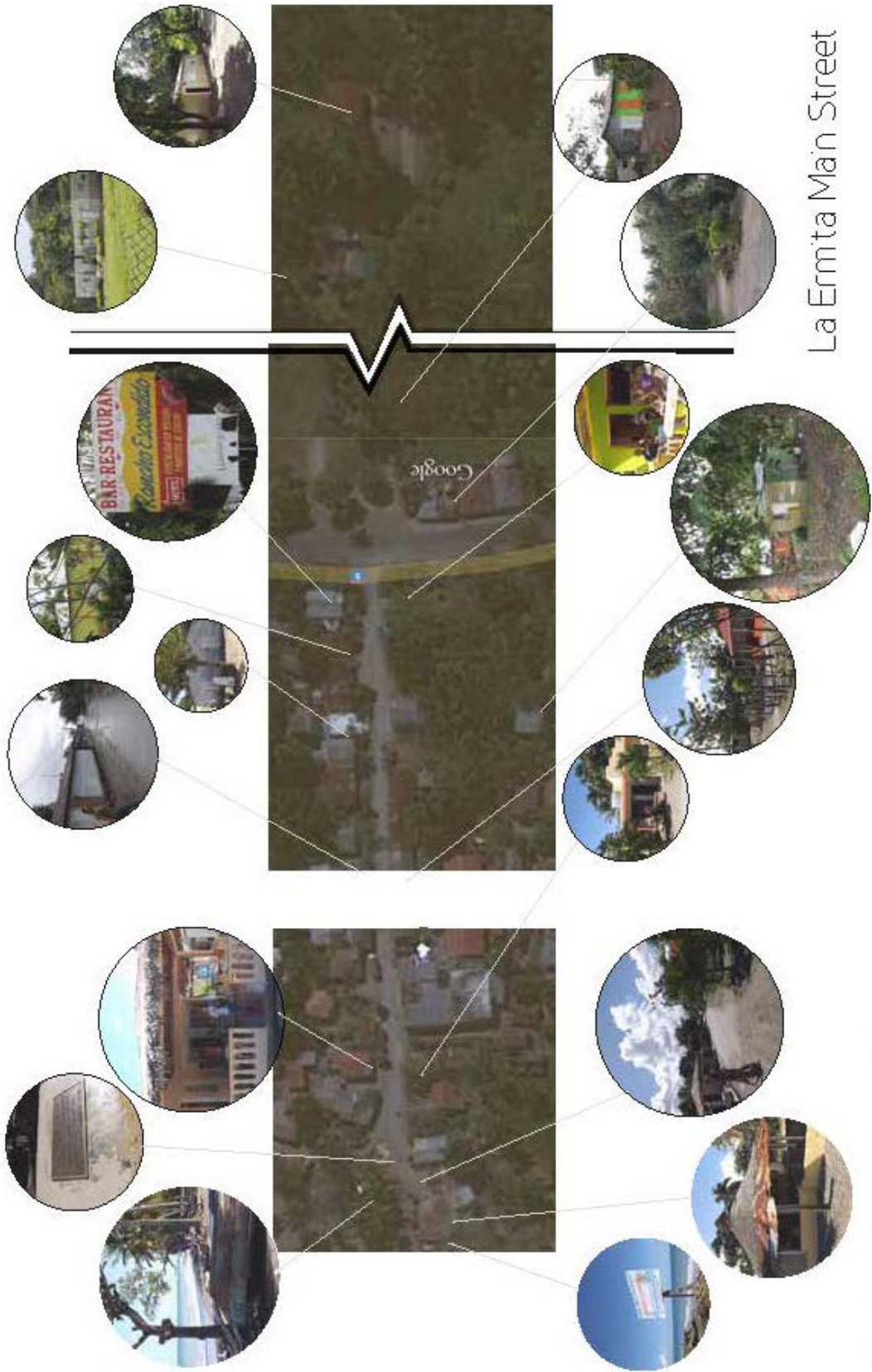


Figure 23: Community design charrette



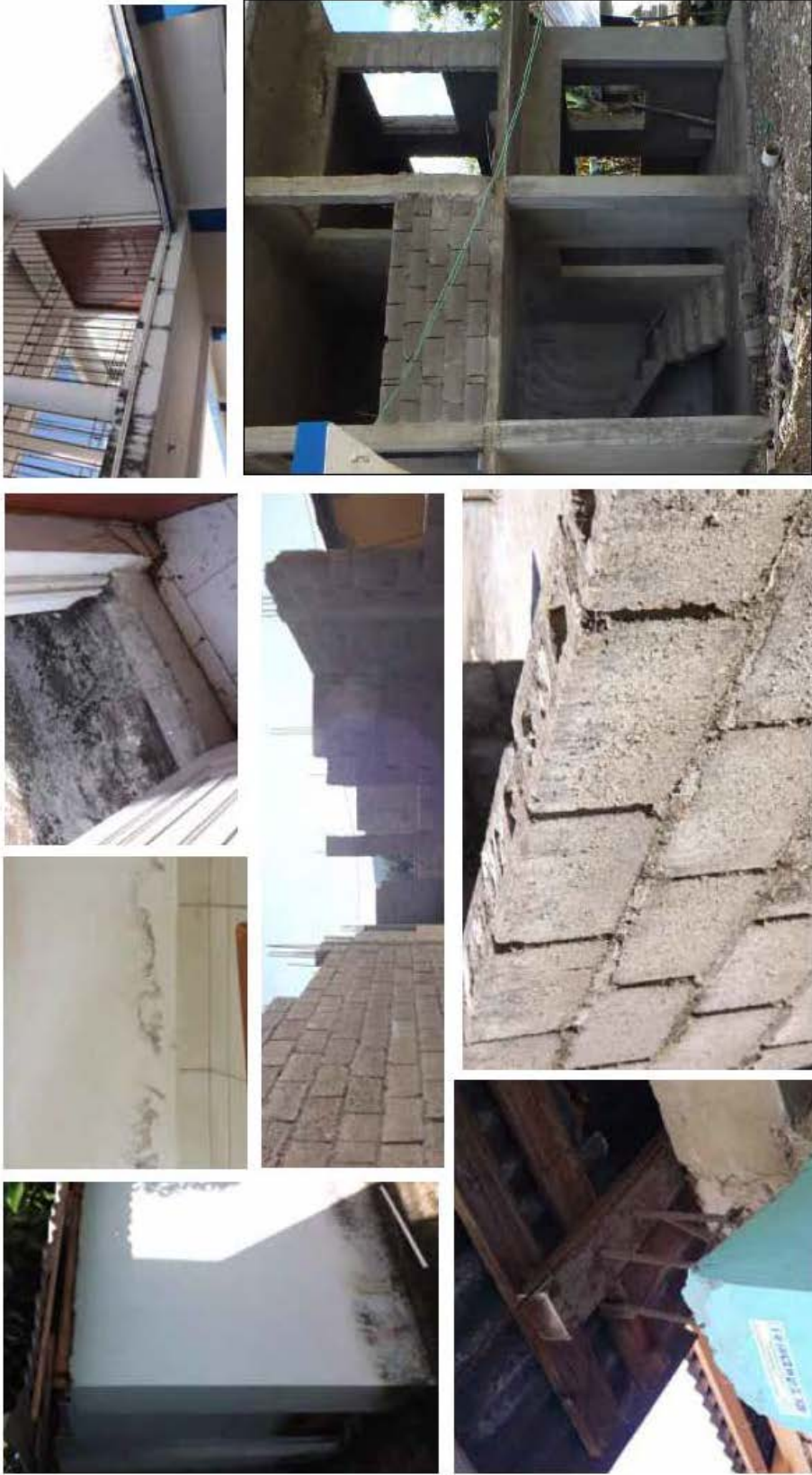
La Ermita Main Street

Figure 24: Building Documentation





Figure 25: Buildings left partially unfinished.



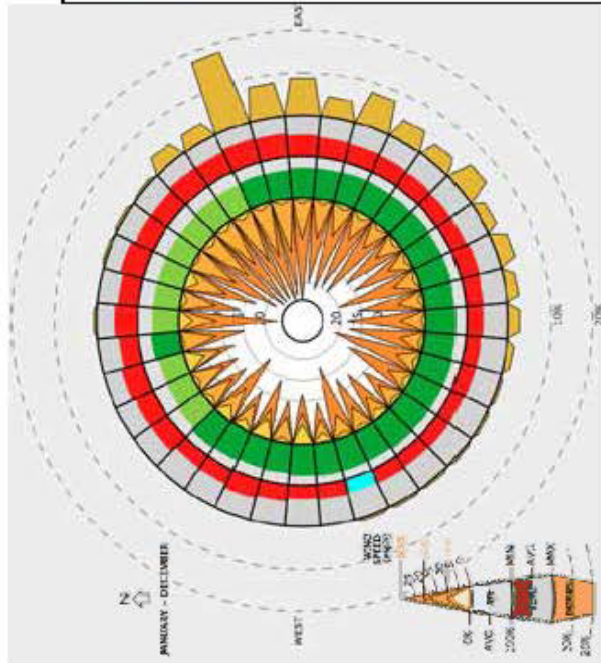
Typical local buildings in the Dominican Republic are created using passive and simple construction techniques. Concrete, wood, aluminum and steel are the typical materials. Many buildings experience severe water damage due to the high humidity, high rain fall and unregulated construction.

**Figure 26: Damage to buildings caused by water exposure**





Figure 27: Typical Buildings



	J	F	M	A	M	J	J	A	S	O	N	D
Max Daytime Temperature (°F)	84	86	86	88	88	88	90	90	90	88	88	86
Min Night-time Temperature (°F)	66	66	68	70	72	72	72	72	72	72	70	68
Hours of Sunshine (Daily)	8	8	8	8	8	8	8	8	8	7	7	7
Hours of Daylight (Daily)	11	12	12	13	13	13	13	13	12	12	11	11
Heat and Humidity Discomfort	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️
Days with some Rainfall	☁️	☁️	☁️	☁️	☁️	☁️	☁️	☁️	☁️	☁️	☁️	☁️
Monthly Rainfall (inches)	8	10	11	11	11	11	11	11	10	9	7	7
UV Index (Maximum)	8	10	11	11	11	11	11	11	10	9	7	7
Sea Temperature (°F)	84	84	84	84	84	84	84	84	84	84	84	84

Figure 28: Climate Calculations for La Ermita

# H2O CHALLENGE



Figure 29: Climate Diagrams



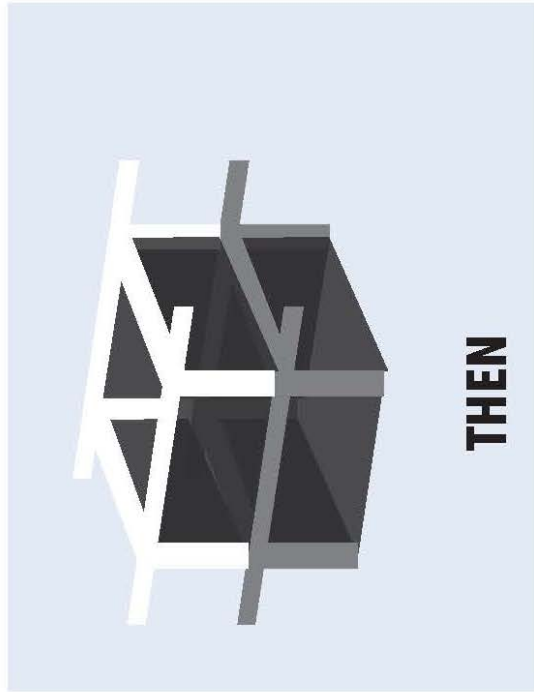
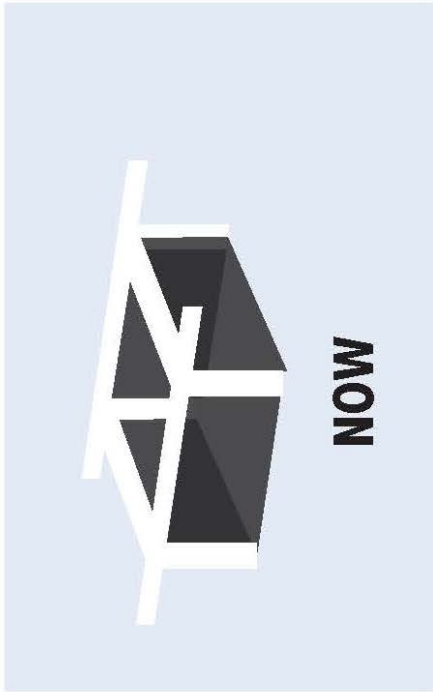
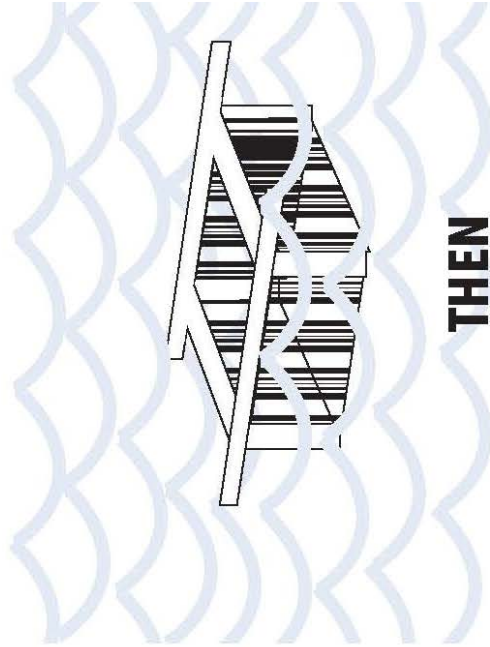
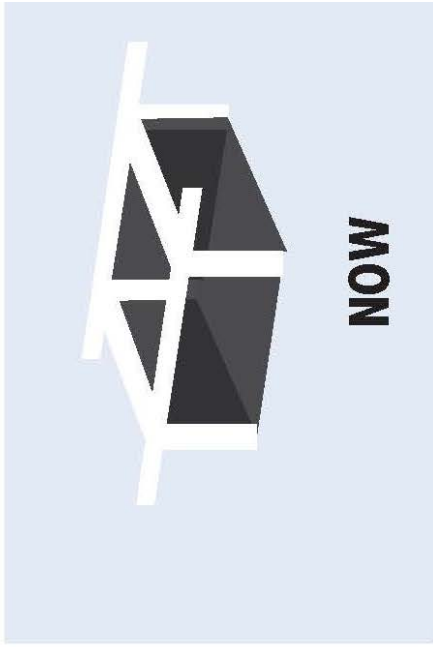
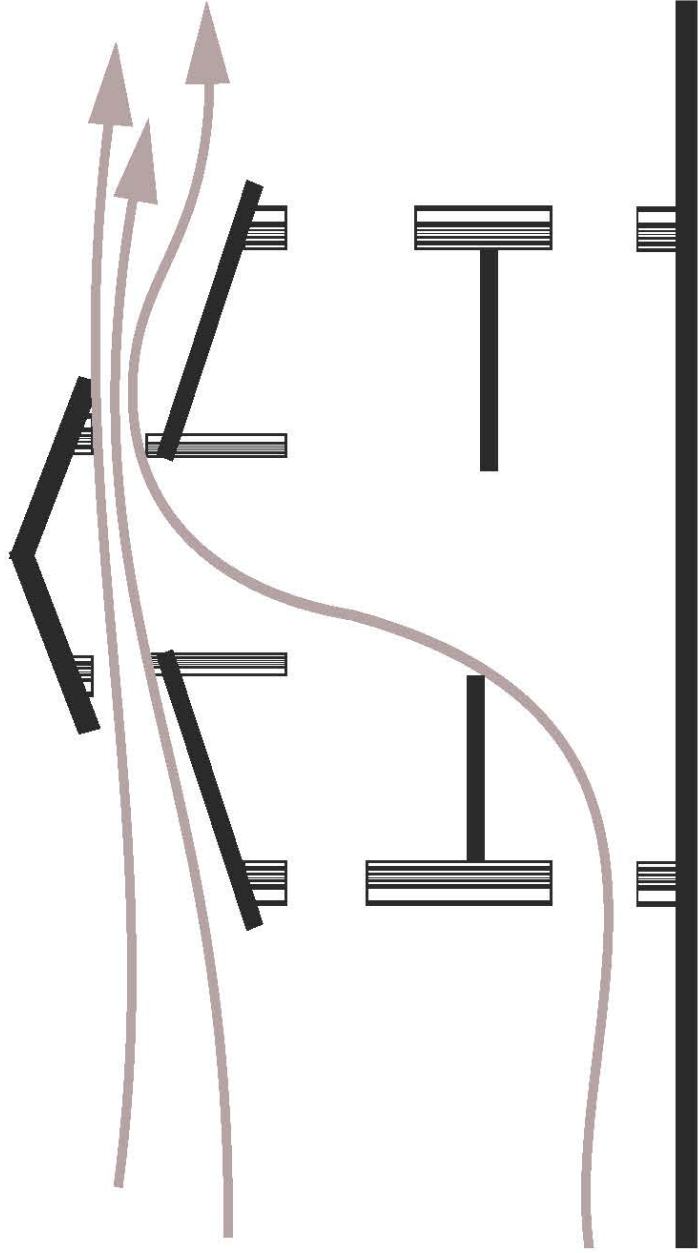


Figure 30: Concrete Frame



High windows should be used to increase air flow through spaces as well.

Solar Shading from both proper roof overhangs as well as trellises work to reduce solar heat gain while still allowing for day

Figure 32: Light and wind from roof pitch



Figure 33: Local Sugar and Coco bags



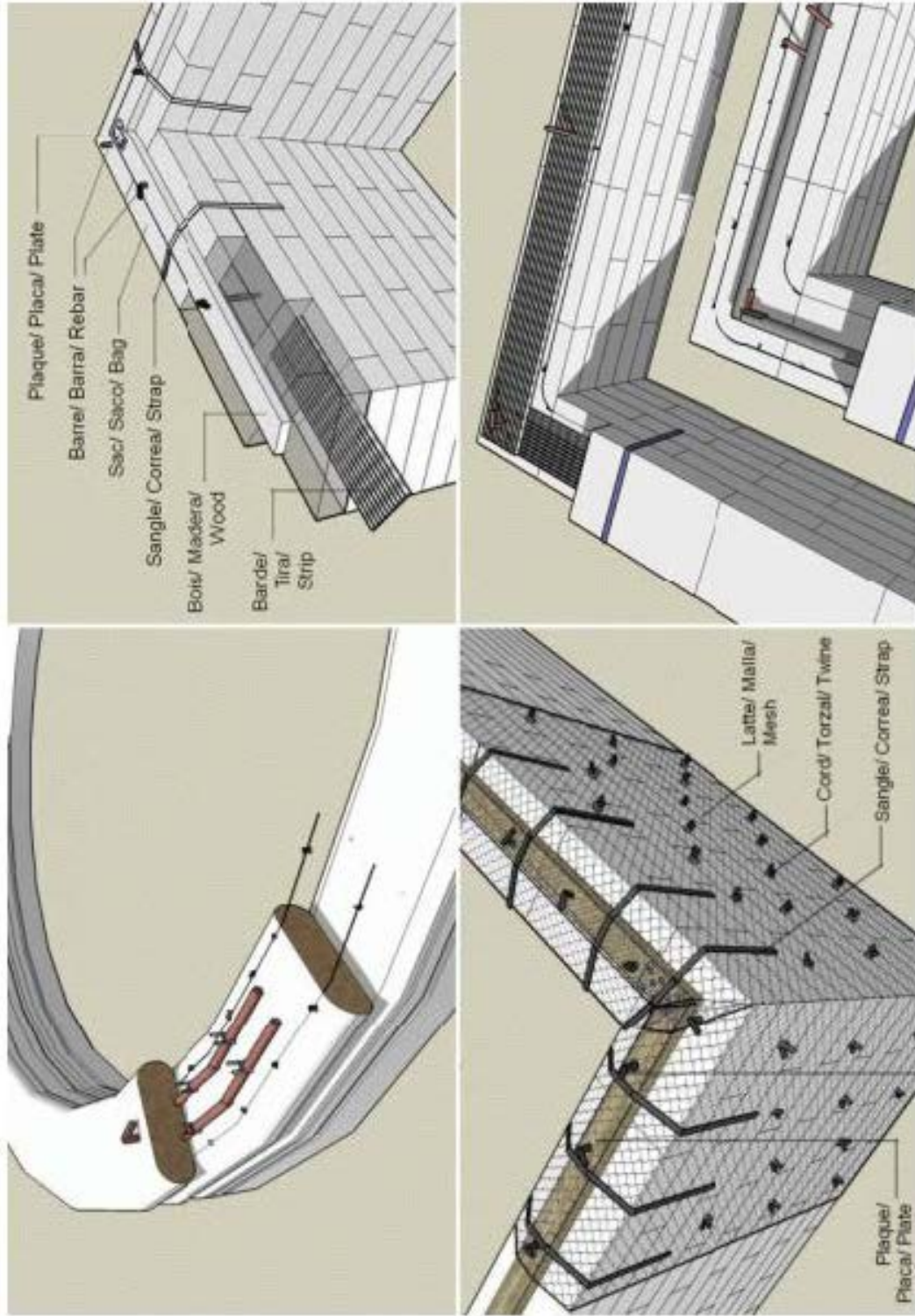


Figure 34: Sand Bag construction Diagram

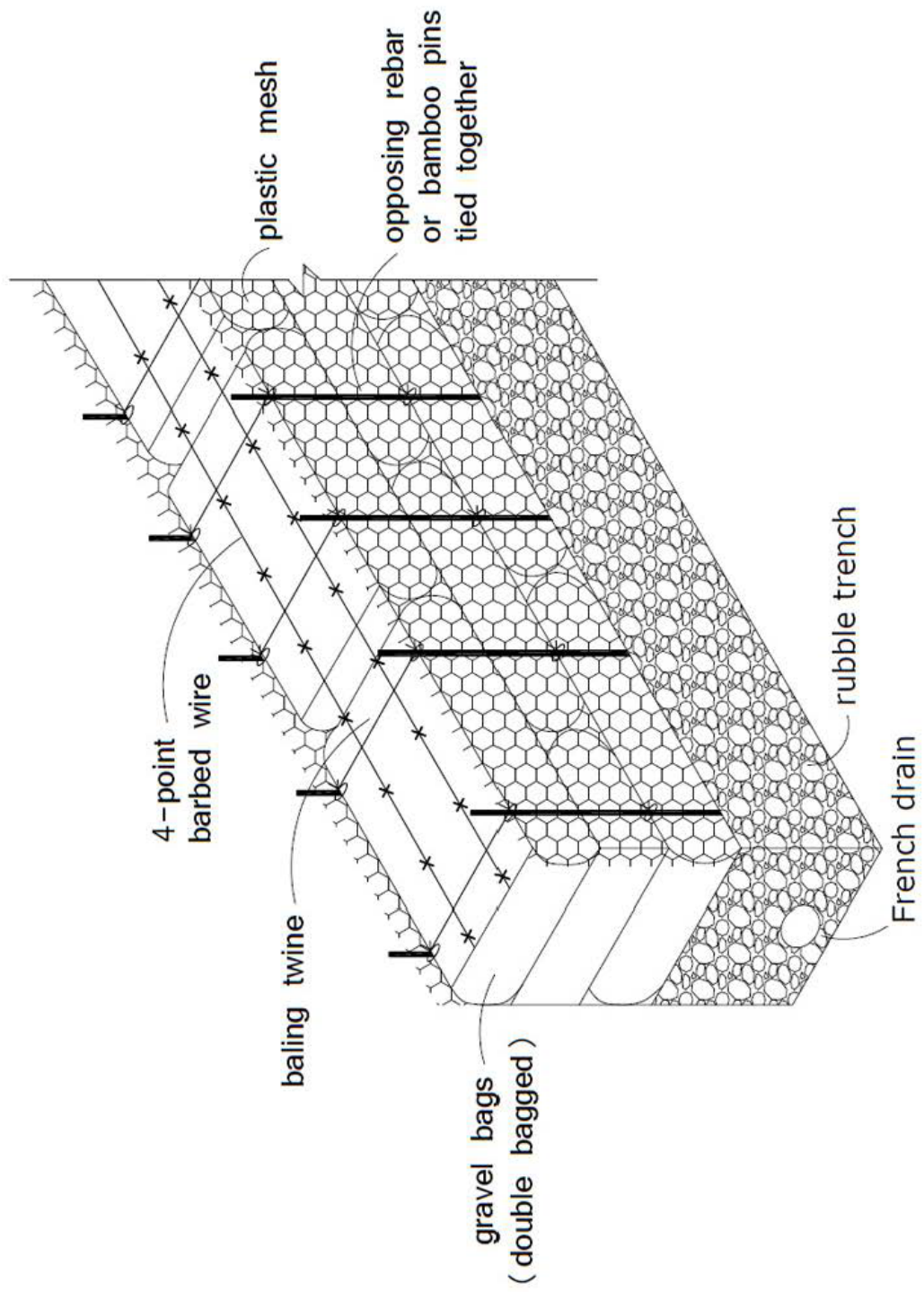


Figure 35: Sand Bag construction, rubble wall foundation

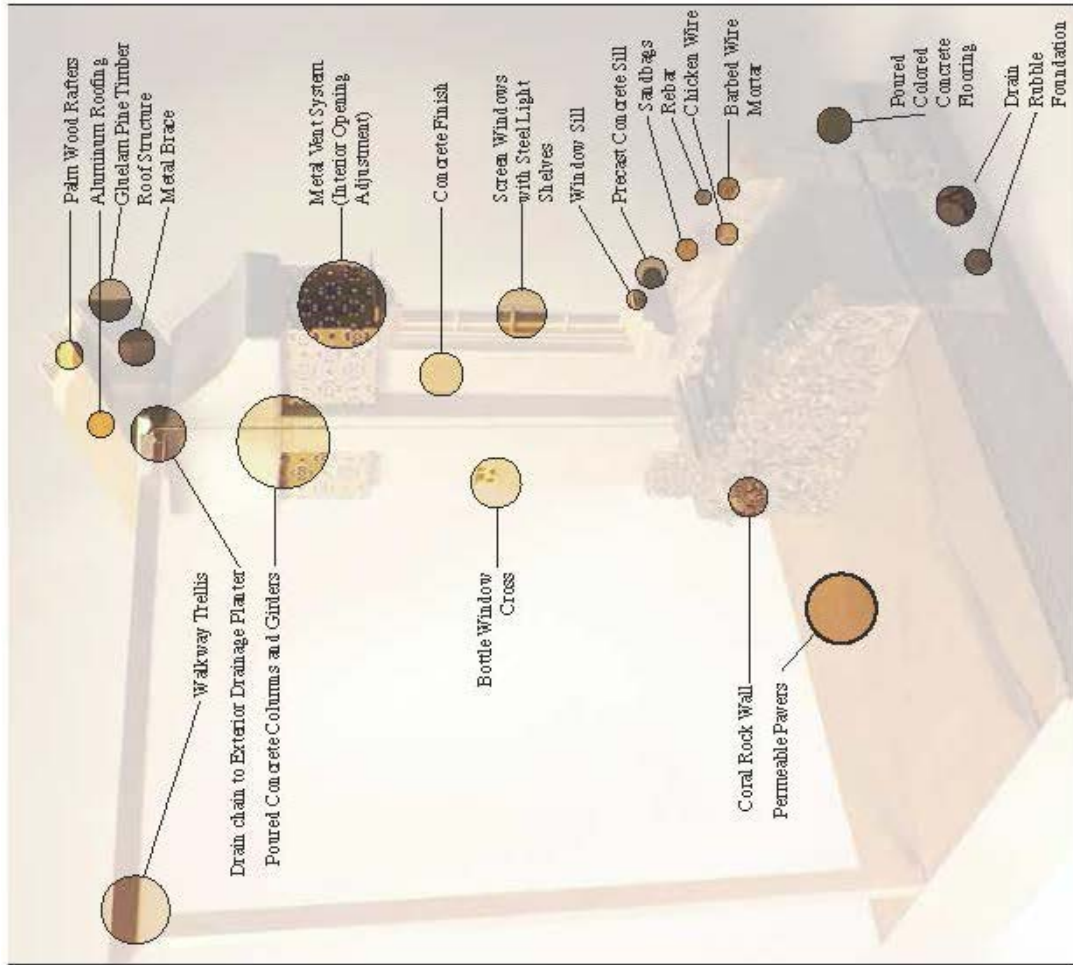
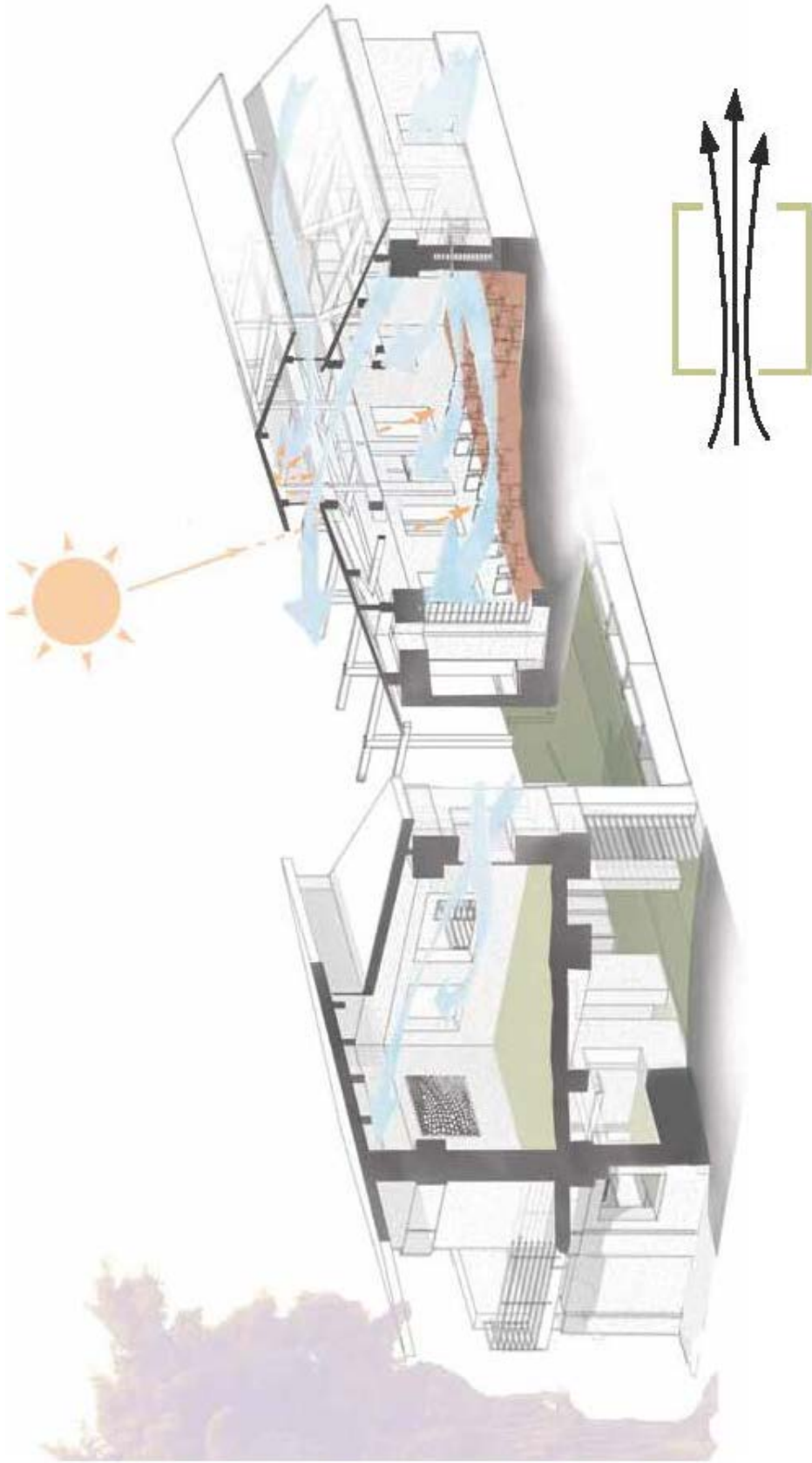


Figure 36: Full wall system model descriptions





To maximize the cooling effect of the wind, windows should be the same size on both sides or the inlet should be ~30% smaller to maximize the wind's velocity.

Figure 37: Wind diagram.

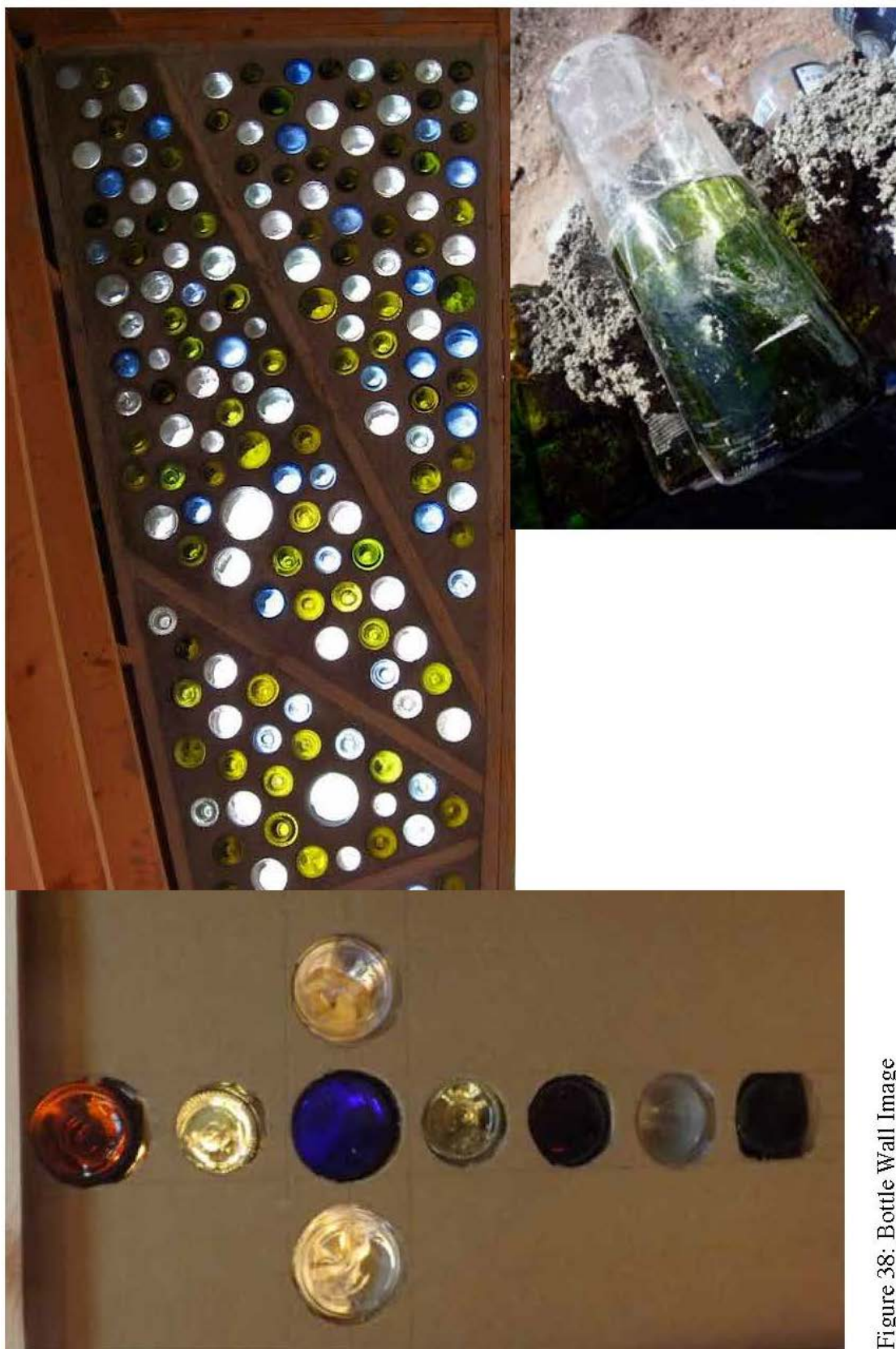


Figure 38: Bottle Wall Image





Figure 39: Coral Wall

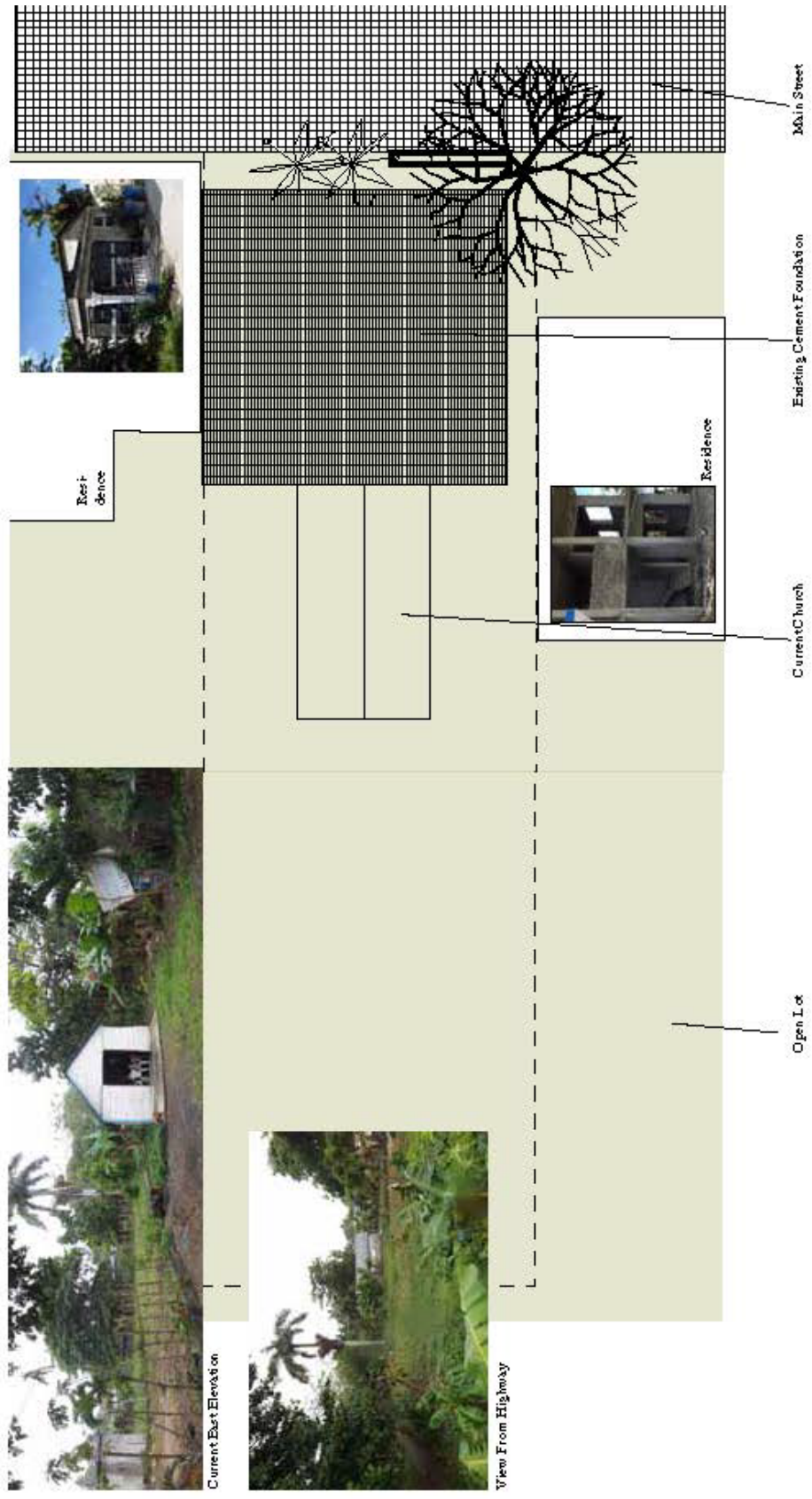


Figure 40: Church Site Currently

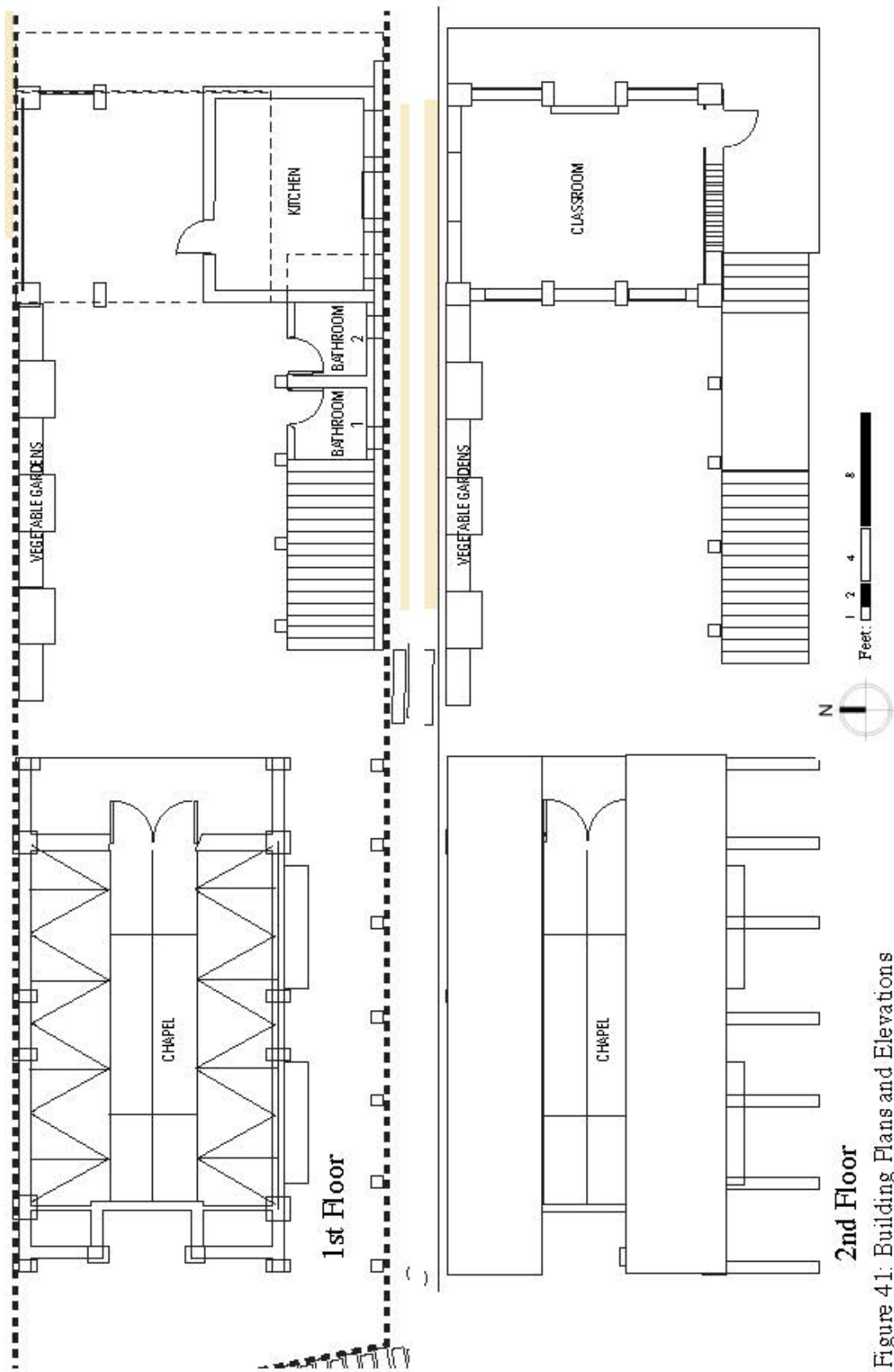


Figure 41: Building Plans and Elevations



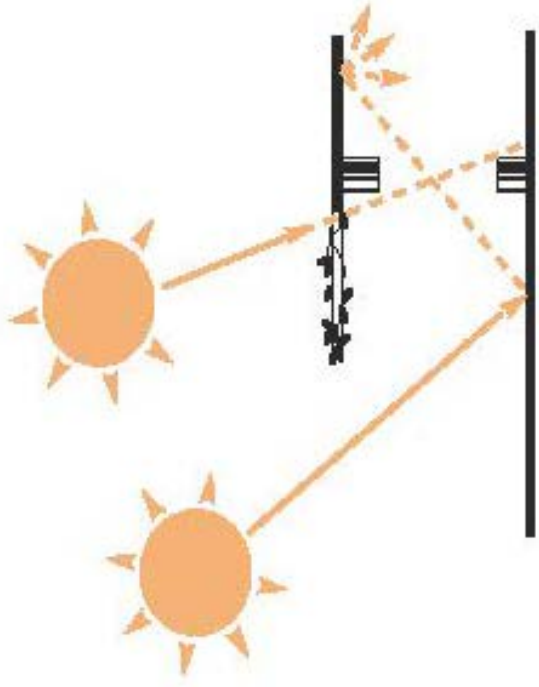




West



East



High windows should be used to increase air flow through spaces as well.

Solar Shading from both proper roof overhangs as well as trellises work to reduce solar heat gain while still allowing for day lighting.

Figure 42: Walkway Shading





Figure 43: Street view rendering

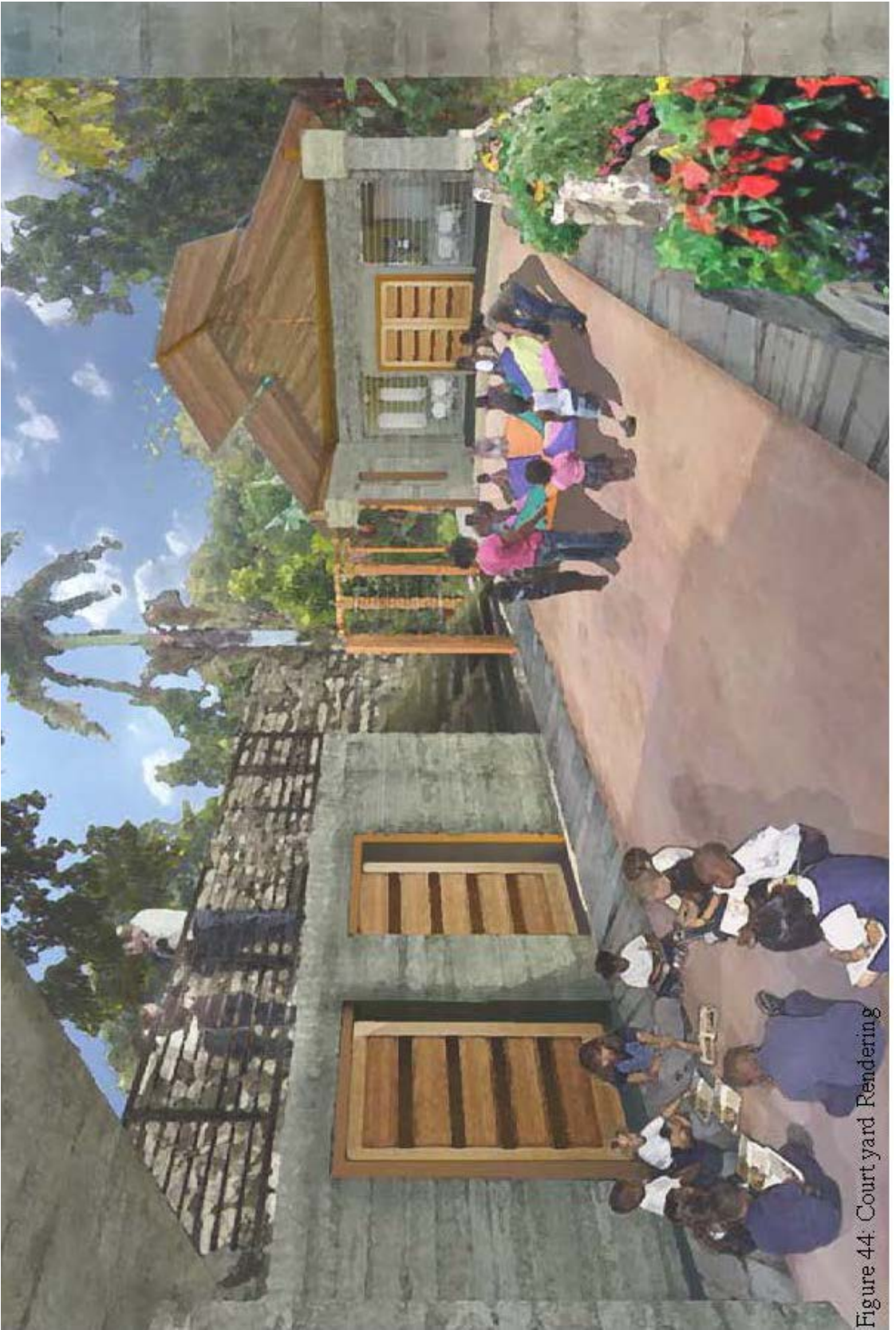
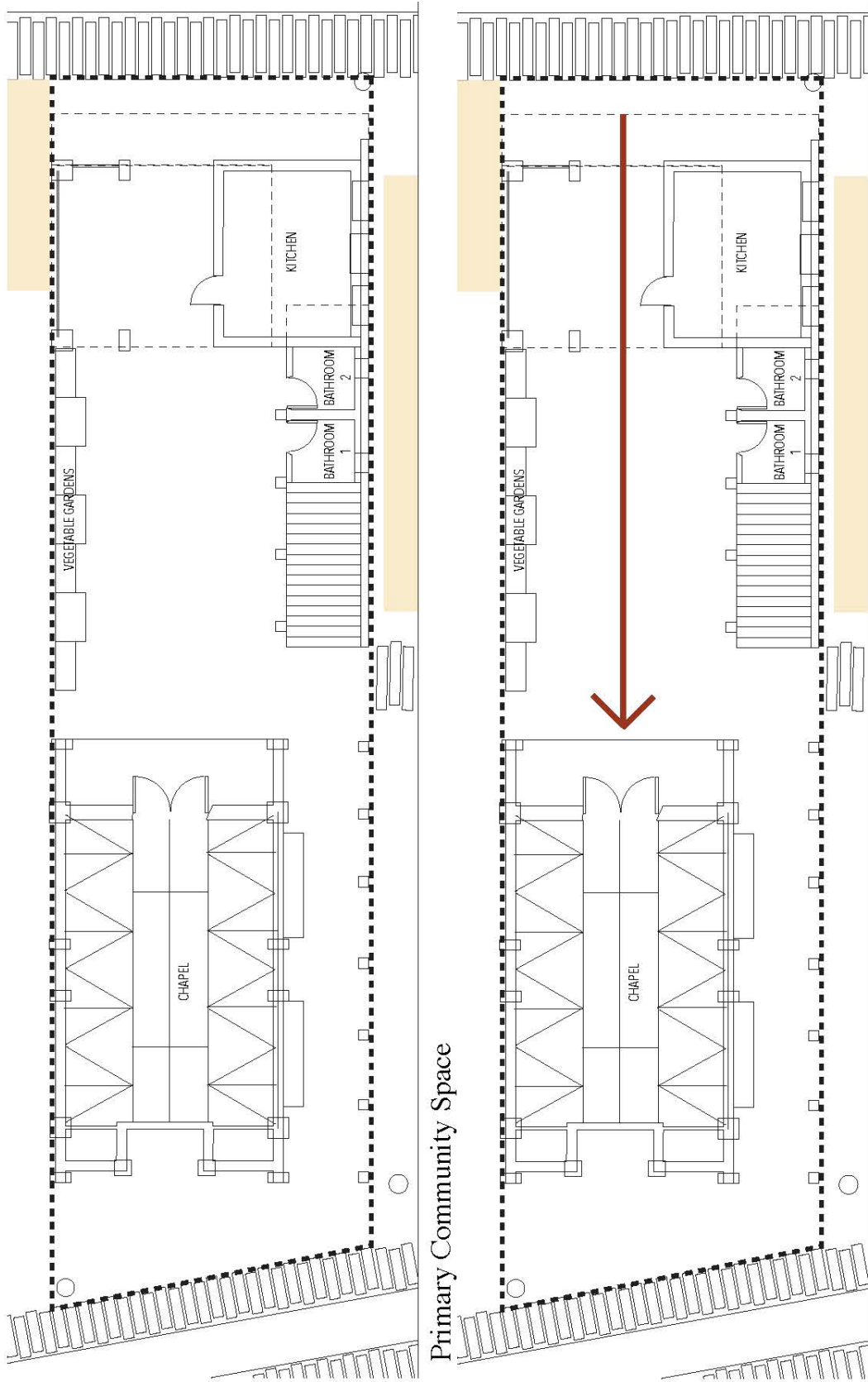


Figure 44: Court yard Rendering

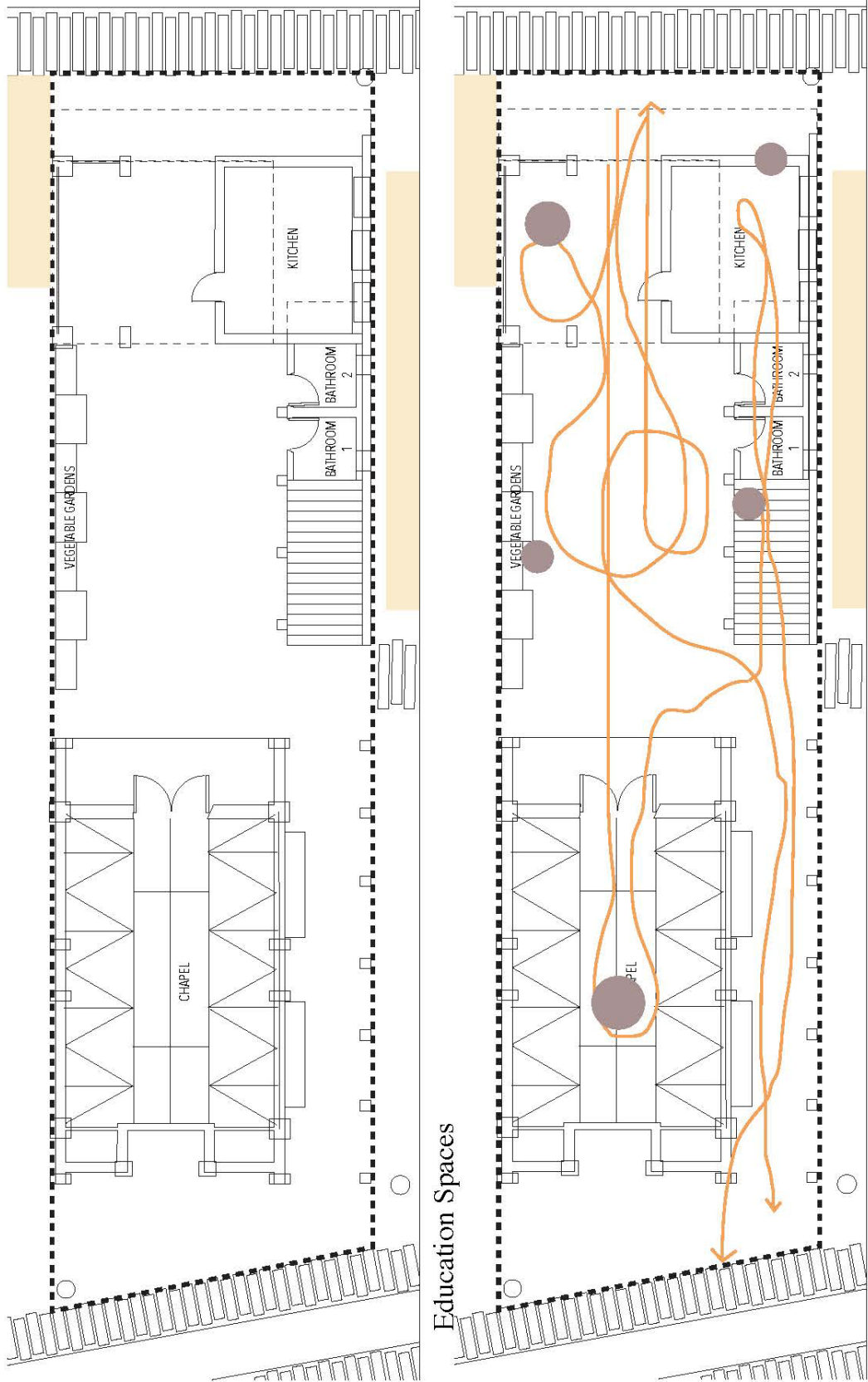




Primary Community Space

Framed Entrance

Figure 45: Site Diagrams



Movement and Pause  
Figure 45: Site Diagrams



Figure 46: Aquaculture Facility in La Ermita

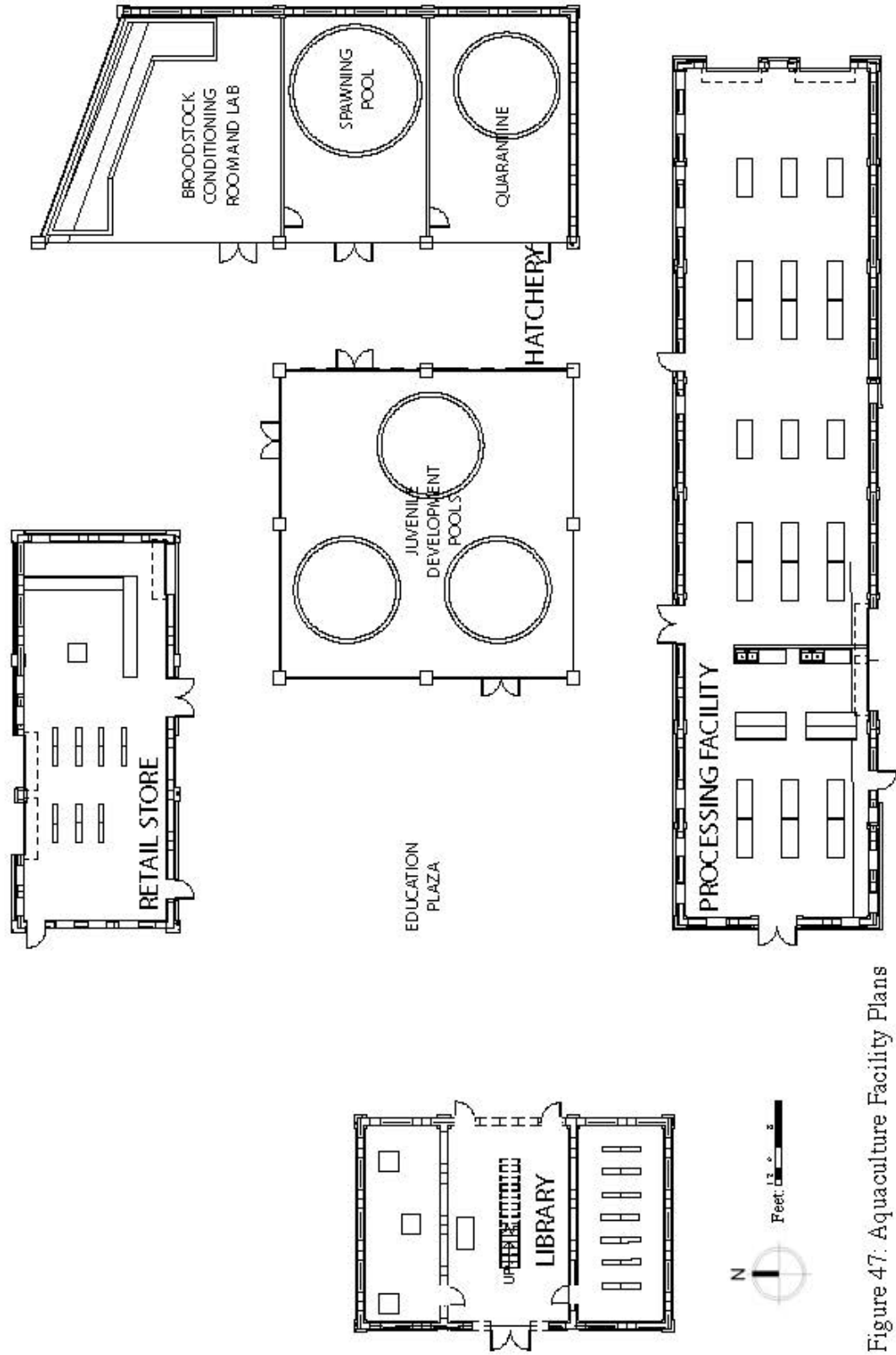


Figure 47. Aquaculture Facility Plans

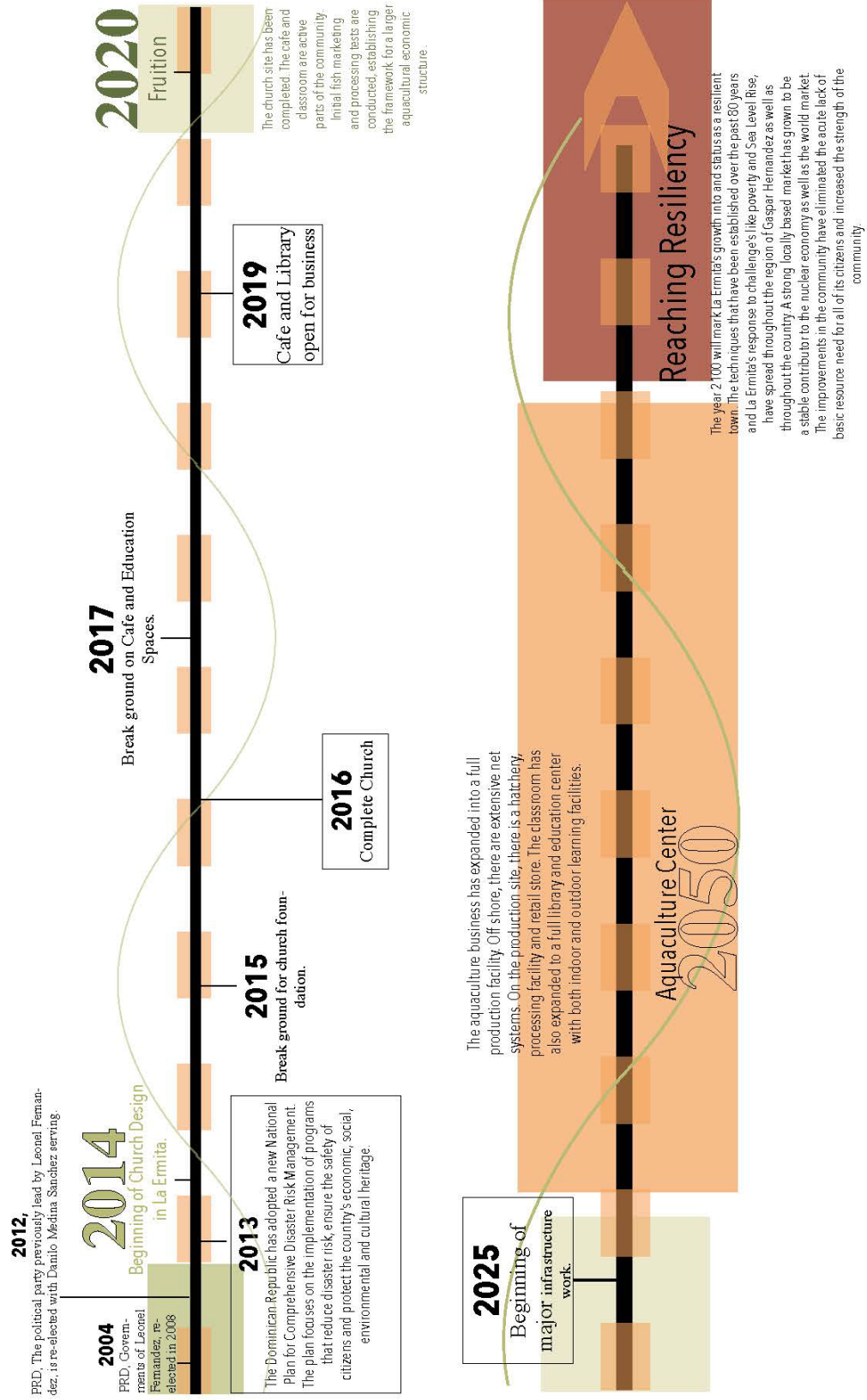


Figure 48: Future Time Line of La Ermita





## New Road Development

Roundabouts at the entrances of the town shift the fast passed four lane road into two lanes, creating greater space for pedestrians along the street and places for motor transportation to park. Reinforcing the pedestrian paths and creating bike streets increases the ease of movement within the town and encourages sustainable transportation. Where the paths cross the main street, a material change of pavers would alert traffic to the potential crossings and further slow down traffic. These crossings would also be acknowledged by street division planters. The sidewalks would not be a continuous slab as is typical, but would be made of poured 2' x6' x4" pieces of concrete that would act as permeable pavers and be both reusable and easy to replace. The side streets would also need to be reconfigured. Along the major street, the sidewalks would be expanded and there would only be one way vehicular access. Some streets would maintain two way access for ease of transportation of aquaculture products.

Figure 49: New Road Development



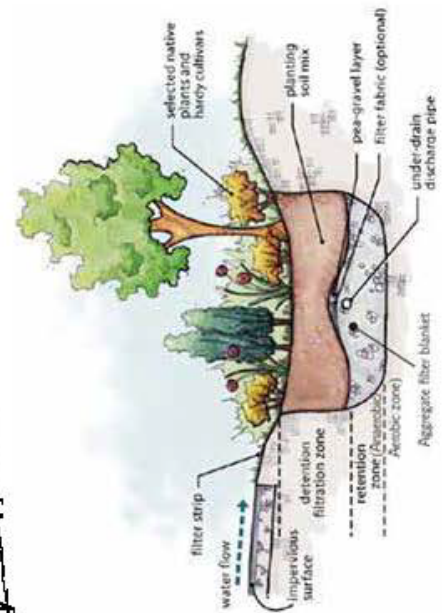


Spanish Lakou

The new developments will create central green spaces that function both as the Courtyard in Spain as well as the communal Taino Lakou. These areas will be used for community food production and recreation. Each area will have a retention zone created under the soil to function as drainage for the town to reduce standing water. However, the center space will not be the lowest point as in a bioswale, but will be raised to replicate the conuco system of the Taino's.



Figure 50: Spanish Lakou





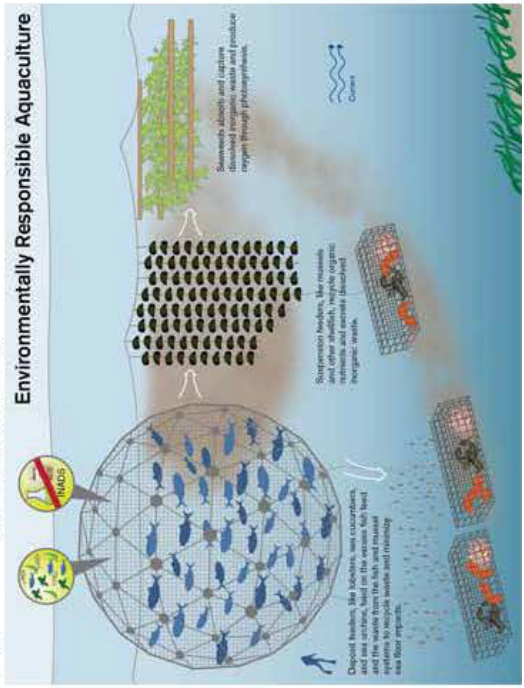


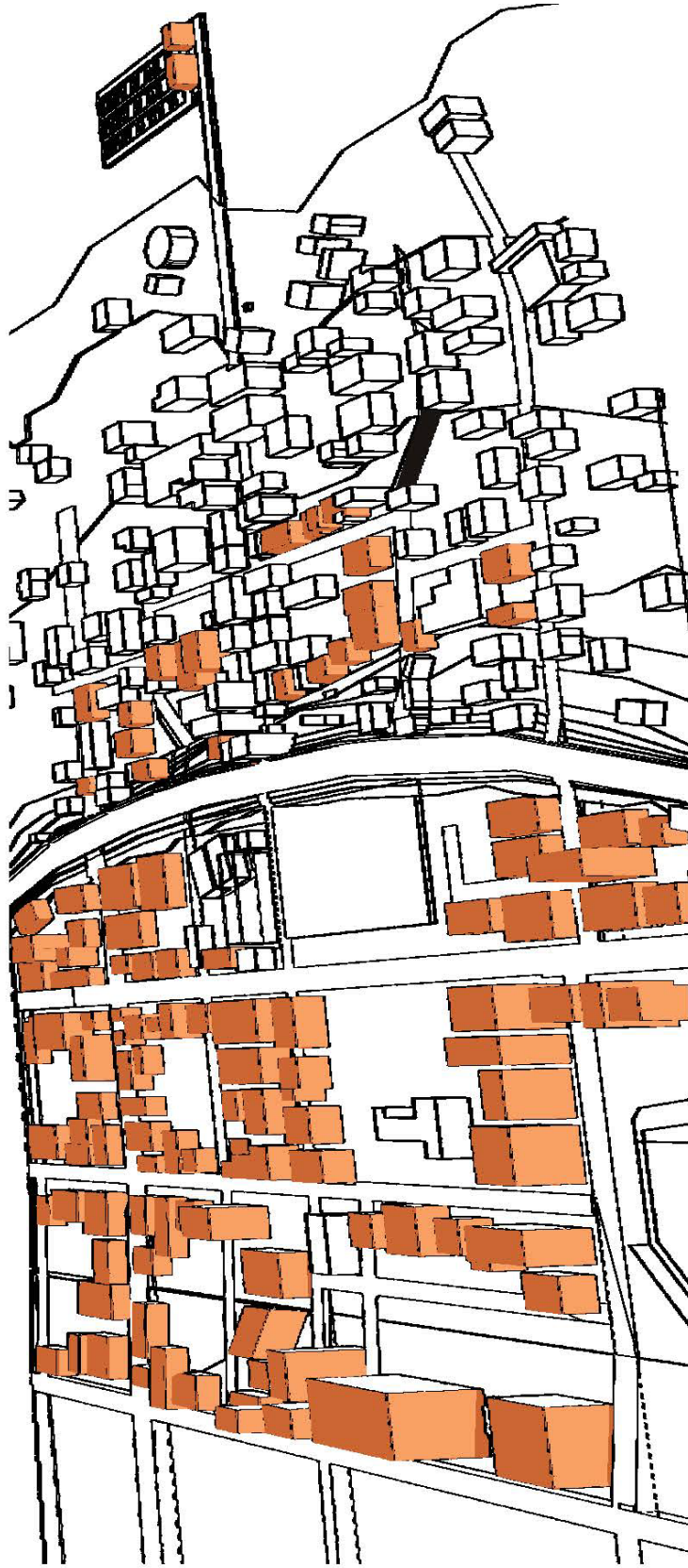
### Aquaculture Development

Currently, fishing is a very undependable source of revenue for the community due to the nature and danger of the ocean and market. Creating an extensive aquaculture system and processing for either long term storage or shipping will better support the established fishermen as well as create a roll for others in the community. As well as a dock and nets created off shore, buildings that will be subjected to sea infiltration could eventually be converted into structures for shallow tidal aquaculture ponds.



Figure 51: Aquaculture Development





### Piecemeal Growth

Using the same system of building as in the church, new building's would be able to be built over time, as is common in The Dominican Republic, but without the extreme water damage that occurs from leaving buildings exposed for months. New development will inevitably occur on the northern side of the road in the next 100 years, such as the church, but most new construction should be encouraged on the southern side to reduce future vulnerability to Sea Level Rise.

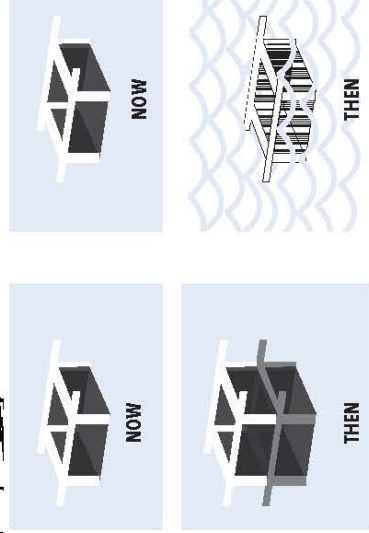
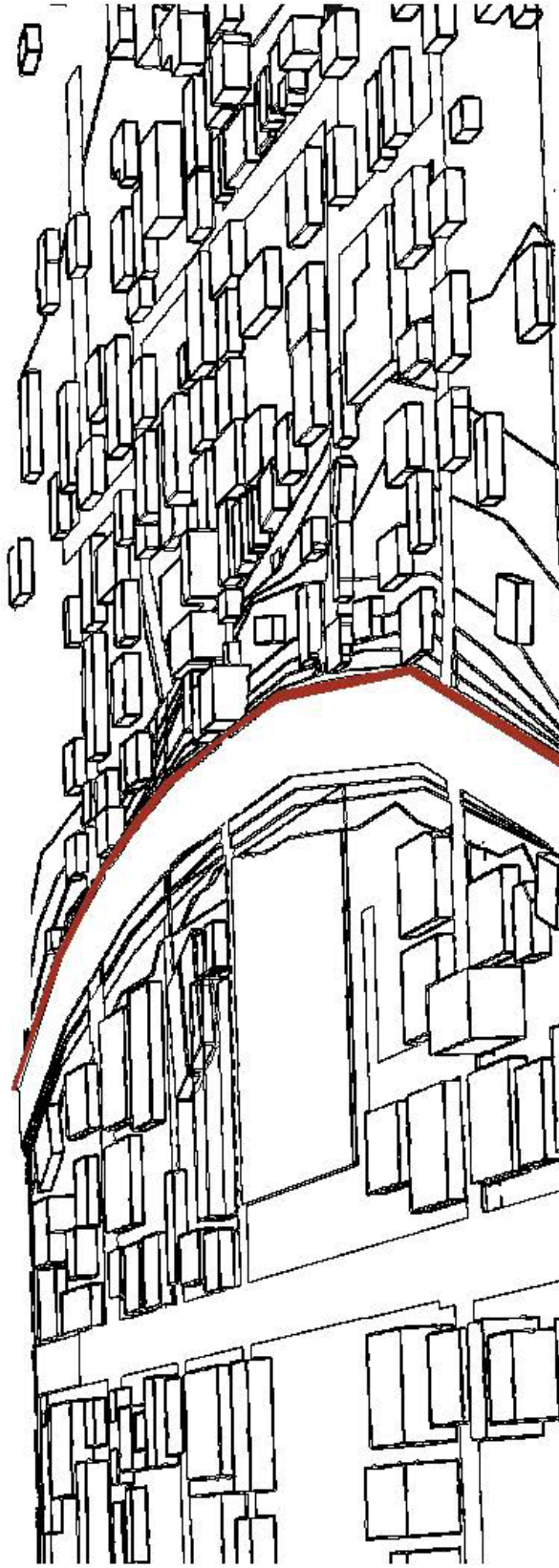


Figure 52: Piecemeal Growth





## Sea Wall

In 100 years, the estimated level of the oceans will rise approximately 9 ft. The main road of La Ermita rests at an elevation of approximately 9 ft. Reinforcing this elevation gain by creating a sea wall will protect the majority of the new town establishments by the year 2100.

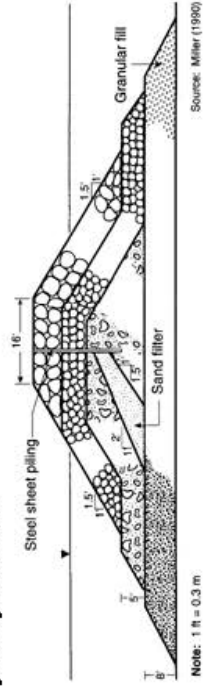
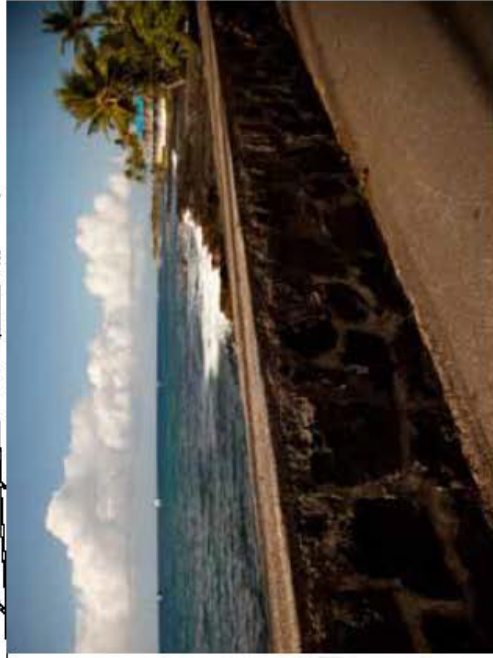


Figure 53: Sea Wall





Scientists have estimated that in 100 years, the seawater level will rise ~ 9 feet. This means that a large portion of the town will be covered in water possibly as soon as 50 years from now.

Figure 54: Predicted Sea Level rise in next 100 years



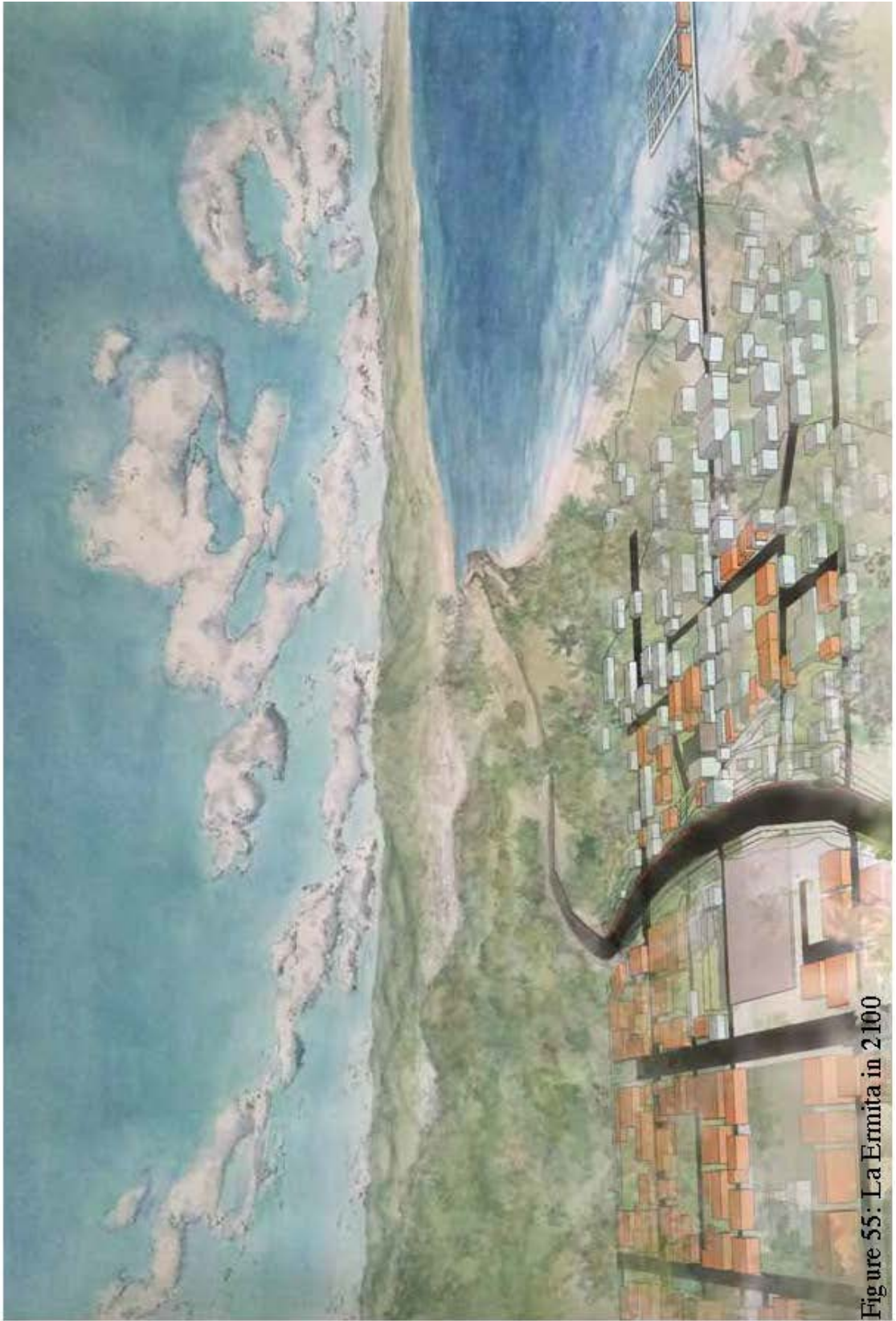


Figure 55: La Ermita in 2100



Figure 56: Plan La Ermita Phase 4



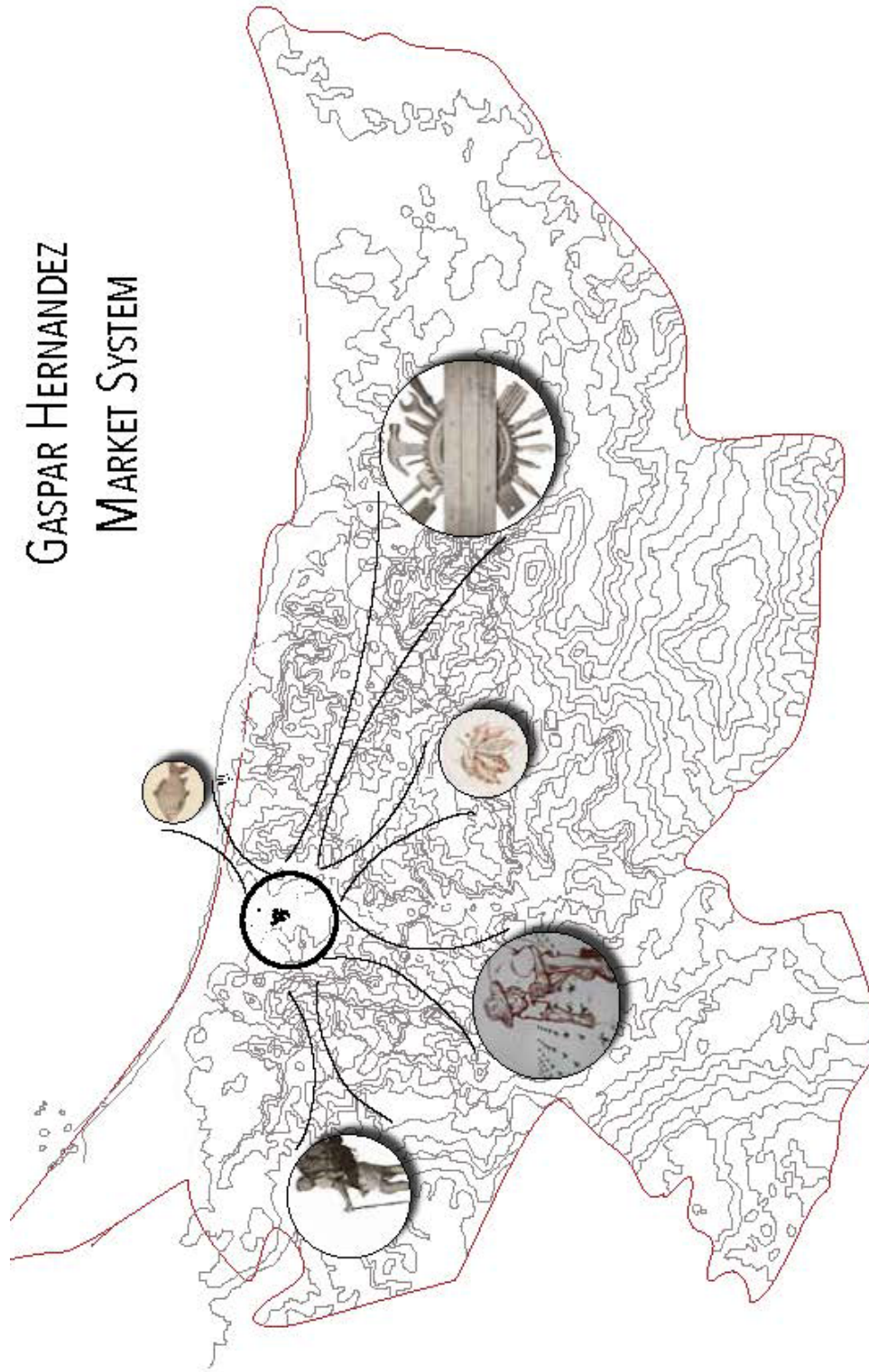


Figure 57: Market System Generated in Gaspar Hernandez from La Ermita Example





The Resilience Regions map offers a fresh way of looking at the relationships between people and place - a perspective that draws out the complexities of cultural and ecological factors. Lines on the map are fixed by necessity, but a dynamic and more realistic view would reveal smaller, nested, and overlapping scales, from the local and regional on up to the global.

**Figure 58: Resilience Regions: Ecotrust**

# BUILDING RESILIENCE IN THE DOMINICAN REPUBLIC

At least 0.4 billion people (60% of the world population) live on less than \$10 a day and 50% of the world population live on less than \$2.50 a day.

**80%**

**COMMUNITY GOALS:**

- 1. Resilience**
  - Disaster Preparedness
  - Risk Assessment
  - Emergency Response
  - Post-Disaster Recovery
- 2. Educational**
  - Disaster Preparedness
  - Risk Assessment
  - Emergency Response
  - Post-Disaster Recovery
- 3. Community**
  - Disaster Preparedness
  - Risk Assessment
  - Emergency Response
  - Post-Disaster Recovery
- 4. Built**
  - Disaster Preparedness
  - Risk Assessment
  - Emergency Response
  - Post-Disaster Recovery
- 5. Basic Response**
  - Disaster Preparedness
  - Risk Assessment
  - Emergency Response
  - Post-Disaster Recovery

**2014**

**2016**

**2020**

**2050**

**2014**

Final Presentation Boards: Spring 2014

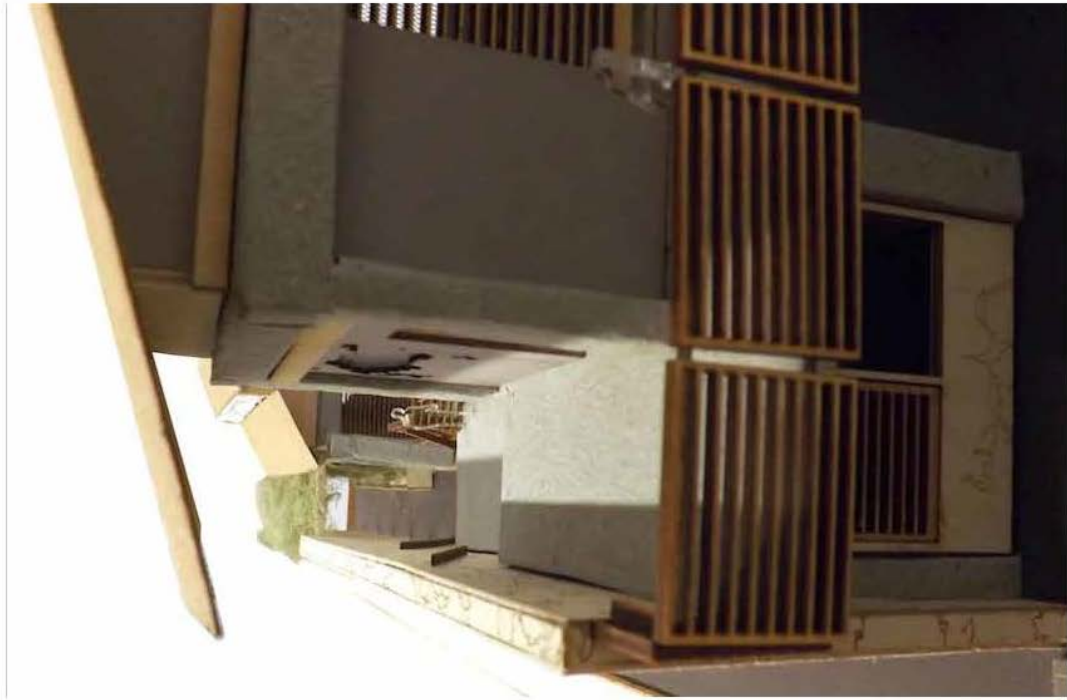




Detail Model



Phase One and Two Model







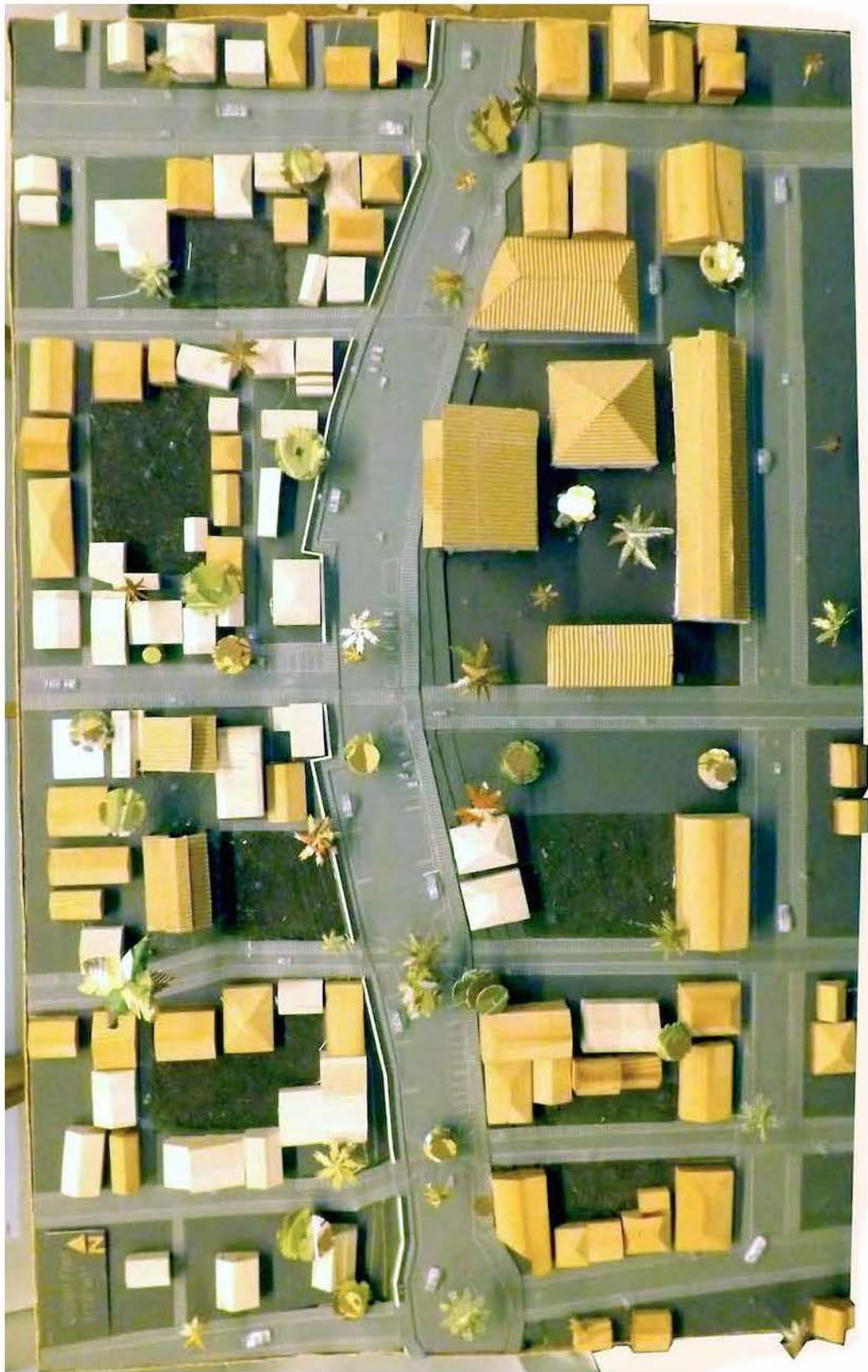




Phase Three and Four Model









Building Material Samples

### Project Language:

Pattern Languages are used to notice problems or observations that apply to multiple areas or aspects of a building process and make generalizable solutions for acknowledged subjects. Created by Christopher Alexander, Pattern Languages can be applied to specific projects, creating a Project Language. A Project Language was created for La Ermita in the early analysis phases of the design process.

Pattern Language



## 1. CULTURAL MELTING POT

### Problem-

The Dominican Republic's culture is based upon the permacultural society of the Tainos, the regulated formal structure of the Spanish, the expressive and resourceful textures of Africa, and the first worlds' cheap technology. This diverse and sometimes contradicting meld of cultures creates a unique and often detrimental vernacular. There is not a clear design strategy for new developments that promotes the establishment of regenerative and lively design.

### Response-

By addressing the most lively qualities of each style, a resilient and whole region can be created.

#### - Spanish Style

The Spanish character of the regions built fabric is an essential part of Dominican culture. Major town centers have a classical Spanish mission square, with park that is bordered with essential functions of churches and markets. The towns originally radiated from this central area in a grid pattern. Dwelling establishments that did not originally create this central base. Developing centers and reinforcing the existing Spanish squares will provide congregation spaces for the community and reinforce the unity that is necessary for resilience building.

#### - Taino Family Development (Lakou)

The Lakou style is a collective system of development that forms shared spaces from the development of individual buildings. They typically originate from a primary node, and can either form around a common center space or as additions. This plans for future growth of spaces and community development over time to play into a larger beneficial whole.

#### - African Colors, textures and screens\* (to be edited to be more pc and accurate)

The development of stylistic and woven screens is common in various African cultures. This adds a rich and resourceful aspect of the culture. The Dominican love of singing and music as a form of story telling also originated in Africa. The richness of the textures, resourcefulness and spirit of African cultures should be incorporated into the buildings and spaces.

#### -First World Technology

Many of the current building systems such as CMU block houses, electrical systems and HVAC are based upon the cheapest options available in first world countries. This causes many problems for the function and longevity of buildings. The introduction of codes and high performance technological understanding from the first world can help this country start an internally strong and sustainable building system, avoiding many of the problems that



have begun to be integrated within the local vernacular (suburbs, toxic industries, autocentricity, low performing buildings, etc).

## 2. CLIMATE RESPONSE

### Problem-

There is an idyllic climate with consistent winds from the North, relatively consistent temperatures and an average 12 hours of Southern sunlight year round. However, typical buildings are comprised of CMU construction with very poor air circulation. This results in very uncomfortable, hot-box like environments.

### Response -

By orienting buildings to take advantage of the Northern winds and Southern sun for heating, cooling and lighting, comfortable building environments can be created through passive techniques. This will increase the health and well being of the occupants and lowers the need of costly inefficient systems.

## 3. LEVELS OF PATHS TO DIRECT TRANSPORTATION UTILIZATION

### Problem-

Although there are many scales of roads and paths currently, they do not effectively connect the region or aid in way finding. The majority of large paths run East to West, while small paths run North to South. There is a challenge of creating transportation system that is efficient and creates a viable solution to the motorcycle based transportation system. Becoming a motorcycle taxi is one of the simplest forms of employment to find. However, this is neither a profitable venture or sustainable solution for transportation in its current function. It also adds to an over abundance of motorists on the streets, making them unsafe for people.

### Response -

The creation of primary, secondary and tertiary paths that create a continuous and logical options of movement based upon amount of use, not only adds intrigue to the area but also acts like a web, stitching the rural areas together beautifully and efficiently. This allows for both the private alleyway as well as larger promenades and transportation routes. This scale will create safer spaces for pedestrians as well, since each scale will have an inherent system for all scales of transportation.

## 4. INFORMATIONAL/ PARTICIPATORY ACCESS AND GROWTH

### Problem-

There are very few opportunities for the community of Gaspar Hernandez to effect change in their built environment. Often change or aid comes from external forces that provide solutions, instead of provide methods. The culture has a habit of building anything when there is money, instead of waiting for when there is enough to complete the project. This leads to unpreparedness and exposes buildings to harsh conditions.

### Response -

The buildings and this project must act as a tool for educating the people to utilize and create change from the internal system to the larger community. The potential of systemic growth is a tremendous attribute that forces a building to be responsive and capable of supporting expansion instead of stagnation.

#### **5. MOISTURE REDUCTION**

##### **Problem-**

The extremely humid tropical climate of the Dominican Republic causes severe water damage to buildings. Current building tactics have not evolved to design for this major problem, which leads to an extremely high number of compromised structures.

##### **Response -**

Building with moisture in mind will create more resilient buildings. By increasing air flow, creating sloped drainage systems, reducing exposed overhangs, and utilizing proper building techniques the new structures become safer and last longer.

Work with the community of La Ermita will continue post-thesis defence.

Next steps include:

- raising funding both locally and internationally through several NGO groups.
- Generating Construction Documents for approval
- Organizing Trips and Educational programs
- Construction
- Post Occupancy Survey

For updates on the progress visit: <http://kaelinolte.wix.com/home#!thesis/c20zn>

Epilog