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## **Building Hope: A Community + Water Initiative, La Villa de San Francisco, Honduras**

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**BUILDING HOPE: A COMMUNITY BUILDING + WATER INITIATIVE,  
LA VILLA DE SAN FRANCISCO, HONDURAS**

A Thesis Presented

by

Christopher D. Mansfield

Submitted to the Graduate School of the University  
of Massachusetts Amherst in partial fulfillment of  
the requirements for the degree of

Master of Architecture

May 2016

Department of Architecture

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Christopher D. Mansfield

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## **DEDICATION**

To the people of Honduras.

## ACKNOWLEDGMENTS

Many thanks to my formal thesis committee members Kathleen Lugosch and Caryn Brause for all their input and guidance throughout the research and design process. Their oversight along with the dedicated weekly design review team drastically impacted the development of the project and its larger architectural concepts.

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I also want to thank my family and friends for their continued prayers and support.

## **ABSTRACT**

### **BUILDING HOPE: A COMMUNITY BUILDING + WATER INITIATIVE, LA VILLA DE SAN FRANCISCO, HONDURAS**

MAY 2016

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It is my contention that through activating participatory design and community engagement strategies, in conjunction with innovative construction methods that address issues of resource scarcity, the standard of living and level of accessibility to critical resources in impoverished portions of Honduras can be drastically improved. The newly provided model of construction can be done in such a way that it is cost effective in its building method, and provides highly sought after scarce critical resources. This allows participants to allocate more of their finances towards other necessary resources they normally would not be able to acquire.

A new community center designed to address the issues of resource scarcity and job opportunities will stand as a first built model with the intent that the methods of construction and innovations employed will be replicated in further applications. The center will be innovative in its construction in such a way that it recognizes local building practices, and brings some new ideas to them allowing for a method of construction that is both improved and more affordable. The center will also take a fresh look at ways the community can address issues of food and water through architectural innovations. The intent is that the success of the center's combined interventions will encourage local

people to replicate the design ideas in their own residential applications. This will improve the quantity of resources available in the community and also start to build a new job market for installing the newly desirable systems.

Resource scarcity has wreaked havoc on the typical Honduran villages' sense of community. Hondurans are in constant competition with their neighbors for scarce critical resources required to sustain life. These resources include, food, water, shelter, and employment opportunities. Violent conflict often arises within communities as individuals compete with their neighbors for the basic necessities required to sustain life.

While architecture alone cannot solve all the issues that contribute to the problem of violence, a new center with a program that builds community and provides needed resources stands to potentially curb neighborhood conflict and begin the community healing process. The center stands as not only a replicable model, but also as an immediate community element to bring neighbors back together physically in daily interactions and emotionally in the new resources being provided.

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## **CHAPTER 1**

### **THESIS INTENT**

#### **1.1 Introduction**

The Building Hope project seeks to investigate the potential of architectural intervention to address critical issues of resource scarcity in the community of La Villa de San Francisco Honduras. Through the help of considerable grant funding by the Ella Lyman Cabot Trust, the project seeks to address the issues through the design and build of a community center designed in such a way that it serves as an observable, replicable model.

The projects initial conception began on my personal volunteer travels to Honduras. In my initial travels I was able to observe the people of the country struggling to obtain basic elements needed to sustain life. Some of the issues such as a need for clean water and cost effective building strategies seemed to be potentially addressable through architectural intervention. During my first trip to the country I had the opportunity to network with Hope Families, an existing non profit community organization that runs a community help program in La villa De San Francisco. The Hope Families non profit quickly became an invaluable partner to the project that will eventually run the new center. While the projects primary intent has been to construct a demonstration design build project, the scope of the research includes a serious emphasis on how the centers demonstration properties may eventually be replicated and applied by community members.

#### **1.2 Thesis Process**

The projects process has many parts. It starts with myself gaining a better

understand of Honduran culture, and what part I play as an individual within that culture. Understanding of the culture was explored through both literature review and first hand experience. As part of the thesis I made two trips down to Honduras. One to work as a volunteer doing construction, the second to immerse myself in the community and their culture. Additional literature review was also done early on in regard to how gender plays a role in Honduran society, how race may play a role in community perception, and how to best address public interest design. Precedent community projects were also reviewed for a broader knowledge base.

The second portion of the process involved a preliminary design phase prior to traveling to the country to meet the community. This involved studying big concepts that could potentially play a role in the design of the center. It was a time of abstract and broader thinking to mentally prepare for the trip to meet the community. The process was intended to be the development of abstract ideas based on what I'd learned thus far, but to more importantly, to visit the community with an open mind and let myself hear what they need. During this period a lot of time was also spent preparing a detailed itinerary to best utilize my time in the village.

After my cultural research and visiting the community the real intensive design process began. Critical community issues identified that need to be addressed were cost of suitable construction and access to clean water. The design of the center was to really be a model of a new method of cheaper construction that also provided the critical and scarce resource of clean water. As stated in the abstract, the design was done in such a way that it can serve as a replicable model.

The full realized project will continue to include the eventual build. Although that stage has yet to be completed, this thesis will talk about some projections as to how that process will work and anticipated tangible benefits to the community.

### **1.3 Thesis objective**

If this thesis were to accomplish solely the task of a designing and building a functional community center, it would be considered a failure. There have been many attempts to build affordable housing to those living in poverty in Honduras. More often than not these attempts fail due to a lack of understanding the culture and addressing the underlying issues. They treat immediate need, but not the issues that create the need in the first place. In this way they may provide a family a house, but not even begin to solve the current crisis of Honduran housing. This project aims to avoid falling into the trap of a simple design build, and works rather to be a culturally engineered model of construction. It starts with the addressing the critical issues the community is facing and works to provide solutions that come in the form of a built structure.

### **1.4 Methodology**

The methodology consists of a three part approach. One part is an in depth study and understanding of community design including research of how to design within a community that is culturally different than my own. I wanted to gain a deep understanding of how I can best engage the community and get members actively involved and interested in being a part of the center's conception. To achieve this I needed to better understand how things like gender and race might play a part in the communities perception of me, an outsider.

Another part of the methodology is a very hands on field based immersive method allowing for a greater anthropological understanding. This involved trips down to visit the community, getting to know individual community members, and working with them throughout the project. Even when I was not physically present, a constant and active line of communication has been kept open between myself and the future users of the facility. Community leaders have been consistently involved in everything from conducting water experiments, surveying potential land, to giving structural design input.

The third part of the approach has been the application of an architectural design process in the project. Under the guidance of a team of architectural professionals, many different architectural design strategies have been implemented in an attempt to solve the specific community issues. The idea has been to understand the issues the community faces and then look at them through the lens of architectural design to see which can feasibly be addressed, and how.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Anthropological Study

The reading of *Working Hard, Drinking Hard: On Violence and Survival in Honduras* by Adrienne Pine provided deep insight into some of the prevailing elements of Honduran culture and the driving forces behind them. Adrienne Pine writes about Honduran culture, economics, violence, and politics from a trained anthropological standpoint as a researcher who has immersed herself in everyday Honduran life over a number of years.<sup>1</sup>

The reading makes it very clear the Honduran population has a keen awareness, and mixed feelings, about the United States. They understand most of their generated income is a result of American consumerism (although arguably exploited). They are also aware of a never ending American military presence. They have a keen understanding of the power of a corporate logo, as much of their industry thrives on creating knock off versions of big company products. Their ambivalent feelings toward the United States can be seen in their graffiti portraying big company logos in different manners.<sup>2</sup>

The book makes it very clear that they have an established culture of violence and suggests that the government promotes this behavior. Hondurans see violence as a normal part of everyday life, and even a sign of progress. The book quotes a local as saying, "When you have progress, as we do, you get delinquency." With the highest murder rate per capita in the world, the violence is far beyond delinquency and death plays a major role in everyday life. The politically owned and controlled media focuses almost solely

1 Pine, Adrienne. *Working Hard, Drinking Hard: On Violence and Survival in Honduras*. Berkeley: U of California, 2008. Print.

2 Ibid., 12.

on violence, showing brutally graphic imagery regularly described as, “death porn.” The media constantly plays extraordinarily gruesome imagery of street murders and death. Bodies on the street are protected by police as opposed to immediately cleaned up so that Hondurans can see the death up close and personal for an entire day. This desensitizing to violence due to constant exposure has resulted in it being the norm.

The consistent violence results in a constant cultural feeling of fear. Pine notes this general feeling of fear was expressed by Hondurans of all walks of life and demographics. From her interviews with gang members to the elderly, all lived with a feeling a fear and danger.<sup>3</sup>

There are a many different thoughts on what perpetuates the violence. One contributing factor is a perpetual lack of nationalism. Pine writes there is little sense of pride in being Honduran. The people do not seem to believe in themselves. They hold up and value other countries while looking down at themselves as poor and invaluable. She observes Hondurans as identifying themselves primarily as, “not being American (of the United States).” This can be seen in how they imitate American culture, entertainment, symbols, and language. One great example she gives is how they name their children after famous Americans, sometimes even getting names such as Hillary Clinton.

They are also observed to replicate American logos and symbols of power everywhere. They will tag walls and clothes and tattoos with symbols such as the Nike logo. In regard to celebrating their own country, the treatment of and respect of their flag is a notable symptom of a lack of nationalism. The Honduran flag is rarely if ever seen displayed proudly outside in towns, shops or homes. The flag as a symbol seems to mean

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3 Ibid., 15.

very little to Hondurans, while the flag of the United States can often be seen painted across entire storefronts.

One of the few glimpses of nationalism can be found in Lempira. Lempira, often referred to as possibly the only recognizable figure in Honduran history, was the native Indian who led the fight to keep out Spanish colonizers and was ultimately killed. The Lempira is celebrated through Honduran currency and statues. His figure has also been glorified over the years. One can see his transformation over the years in currency. Lempira started out as being depicted as a humble Indian, as years have gone on his image has been glorified to a strong warrior.<sup>4</sup>

Pine also talks of a general feeling of being replaceable. Many are unemployed. The ones who are employed work for large corporations doing jobs that require no specialized skills and leave them easily replaced. This lack of employment and pride leaves the men in the culture, which is historically patriarchal, feeling as though they have little worth. Gangs provide networking, a sense of pride, and economic opportunity to the men of Honduras. With extreme violence the norm, and gangs serving as a way to stay economically stable and feel valued, it is little wonder why so many Hondurans fall into this trap. Gang membership is estimated to be around 31,100 members with 70,500 sympathizers. This leaves over 100,000 members if the society of about 8 million directly tied to specific gangs. Unfortunately, very few gang member survive, as demonstrated in Pine's interview with six young gang oriented boys, all of whom have died since the book's publication due to gang violence.<sup>5</sup>

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The violent culture tends to blame themselves individually for their problems.

4 Ibid., 22.

5 Ibid., 25.

Pine describes the mindset as being such that locals believe, “economic inequality is due to differences in ambition and ability...individuals do not inherit their social status...but attain it on their own.”

The tendency to have large families also plays a role in poverty. Many families have 10 or more children, resulting in a need for children to sacrifice education to work to support the family. This perpetuates the cycle of unskilled poverty.

It has been sufficiently established in Pines book, that the political construct of the Honduran government is that of fear, violence, and corruption. This accusation is strengthened by the fact that the Honduras government is rated to be the 3rd most corrupt in the world. Pine writes, “The Honduran government exploits the population’s fear of increasing violence. Poor people are more afraid of their neighbors than of the repressive neoliberal state.”<sup>6</sup>

With this corruption and fear present in everyday life, it is no wonder that many Hondurans turn to alcohol as an outlet. Alcohol is a very active part of Honduran culture. It has very close ties to the patriarchy style family system the country is culturally grounded in, and is considered a sign of machoism. Pine quotes a local Honduran as having said, “Our formation or lesson from our parents is that a man, if he’s really a man, should smell, of alcohol, tobacco, and women.” This feeling on alcohol use is echoed throughout the different parts of the country. There are many perceived positives to the outlet of drinking in Honduras. One perceived positive is it gives the drinker a safe place to speak out verbally, in the sense that they can openly speak about frustrations and injustices experienced in everyday life and no one takes it too seriously as it is just someone who is

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6 Ibid., 62.



drunk. To make such a stand and start a movement as a sober thinker could be dangerous, as a drunk it's acceptable. The Honduran government is able to spin alcohol abuse to meet their own agenda. Through victim blaming and references to acts of violence committed by drunks the media portrays a drunk as being a drunk by their own devices. If they had striven to achieve and not drank they would be somewhere far better, instead the drinker is throwing their life away and causing harm to those around them. Increased drunken activity raises levels of fear and allows more government presence to 'help' handle those who appear not to be able to help themselves.

Something to consider about the level of alcohol abuse is that often times the sober men cannot provide any more than the drunk men. The man who works hard, best educates, and strives for a better life is still almost always limited to the same opportunities as the drinker. This leaves little to no incentive to stop drinking. These drinkers then blame themselves and the religious consider themselves sinners with, "no one to blame but themselves."<sup>7</sup>

Pine also talks extensively on the influence of corporate powers in Honduras in regard to economy. The Honduran economy has long suffered due to exploitation by U.S owned agricultural and textile companies. Around 1840, the largest portions of fertile land in Honduras were bought up by large U.S. companies for exporting textiles and bananas. These large scale plantations early on consisted of mixed groups of Hondurans, some of whom associated with being black and others lighter skinned. This divide not only created racial tensions, but also made organized labor unions difficult. Honduran workers in these large scale plantations were divided as a whole and taught very specific simple

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7 Ibid., 65.

skills rendering them easily replaceable.

The outside corporations over the years have essentially turned Honduras into a one crop country (bananas). Honduras is left with almost all of the profits of its prime land going to foreign corporations and a country of people receiving low wages with no job security.

## **2.2 Race and Gender in Community Design**

The study of gender in regard to design is one of complexity. In her writing entitled, *Introduction: 'Gender, Space'* Jane Rendell speaks on the idea of separate spheres in regard to men and women. She writes, "The most pervasive representation of gendered space is the paradigm of 'separate spheres'. An oppositional and hierarchical system consisting of a dominant public male realm of production (the city) and a subordinate private feminine one of reproduction (the home)." This paradigm is of particular interest to my understanding of Honduran culture as Hondurans are traditionally patriarchal to an extreme. Women are thought of as belonging in the home and raising children (reproducing) while men are expected to go out and provide for the family. Any other family structure has been traditionally looked down upon.<sup>8</sup>

As in the United States with the feminist movement, the role of Honduran women in the workplace has drastically changed since the 1980's with the boom of the textile industry. Women have almost entirely replaced men in textile factory positions, working for less pay. Men have now found it a struggle to hold the patriarchal role in their household and often turn to gangs and violence as an opportunity to reestablish

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8 Rendell, Jane. *The Pursuit of Pleasure: Gender, Space & Architecture in Regency London*. New Brunswick, NJ: Rutgers UP, 2002. 101-111. Print

their perceived dominance. This cultural change has produced much tension in Honduras. Women migrating to the area of textile plantations (the city) at a rate as high as 5 women to every man, creates constant tension.<sup>9</sup>

Rendell speaks on reevaluating the separate spheres of men and women by taking a look at activities of production that take place in the typically female private sphere. There are many activities of production that occur in the private sphere that if reinterpreted, could alter society to allow males to feel fulfilled in completing those roles. She writes, "More recently, constructions of public masculinity have been redefined in ways which connect male identity with models of domesticity. In all these cases, one of patriarchy's positive terms (production, public, male, city) is re-interpreted by showing its previously obscured connections with a term originally represented negatively in patriarchal ideology (reproduction, private, female, home)."<sup>10</sup> This thought process of re-analyzing how a patriarchal community perceives private production could potentially play a key role in the design of the Honduras community space.

If Hondurans were to attribute aspects of production in the home to a neutral sphere (neither masculine or feminine), there is the potential that local community production could be grown exponentially and gang violence reduced as more Honduran males feel fulfilled in their family role. Local production in regard to things like the growing of community food, rainwater collection, and home construction could be a point of collaboration between the two traditional spheres, diminishing tensions. A community space designed in such a way that it adequately combines these spheres may be able to re-connect the local community as a whole while also building a more positive non gender

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9 Ibid., 110.

10 Ibid., 111.

oriented household in which roles can be shared.

The reading of, *Yearnings: Race, Gender and Cultural Politics* by Bell Hooks was particularly interesting to me. Especially when she talks about words and language as being a place of struggle. The author writes, “Often when the radical voice speaks about domination we are speaking to those who dominate. The presence changes nature and direction our words.” The author is presenting the idea that the way in which different racial groups talk to each other and themselves changes dramatically depending on who is in the conversation. She is pushing the idea that the dominant group has a particular language, and the suppressed group has to be able to understand and interact with that kind of language in order to thrive. Similarly, the suppressed group has their own language. One that may be spoken amongst themselves, but altered in the presence of other groups.<sup>11</sup>

I think the idea of language being a struggle is present in a multitude of different groups, including differences in race but also differences in general social class. Having spent a lot of time in impoverished communities I can say that the way people of these communities interact with and talk to each other is very different than how they interact with and talk to an authoritative type figure that is foreign to their group. It could almost be perceived that there is a language barrier that comes with the racial or social class differences. I believe this language issue can be seen in the dominant group as well. They speak in a certain way to one another, yet very differently when speaking to someone of a perceived lesser status. The attitude and language changes and becomes cloaked depending on the audience that is present to a point where communication can be

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11 Hooks, Bell. *Yearning: Race, Gender, and Cultural Politics*. Boston, MA: South End, 1990. 203-09. Print.

inhibited.<sup>12</sup>

The author writes, “Silenced. We fear those who speak about us, who do not speak to us and with us. We know that the forces that silence us, because they never want us to speak, differ from the forces that say speak, tell me your story.”<sup>13</sup> I think this can easily be tied to the feeling of language differences. Differences in agenda cultivate and intensify differences in language and speech. When the two parties come together with agenda, language is altered by both oppressor and suppressed to combat each other and realities are lost. In contrast if the conversation is open and listening oriented, language barriers tend to become minimal, or disappear entirely. This is when true creativity and new ideas can thrive.

This type of language study is invaluable to the Building Hope project. My perceived presence in a community to which I am alien to will drastically impact both how the locals interact with me, and how they feel about the project in their local community. Being an outsider from a perceived dominant country I have to be very aware of these issues and the roles they may play in interactions. While it’s impossible to totally eliminate the perceptions, visiting the community with an understanding of the power dynamics and possible perceptions will empower my understanding of interactions with the local people.

Given Honduras’s extensive and complicated history with the United States, there are strong cultural feelings towards Americans. I have to be aware of those feelings and be prepared to address them appropriately. Applying this concept of non-dominance

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12 Ibid., 205.

13 Ibid., 206.

and open listening while meeting with the community can ultimately go a long way in minimizing the language barrier.

### **2.3 Public Interest Design**

Jeremy Till's essay entitled, "Architecture of the Impure Community" really hits on some key underlying issues that need to be addressed in regard to community architecture. Till exposes a considerable flaw in community architecture when he talks about, "The Myth of Community." He argues that the considerable majority of a community will avoid participation due to their own fears. This stands in great contrast to how we typically like to think of the Utopian community as consisting of meetings and neighborhoods filled with various members of society driven to collaborate. If Till's argument that most people don't participate and hide tucked away under the larger blanket of their community is correct, then who does that leave actually making community decisions? The reality of the political construct of the community then comes into play and decisions are made by a select group of politically motivated individuals, architects, and state run entities. The end result then perpetuates this idea that architects come and swoop in from on high and impose their own will. <sup>14</sup>

This rejection of community in regard to participation, but acceptance as a blanketing statement also carries over to community layout, resulting in suburban designs where privacy and individual territory is valued over the collective whole. Till goes on to argue that community architecture needs to be willing to give up the flawed Utopian ideals of what it should look like, and begin to accept the impurities of community in order

for progress to occur. He writes, "Architecture...must relinquish its delusion of purity and

<sup>14</sup> Till, Jeremy. "Architecture of the Impure Community." *Occupations of Architecture* (1998): 61-75. Print.

accept contingency and the reality of social construction. We should not talk of community architecture, but the architecture of the impure community.”<sup>15</sup>

Armed with an understanding of the myth of community and the need for acceptance of its impurities, Till begins to provide answers to how to respond to the impure community later in the essay. He talks about the importance of maintaining the architect’s position of specialized knowledge while also sustaining the rights of the users. Architects very clearly have a specialized knowledge they are bringing to the table. If they did not, their insight and skill would be minimized to the ability of technically drawing. On the same token, the realistic feelings and considerations posed by the community should not be dismissed, but rather identified with. Till states that both the architect and the user, “can be invigorated by the movement between angelic aspirations and dirty realism.”

He goes on to argue that once these real tension fueled conversations occur, spacial reconfiguration will follow. The desired community model achieved through the realities of community, as opposed to Utopian ideas of what it should look like. I have to consider how this is applicable to the Honduran community project. In a place where the idea of privacy and community disconnection is amplified, how does a designer begin to accept the impurities and work with them to achieve positive spacial reconfiguration? It also poses the question of how does the architect differentiate what level of community dis-functionalities are acceptable or almost necessary? Understanding the Utopian idea of the community as a flawed model allows for the leaders of the Building Hope project to address community design interaction through a more realistic lens of the power structures at play, and how to work within them. <sup>16</sup>

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15 Ibid., 65.

16 Ibid., 70.

## CHAPTER 3

### PRECEDENT STUDIES

#### 3.1 La Esperanza Project by George Tehan

The La Esperanza Project by George Tehan focuses on the relocation and rehabilitation of a select poor population in the city of Tegucigalpa, Honduras. The project looked specifically into a local population that has established makeshift housing at a central dump site. These locals spend every day sifting through arriving garbage in search of food, valuables, and building materials to improve their housing.<sup>17</sup>

One notable aspect of the project is Tehan's decision to relocate the target population to an undisturbed site to rebuild. While the objective of removing the locals from the dump site is understandable, the chosen solution of an untouched site feels a bit Utopian. Realistically if this option were to be pursued there would surely be unexpected consequence. One potential consequence would be that new poor Hondurans would move to the dump site as it would now sit vacant and the potentially valuable garbage would be untouched. Although this solution could improve housing for the current dump residents, it would not end the problem of people living at the dump.

The project hits on some valuable points in terms of construction and Spanish influence. Tehan looks to utilize Spanish colonial methods of construction that are cheap, affordable, and simple. The Cinvaram Block Press shown in Figure 1 is a system of block building in which an adobe mud mixture is put into a metal formwork and heavily compressed. This result is a much more standardized, stable block form in comparison to simple adobe block building provides. I think this could be a good possible solution as it's

<sup>17</sup> Tehan, George. Village Building in Honduras 6-40.



something the locals can easily replicate, it holds true to traditional building practices, and greatly improves the current system with minimal cultural impact.

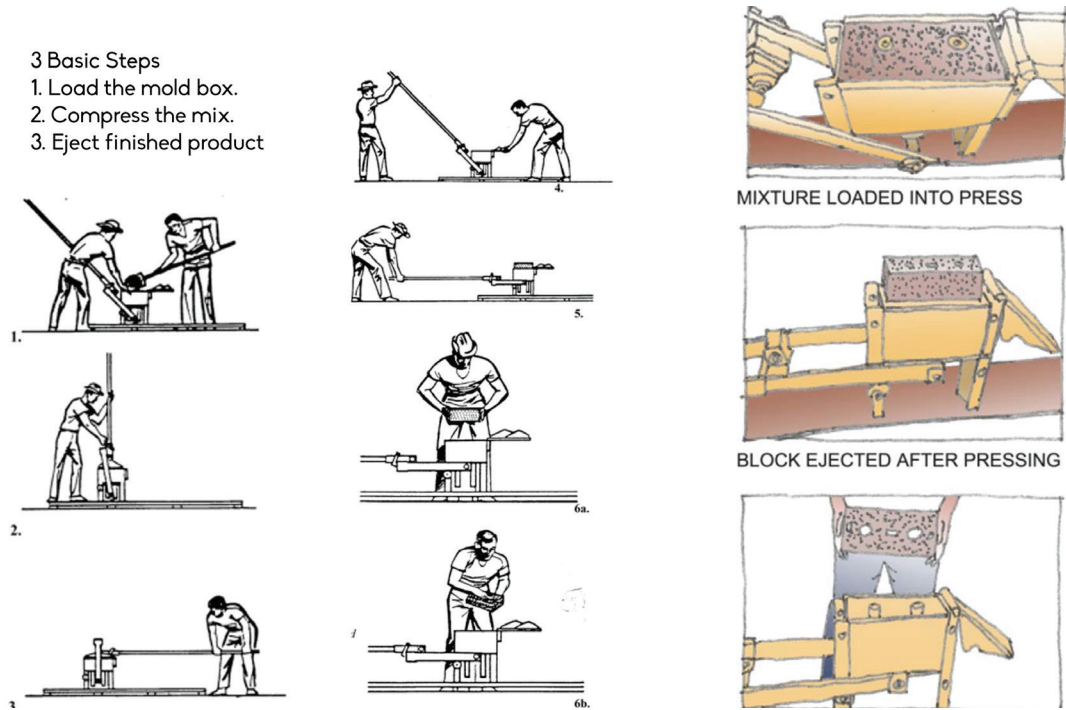


Figure 1: Cinvaram Block Press (Image credit: George Tehan)

Tehan also provides valuable insight in terms of town planning and housing design in Honduras. In terms of town planning the overall scheme has a very centralized marketplace and public space with housing radiating outward. This feels very effective in respecting current Honduran town planning while also building community. A central marketplace is key for locals to sell their goods and network as a community. Since most Hondurans travel on foot, the central marketplaces makes the downtown more easily accessible for everyone. Access to markets via foot travel is key to growth so Tehan puts forward a very realistic town planning proposal. <sup>18</sup>

18 Ibid., 32.

In regard to residential floor plan the proposal feels very strong. Hondurans currently struggle to build their homes in such a way that they feel protected from violence but also feel as though they are a community. Tehan brings forward a system the interlocks two L-shaped homes with a central green space. This feels very respectful of the culture and also builds community through a community garden.<sup>19</sup>

Overall the proposal brings some very valuable ideas to improving the communities of Honduras. Although the project steers away from the pre-established poor communities in favor of a blank slate, it still provides valuable insight into how designers can effectively improve Honduran building practices while respecting history and culture.

### **3.2 ISHACKIV by The HAPPI Organization**

The HAPPI (Homeless and Poor Peoples Initiative) organization is a nonprofit group made up of architects using their skills to improve housing in impoverished areas of the world. One particular project of interest by HAPPI is their IShackIV house in South Africa.

The IShackIV was completed using entirely recycled and natural materials making it a perfect case study for building with minimal resources. The main columns for the home are comprised of recycled telephone poles that are dug into the ground with a base foundation made out of recycled tires shown in Figure 2. The poles are painted with old motor oil to repel water and insects from destroying the wood.<sup>20</sup>

Once the tires are packed with soil and put in place as foundation, the main walls are then put into place. The design utilizes old shipping palettes filled with an adobe mud

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19 Ibid., 38.

20 Natural & Sustainable Building & Technology Consultants

and straw mixture as the main wall material. This system has a lot of benefits as it recycles the old palettes, creates a modularity in building construction, and offers the insulation benefits of adobe building. Once the walls are in place all gaps are filled with mud and straw and the metal roof is added. The metal roof is a shed style allowing for a single metal sheet to be used across the width. This minimizes cutting the metal ultimately saving material. The interior is finished with a mud plaster and stone flooring to complete the project. A series of photos showing these construction methods all the way through to the interior completed design can be seen in Figure 2.<sup>21</sup>

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21 Ibid.,NP.



Figure 2: HAPPI ISHACKIV construction (Image credit: HAPPI Organization)

Overall the building system seems entirely effective and replicable. The project has no aspect that cannot be built and replicated by locals. The material selections seems to have a lot of positives as well. The pallets and recycled telephone poles are being re-purposed in a very viable manner as opposed to becoming waste. These types of materials could potentially be very cheap or even free. One question would be the accessibility of the resources used. I would be interested to know if this part of South Africa has an abundance of old telephone poles and tires. The accessibility of these recycled resources is critical to replicability.

I would be curious to see more on how this design fits the culture of the area. HAPPI displays the project in a very localized on site fashion. It is unclear how this type of building practice and form matches up with the local culture and history.

### **3.3 KPSP 01 by Kounkuey Design Initiative**

The KPSP 01, or Kibera Public Space 01 Project by Kounkuey Design Initiative is located in the urban portion of Kibera in Nairobi, Kenya. The area consists largely of slums and could be argued to be the largest slum area in all of Kenya. The project's goal was to transform a riverbank that was overrun with sewage and debris into a public usable space.

Figure 3 shows the site prior to construction. Although Kibera functions as a town, it is not formally recognized as such. This leaves the community with no access to municipal services such as water and sanitation. The result of no sanitation system has been that locals dispose of garbage and sewage in two main rivers that flow through the community. This results not only in garbage buildup at the river's edge but also immense potential for the spread of disease. <sup>22</sup>

22 Lepik, Andres Afritecture: Building Social Change.Ostfildern: Hatje Cantz, 2013. Print.





*Figure 3: Existing site prior to intervention. (Image credit: Kounkuey Design Initiative)*

The design of the public space has many different community initiatives that contribute to its success. The space incorporates an assembly and educational center, a playground, office building, rainwater collection system, and a garden / composting center. An initial sketch outlining some of these ideas and methods of implementation can be seen in Figure 4. The program was carefully developed and crafted by the guidance of locals and their requests for particular needs. Given the communities lack of municipal resources, it stands to reason that collection of rainwater and composting gardens would be an issue the project addresses.<sup>23</sup>

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23 Ibid., 62.

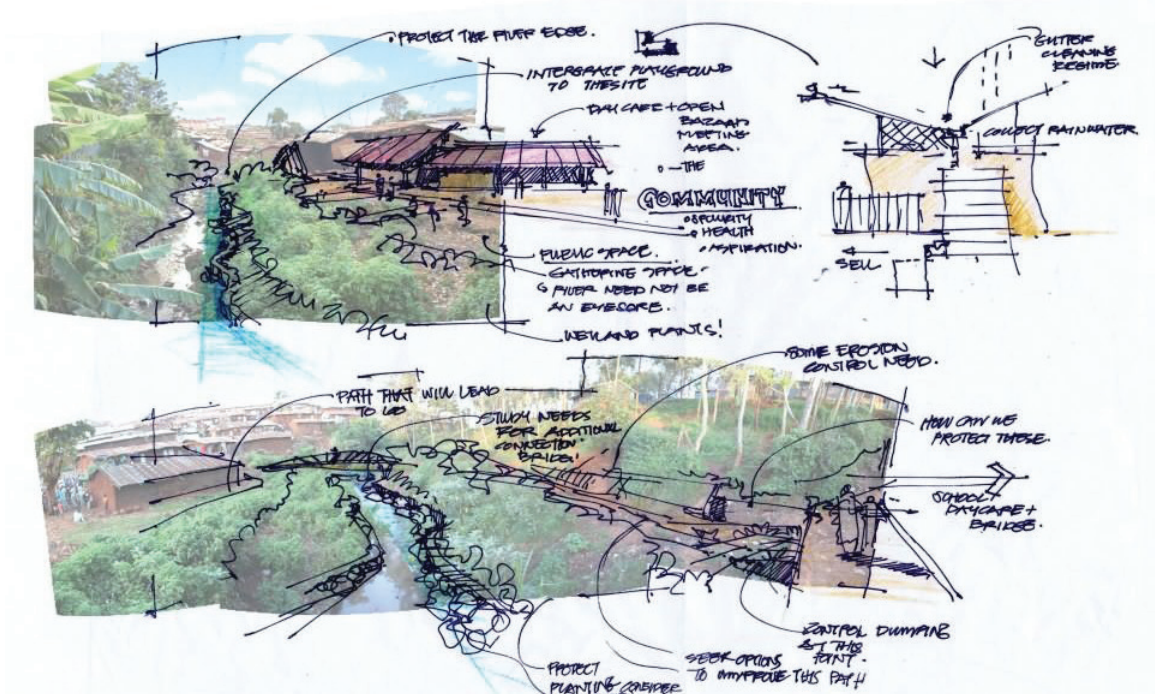


Figure 4: Kounkuey Design Sketches. (Image credit: Kounkuey Design Initiative)

Figure 5 shows a photo of the community playground as it fits into the context of the building and site. With an immense number of youth in the area, the playground acts as a safe place of exploration. The playground is constructed of culturally appropriate materials, while also considering economic efficiency through the use of things like recycled tires as part of a swing set and play area. The rainwater collection cistern can be seen in the background. This is a vital source of clean water for many in the nearby background of the playground. Its prominent location makes it a constant visual in the design connecting the building occupants with the critical water source.<sup>24</sup>

24 “Kounkey Design Initiative | KSPS01.”





*Figure 5: The community playground. (Image credit: Kounkuey Design Initiative)*

A common issue Kounkuey Design Initiative uncovered in previous case studies is a lack of facility maintenance after implementation. The building has an established “micro business” that maintains the facilities to counteract this concern. The water and vegetables grown in the garden depicted in Figure 6 are sold at a low reasonable cost to the community. The proceeds of the sales go towards continued maintenance and facility improvements. Compost generated is also sold to local and larger flower companies in the nearby area.<sup>25</sup>

The monetary income and small business run by locals have proven invaluable to the facilities growth. The public space has since grown in many ways, including reinforcement of the nearby riverbank, growth of assembly spaces, and enlargement of the playground. The project’s success is greatly impacted by its attentive solutions to issues expressed by

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25 Lepik, Andres Afitecture: Building Social Change.Ostfildern: Hatje Cantz, 2013. Print.



the community. The innovative responses to major industrial issues make this once trash ridden site a public space of continued success.<sup>26</sup>



*Figure 6: Kounkuey Design Sketches (Image credit: Kounkuey Design Initiative)*

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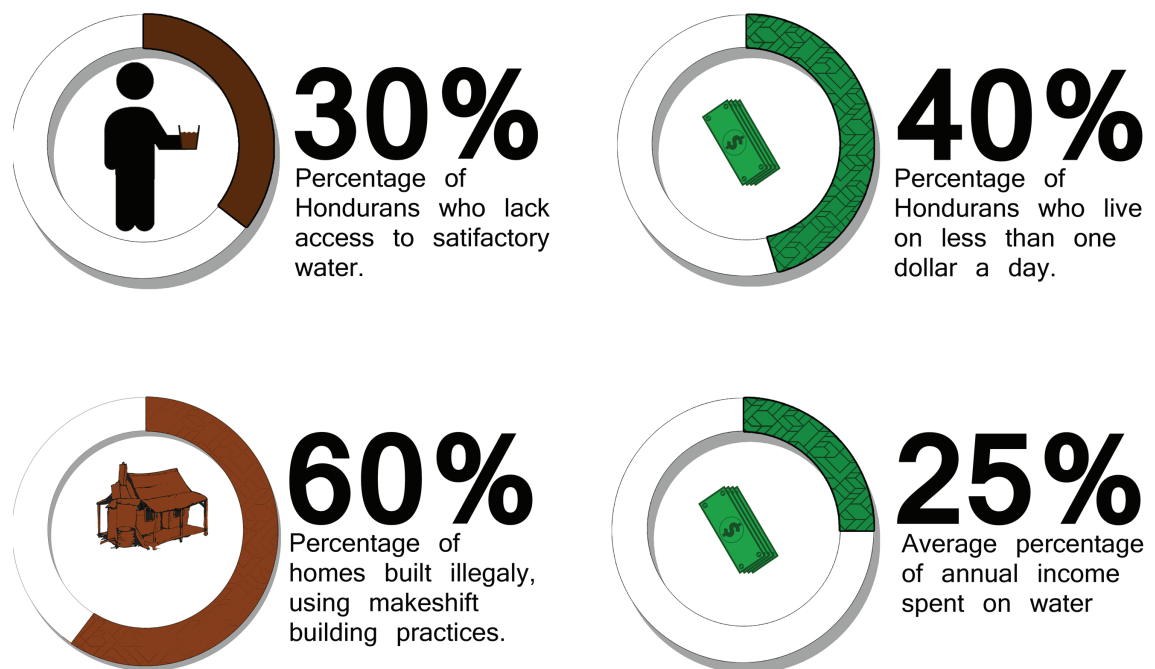
26 “Kounkey Design Initiative | KSPS01.”

## CHAPTER 4

### RESEARCH AND TRAVEL

#### 4.1 Early Understanding of the Need

Prior to traveling to the specific village selected for the community center, I worked extensively to gain a better understanding of the general need in the country of Honduras. While its clear that all the issues in a country like Honduras cannot be addressed through architectural design, there were a few troubling statistics shown in Figure 7 that could potentially be addressed in the community center design.



*Figure 7: Honduran housing, finance, and water statistics*

The issue of clean water was immediately recognized a major crisis on a national level in Honduras. Water is only a problem in Honduras due to a lack of infrastructure. The country gets plenty of rain and has significant water sources to the point that if the

infrastructure were in place, water would not be a problem. That being said, a lack of available clean water has had crippling effects on individuals and communities. Thirty percent of Hondurans lack access to water that is of a satisfactory quality. This is a significant number of Hondurans who do not have access to a critical element of survival. A large driver of this statistic is the cost of clean water. Water costs an average of \$1.50 U.S. currency for a three gallon jug refill. This may not sound like much, but when you consider that forty percent of Hondurans live on less than a dollar a day, the price of three gallons of water costs more than a day and a half's expendable income. The end result is a country where an individual spends an average of twenty five percent of their annual income on water alone. This is money that with the right water infrastructure, could be going towards other desperately needed critical resources.<sup>27</sup>

Another impactful statistic to consider involves the condition of housing in the country as a whole. Over sixty percent of Hondurans live in housing that is built either illegally, or done using makeshift building practices. This results in large quantities of disorganized, unplanned, and often unsafe shelters. From this arises community situations where land ownership is conflicted, resulting in angry confrontations. This general problem was felt to be one of the most pressing early on in my research as it has direct ties to architecture. More than half of the population in such a drastic way that they don't have satisfactory shelter.<sup>28</sup>

#### **4.2 The Community of La Villa**

After researching the country as a whole, the next step was to do some background research on the village of La Villa de San Francisco selected for the project. Before going

27 Interview with Katie Castro

28 Dendinger, Roger. Honduras. New York: Chelsea House, 2008. Print.

for an actual visit I wanted to understand as best I could the towns demographics and how it functions. This research involved direct communication with leaders in the village including phone conferences and surveys.

The community of La Villa de San Francisco is a municipality in the department of Francisco Morazán, in the Republic of Honduras. It used to be a village part of the municipality of San Juan de Flores, until 1923, when it was given the category of Municipality.<sup>29</sup>

Currently according to a recent census conducted informally by the city it has 12,000 inhabitants, but according to the INE, it has a population of only 8,000. The town is located about 55 km from the capital city of Tegucigalpa. The territorial extension of the municipality of Villa de San Francisco is 77.8 km<sup>2</sup>.

The community's economy is based solely on agriculture. The main crops include sugarcane, corn, beans, watermelon and bananas. It is important to note that all of these crops are seasonal, and provide temporary employment for a total of six months of the year. This means that for only a total of six months of the year there are job opportunities available. The job opportunities are not enough to employ everyone seeking work. Those who are fortunate enough to get seasonal employment are still victims of low wages. The other six months there is almost no employment opportunity.<sup>30</sup>

It is noteworthy that the work has traditionally been done almost entirely by men. Being a historically patriarchal society, women until recently have almost always worked within the home. This is an area of recent change, with watermelon plantations

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29 Interview with Gunther Gallo

30 Ibid., NP.

now hiring almost only women. The corporations are finding that women can carry out the requirements of harvesting this crop, and will work for cheaper wages than men. The result is a community of where women are making lower wages and men are feeling displaced from jobs they once had counted on to support their families.

The town of La Villa has a few great aspects that were taken into consideration in choosing it for the project. One considerable aspect is the town's proximity to Tegucigalpa, the largest city in Honduras, shown in Figure 8. Tegucigalpa is known for its extreme violence, and is not a place a project like this could be safely implemented due to the extraordinary risk of violent encounter. With that said, Tegucigalpa is a city that could very much so benefit from the new ideas the community center will bring. La Villa is just far enough away from the city that the community is safe, yet close enough that if the community center has measurable impact, it will carry over and spill into the nearby city.

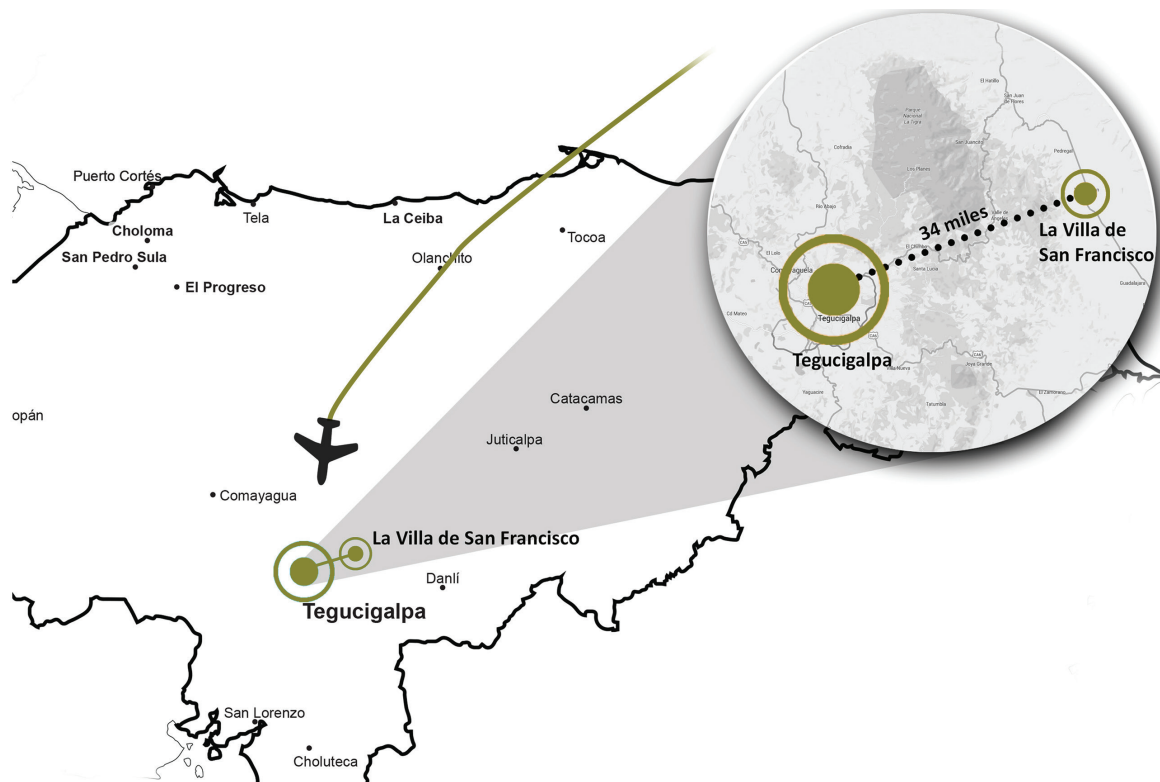


Figure 8: Map showing La Villa in relation to Tegucigalpa (Image credit by the author)

### **4.3 Travel Itinerary**

I traveled to and spent just over a week in Honduras at the end of December, 2015. The trip consisted of time spent in both Tegucigalpa and La Villa. My time there had to serve a multitude of purposes. The main objectives were to gain an understanding of the community of La Villa, explore different potential available options for a building site, acquaint myself with the Hope Families Honduras team that will eventually run the center, and spend time understanding how their program currently runs in their rented space.

On top of these primary objectives I also needed to survey and gain an understanding of construction materials and methods. I wanted to understand how things were being built, why they were doing it that way, and how much it cost. Part of this process was a survey of building materials costs and availability in Tegucigalpa as that is where we will be buying our supplies. This was critical to understanding what they were using to build and why. My general travel itinerary created before I left can be seen in Figure 9. Time was split up accordingly to allow for a very experientially diverse and productive week.

| Date   | Trip Itinerary  |
|--|---|
| <b>Monday, Dec 14<sup>th</sup></b><br>(Tegucigalpa)                  | Arrive in Tegucigalpa Airport at 1:00pm<br>Conference with Katie Castro, week overview and prep.  |
| Night spent in Tegucigalpa   |   |
| <b>Tuesday, Dec 15<sup>th</sup></b><br>(Tegucigalpa)                 | <b>AM:</b> Exploration of city of Tegucigalpa communities / Culture<br><b>PM:</b> Meet with local architect Mario Aguilar to discuss building practices, drawings, and Honduran construction processes. Discuss our projects scope and his role.<br>(Possibly visit a construction site of his if applicable?)                        |
| Night spent in Tegucigalpa   |   |
| <b>Wednesday, Dec 16<sup>th</sup></b><br>(La Villa de San Francisco) | <b>AM:</b> Visit local hardware stores, material suppliers, and adobe production facilities.<br><b>PM:</b> Visit sugar cane and watermelon manufacturing sites (if applicable)<br>Casual interviews with local community members to understand lifestyle, needs, community aspects, etc.  |
| Night spent in La Villa de San Francisco                             |   |
| <b>Thursday, Dec 17<sup>th</sup></b><br>(La Villa de San Francisco)  | <b>AM:</b> Meet with local officials of La Villa de San Francisco<br>Meet with local construction workers to discuss building techniques<br><b>PM:</b> Tour of La Villa (community spaces, parks, gardens etc)  |
| Night spent in La Villa de San Francisco                             |   |
| <b>Friday, Dec 18<sup>th</sup></b><br>(La Villa de San Francisco)    | <b>AM:</b> Home visits of community members who might directly benefit from the project.<br><b>PM:</b> Meet with project owners (Hope Families & Promise children) to discuss needs, program, scope, building type etc. *Local community members who will use the space also present at this meeting to help sketch and provide input |
| Night spent in La Villa de San Francisco                             |   |
| <b>Saturday, Dec 19<sup>th</sup></b><br>(La Villa de San Francisco)  | Day spent in La Villa de San Francisco on site with community members sketching and brainstorming ideas. *Design Charrette with all community members invited*  |
| Night spent in La Villa de San Francisco                             |   |
| <b>Sunday, December 20</b>   | <b>AM:</b> Early morning Church service in La Villa church<br><b>PM:</b> Afternoon Spent in Tegucigalpa with Katie Castro per her itinerary   |
| Night spent in Tegucigalpa   |   |
| <b>Monday, December 21</b>   | Early AM Departure  |

Figure 9: Travel itinerary.



#### 4.4 Community Observations

In my short time within the community I worked to learn and expose myself to as much as possible. Something to note that the locals are proud of is that currently there are no indications of heavy violence in the area in comparison to nearby regions. Heavy violence being defined as regular murders and gang activity. A lot of this has to do with the town's rural farming character.

At first glance the town feels very much like a farm town. Observing the massive quantities of well tended sugar cane crop would lead one to think the town would be a community of prosperity. There is more than enough crop being grown and employment from those crops during the harvest season that the town should be financially stable. Unfortunately due to the outside corporate presence, none of the land, equipment, or crops are owned locally. Locals typically make an average of five dollars a day working sun up to sun down.



*Figure 10: Main road entering the village. (Image credit by the author)*



The working conditions are blatantly unhealthy. Slash and burn crop practices are used and the workers can be seen covered from head to toe in black ash. They mentioned many times they are exposed so often it is impossible to ever get off. The ash can be seen falling from the sky in any location in the town, causing chronic respiratory issues for all living locally. Very cheap low quality pesticides are also sprayed over the work areas in an attempt to protect the crops. Locals don't seem as concerned about this, but local officials expressed to me a concern about the lack of studies on what the long term effects will be on individuals breathing those pesticides regularly.

In discussing with workers why they don't unite for better pay and working conditions, workers expressed their keen awareness that there is always someone else in line eager to take their job. They emphasized how easily they can be replaced if they were to try and stand up for better pay. This does not help community and neighbor relations. Neighbors are competing for the same jobs, that once acquired provide enough to barely get by and rob the individual entirely of health and well being.

One of the more easily observable sociological negatives prevailing in the area is the high level of alcoholism. Community members can be seen spending their wages on alcohol in heavy quantities. This was a bit tough for me to understand because the little money they do make is so critical to family survival. It appeared to be a coping mechanism for many given the extraordinarily hard and unhealthy work. Alcohol provides a release and an opportunity to vent. The issue of money squandered on alcohol caused observable family tensions. It was also clear that the violence that does occur in the community was

most often alcohol fueled.

The community is also plagued by a very bad mosquito born illness called chikungunya. The region of Honduras where the community is located in was ground zero for the virus's outbreak in the country. Caused by mosquito bites, the virus leaves the infected individual with extreme muscle and joint pain. This pain in the early cases has been observed to last for life. Most locals have been infected and live with the virus as part of regular life, taking minimal precautions as culturally it is almost the norm to become infected. One observable protective measure is many homes employed mosquito nets for sleeping.

Another clear and observable issue in the community is a lack of clean water. Many houses have no municipal water connection. These families often rely on purchased water, usually delivered. If they cannot afford this they will then often times pump water out of the stream. Families that do have municipal water pay monthly for the connection. The monthly charge of about \$10 dollars is a lot for most of them. Even having municipal water, it is far from drinkable without treatment. Municipal water is often brown and dirty. Another thing to note about the municipal connection it that for many months during the dry season it may not flow at all. The faucets will literally be dry. It can be seen that water is an everyday challenge, and financial burden.

#### **4.5 Hope Families Program Observations**

The Hope Families program is a faith based U.S. non profit that currently services the youth and their families in the community of La Villa. They were an ideal candidate to become a partner in the community center build and upkeep given the success of their

current program and their established community presence. One of the main causes of failure in a design build project is a lack of program and facility upkeep after construction. Hope Families already has a reputable program in place and the funds to maintain and grow the new facility. Their presence in the community is also a huge benefit to the project in regard to community relations and also assisting in things like understanding the right land to purchase and organizing a work team for the build.

The Hope Families program currently services 60 families in a variety of ways. They maintain a rented community center for the kids in the program. The center provides healthy after school activities and encourages continued learning with things like access to shared computers. The center is also a place for counseling kids. According to the local Hope Families team depicted in Figure 11, over three quarters of the kids in attendance have been the victims of sexual assault. The problem is prevalent in the village. During my time there a sexual assault incident occurred with a young girl in the program. I was able to observe the team counsel the child's mother, whom they were able to stop from taking violent action in her own way. They also brought the child to the doctor immediately and covered those expenses. On top of all this they also met with local law enforcement on the issue and acted as a mediator for the mother.

In conjunction with the youth support, the program also serves their households and families. One way this is done is through subsidized housing when required. I was able to do home visits and drop off donations to some of the families in the program during my time there. Almost all the families in the program are single mother households. Often times without the program's support the mothers would be on the streets with their children. The program combats this with a safe place to live. The program also provides

subsidized food for families in need. Through the U.S. funded non profit food is purchased in bulk at a discounted cost and provided when needed to families in the program.



*Figure 11: Hope Families leadership team. (Image credit by the author)*

Families are chosen for admittance into the program based on level of need and willingness to abide by program guidelines. In return for the services the families agree to regular home checks. This is to ensure food and assistance is being properly allocated. The families agree that they will not pull the children from school to work. Children of families in the program must be allowed to continue their education if the family is to receive assistance.

During my time there I was able to observe a special end of school semester weekend event (pictured in Figure 12). There were over seventy kids in attendance. The event included new school supplies for kids that made honor role that semester or had

perfect attendance. The program makes a clear effort in to create an incentive for learning. The kids seemed to throughly enjoy the program's presence in their lives. Many of them coming from troubled home lives, the program was clearly looked up to by the children as a place of mentorship. The children also received a healthy dinner for being in attendance, something they were clearly excited about.

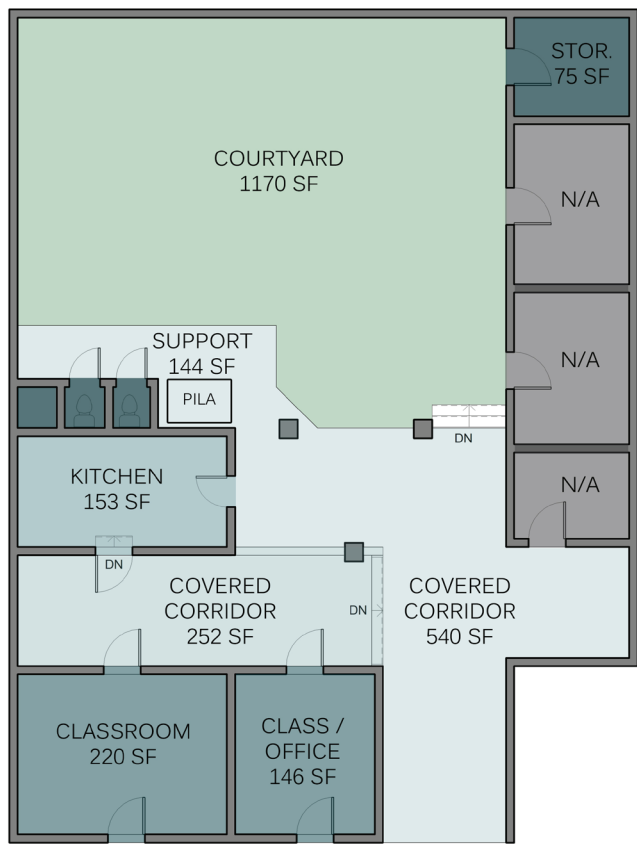
In talking with the leadership, they expressed some critical concerns in their current space that could be addressed in the new design. One aspect of concern was security. Theft is a constant issue. Due to the fact that the space is leased the program does not want to put money into additional security measures, and the landlord does not provide upkeep. For example, the front door is falling apart and anyone can just walk in. They felt a need for a more secure space.



*Figure 12: Hope Families Children at the Current Facility. (Image credit by the author)*

They also wanted more separation for the children in different age groups, while maintaining an area a communal gathering area. A lot of discussion was centered around

the best way to give separation, but allow for large scale gathering. Along the same lines, the team also talked about room for expansion. The program is current cramped into a small facility with a lot of inefficient corridor space, (shown in Figure 13). They wanted the new facility to have more growth opportunity, as this facility is already insufficient for their needs, and corridor space has become classroom areas.



**EXISTING FACILITY**

|                             |            |
|-----------------------------|------------|
| FULLY INTERIOR SPACE.....   | 520 SQ FT  |
| COVERED CORRIDOR SPACE..... | 792 SQ FT  |
| SUPPORTING SPACE.....       | 223 SQ FT  |
| TOTAL.....                  | 1535 SQ FT |

*Figure 13: Hope Families Existing Facility Floor Plan. (Image credit by the author)*

One last critical issue the program’s team heavily emphasized was a need to for clean water. They spoke a lot about a lack of water in the center, and how much it affects everyday operations both financially and in daily labor. They were uncertain if this was an issue that could be resolved, due to weather patterns. The community has an extremely rainy season from May until November, and then an extreme dry season, from December through April, (shown in Figure 14). During the dry season the program finds it tough to obtain water at all, let alone clean water. This is a critical issue inhibiting wellbeing. Its also a huge financial burden due to the cost of purchasing the water.

In further exploring the issue of water, the Hope Families team ran a week long water usage study. During this week they measured exactly how much water they were using each day. The end result was 36 gallons of water a day everyday. This average of 36 gallons per day is in a mindset of strict conservation, and if attainable, more, cleaner water could be a tremendous asset to the program.

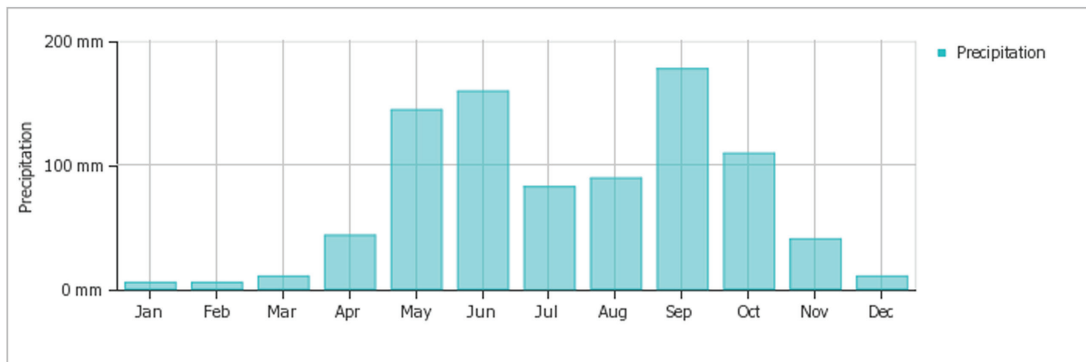


Figure 14: Yearly precipitation data for La Villa (Image credit: weather-and-climate.com)



#### 4.6 Architectural Observations

One last important element of the trip was observing architectural construction practices and materials in the region. Armed with the understanding that as a country a majority of people live in makeshift housing, I wanted to understand why that was and how it was being done. I also felt it was necessary to gain a deep understand of the materials available and their costs.

I embarked on the trip with prior knowledge and excitement about a bottle construction home just outside of the village. This peaked interest as something to study in regard to its level of success, and possibly as a building method. Given the water situation, plastic bottles are readily available in the area. It could also be a way of adding sustainability and turning an element of trash in the community into a valuable building material. The bottle house just outside the village that was visited as part of the trip itinerary (shown in Figure 15).



*Figure 15: Home outside the village constructed of bottles. (Image credit by the author)*



The house was built on a local farm, and the wall construction is entirely of bottles filled with sand, and sun dried adobe mud. The owner of the abandoned bottle home was part of its original build and available to discuss the process. He told us how the house used over 10,000 bottles and took over two years to collect all the bottles needed. He stated the bottles were filled with simple sand from the nearby river. The home was in terrible shape. It was missing a front door and the inside was very clearly abandoned. This is particularly concerning given the quality of the space in the house is remarkably better than the conditions of most local homes in the area. The owner did not give a good reason as to why it was abandoned, but was enthusiastic about employment opportunity to possibly do a new bottle build. The condition of this house and the fact that no one lives inside was of grave concern. We could not trust the owner to be honest because he saw a valuable employment opportunity as a bottle construction expert. Our local project team felt as though the house was either unsafe in some way the owner wasn't telling us, or just so different from the cultural norm that locals did not feel safe living in it.

Bottle construction was looked at extensively as a very real possibility for this project, but determined to be a method that really misses the problem. One example of this is that Bottle construction would actually cost more than using the locally made fired brick. One brick fulfills the wall square footage of two bottles. By the time we paid an acceptable wage to collect and fill the bottles with sand, the cost comes out higher than if we were to use a locally owned brick company that hires local workers and produces a quality, culturally fitting product. The local brick (see Figure 16) cost 18 cents and one brick provides the wall coverage equivalent of two bottles. On top of the cost, aesthetic and culturally factors, the bottles also pose a grave danger in the very common case a

Honduran kitchen fire. Kitchen fires are frequent. If the building were made of bottles the fire would melt the plastic releasing toxins into the air and immediately compromising structural integrity. After a full evaluation it was clear that the cost of wall construction was not the problem, and bottle construction alone was too far removed from the cultural norm to be effective, and was also unsafe.



*Figure 16: Local brick being used in construction with bottle for comparison. (Image credit by the author)*

The disappointment in bottle construction left me looking to uncover the opportunities to innovate using the existing methods of building as a base. To do this I worked to better understand how homes were currently being done in the community by studying them and talking to locals. Although there is no real standard of construction in the town, I was able to observe two common trends in building construction. The first distinct method is lower cost (see diagrammed in Figure 17).

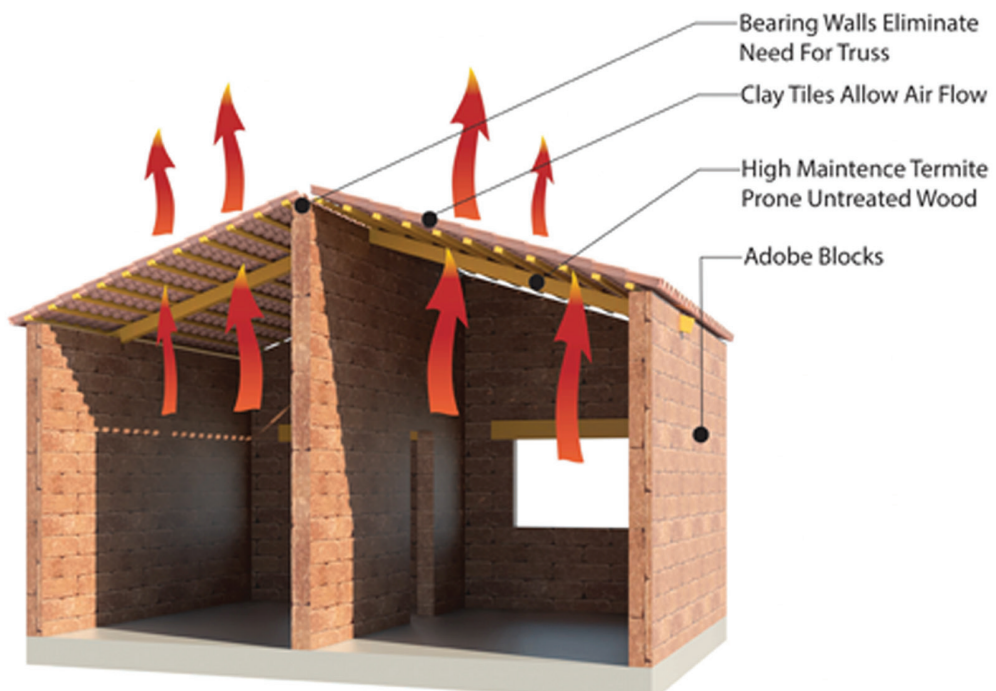
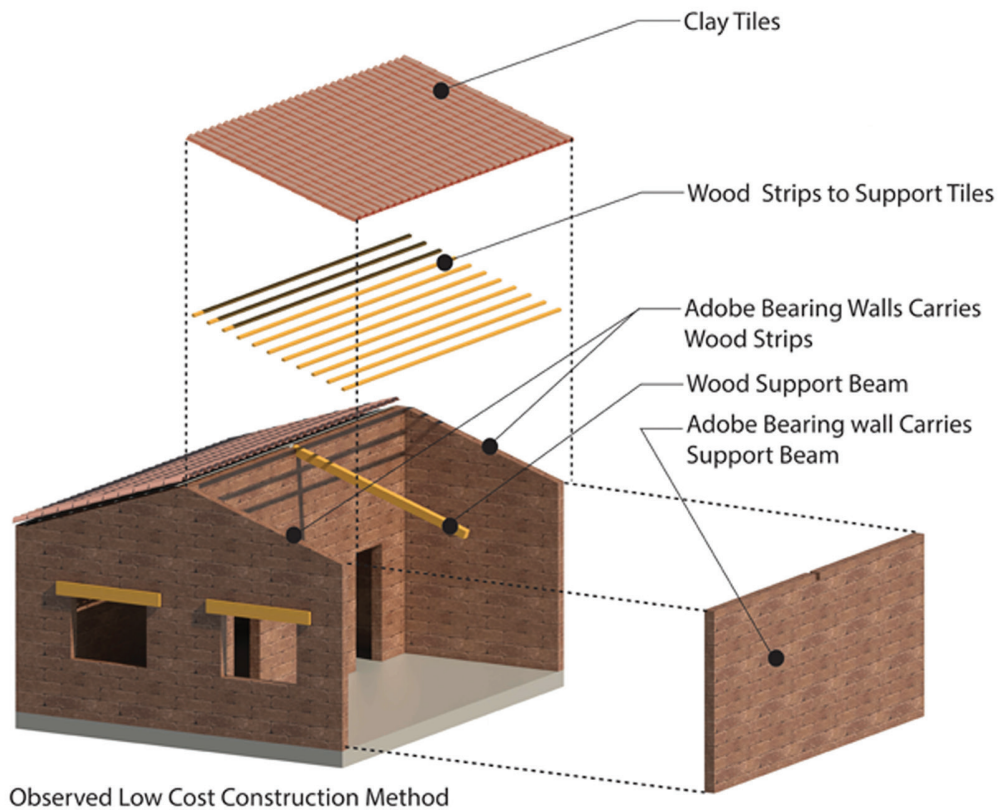


Figure 17: Low cost construction method diagram. (Image credit by the author)

The low cost method is built using adobe block walls as structural bearing walls. It typically has a center bearing wall, and stepped outer bearing walls as shown. Scrap wood is then used to span these walls and hold up a tile roof. The nice thing about this method of building is the ease of construction. The method is innovative in that the adobe walls on the exterior make the form of the triangular roof shape and become a structural ledge for beams to sit on. The design also handles cooling of the interior well through natural ventilation. The tile roof allows for heat to easily escape allowing for air circulation and cooling. Locals always stated tile as the preferred roof option in the community because of its ventilating properties.

The design also has many considerable drawbacks. The most critical drawback is structural integrity. Pressure treated wood is expensive and not readily available in the region. That means locals are using non pressure treated scrap wood as beams to put up the roofs. This results in questionable beam sizing and integrity. Termites are also a major issue in the area with adobe construction. This type of design even with maintenance does not last long due to termites eating the wood. Termite damage starts to compromise structural integrity from the start. I was able to observe many homes done in this style with drastically varying beam sizes that more often than not looked structurally compromised do to size or termite damage. The design also does not perform well in an earthquake as their are no structural ties holding the blocks together. Indoor air quality and lighting is also very poor due to the exposed adobe. It is also important to note that in the recent years the price of the fired bricks in the community have become comparable to the adobe blocks.

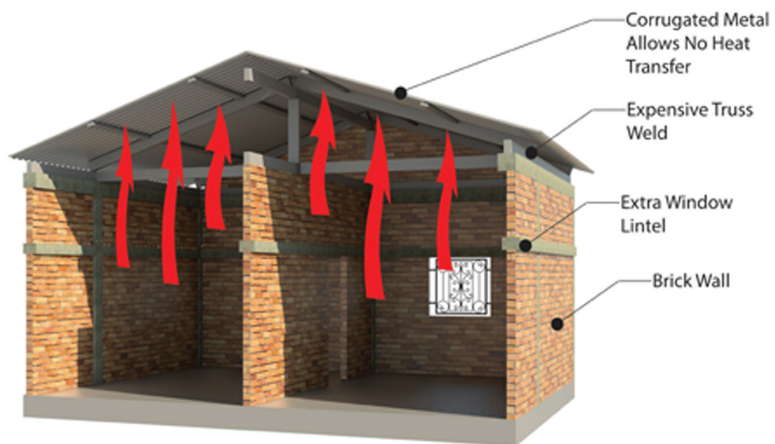
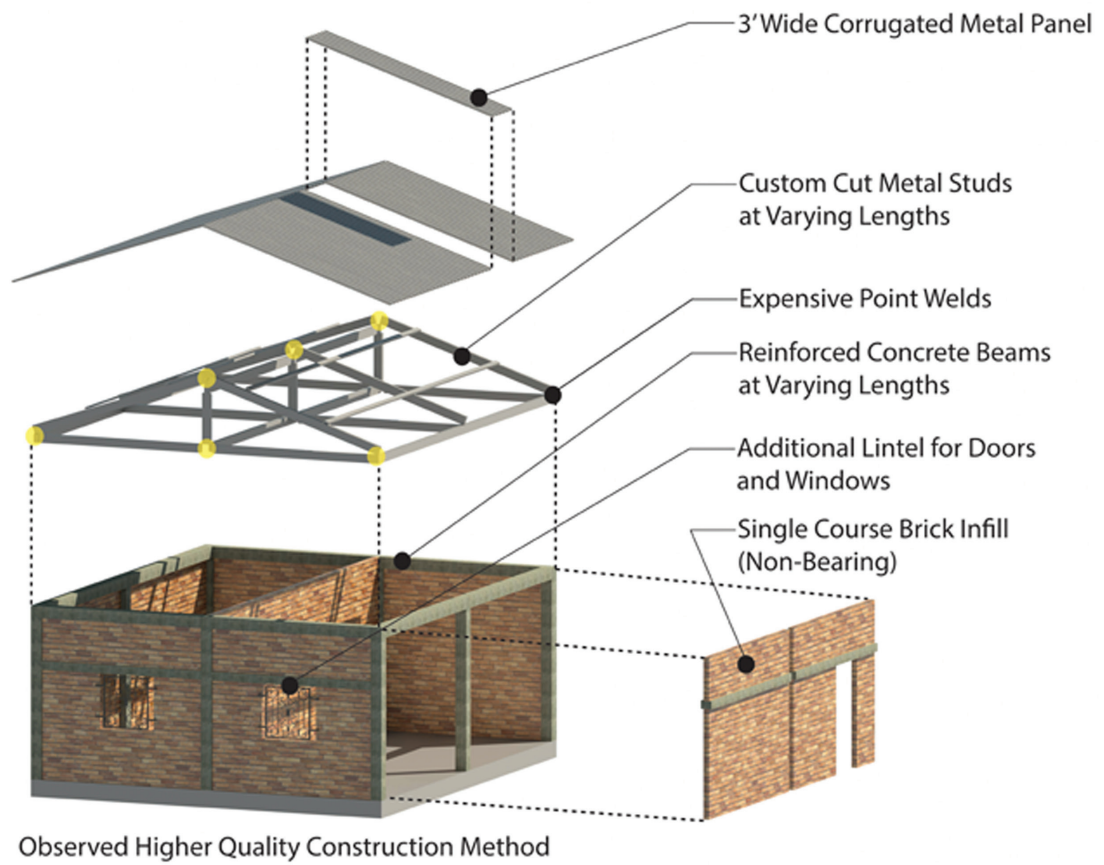


Figure 18: Higher quality construction method diagram. (Image credit by the author)



The second building method used (see diagrammed in Figure 18), is of a higher quality construction and meets basic living requirements. The design utilizes rebar reinforced concrete columns and beams. The wall infill is typically a single course locally manufactured brick and is not structurally bearing. The roof is built using a combination of 2 x 4 and 2 x 6 metal C channels. The channels are cut and welded together in various lengths to meet each individual's home design and spans. The roof uses a corrugated metal sheathing that comes in 3' widths. Windows are almost always open to outside air (no glazing) and typically barred with protective, and often decorative metal window bars. It's important to note that the window bars are made locally and usually done per order to meet a variety of opening sizes and designs. A concrete lintel is typically used to allow for window and door openings. This design often had a concrete floor poured floor slab, whereas the lower quality method was often a dirt floor.

In talking with villagers, it was established higher quality construction method is more desirable in every way except for the roof. The metal roof does not allow for passive air flow, inhibiting cooling inside the space. When inside a home with this design it can often be seen there is buildup of soot on the underside of the impermeable roof panels. The spaces with a metal roof were notably hotter than those with tile. In areas where there was an indoor kitchen, this problem was even more severe as the rising heat has nowhere to go. In a climate as consistently hot in Honduras, passive cooling is even more critical than in most other parts of the world. Locals expressed an understandably much fonder view of the tile roof, but preferred the quality of the interior space of this design in every other aspect.

With an understanding that cost of wall construction was not a major factor inhibiting more villagers from building using the higher quality method, I spent time working to understand what was preventing many building with the better method. The inhibiting factor very quickly presented itself as being the cost of installing the welded metal roof. A welded metal roof is far more expensive than using the adobe structural bearing walls. This is due to a few different factors. The biggest issue is a welded roof requires hiring a skilled welder that can put together such a system. Most villagers build their homes on their own to save on cost of construction. To install the welded system a welder must be contracted for the job. In speaking with locals and meeting with a local welder there are not many people in the area that perform the service, and labor costs for this type of particular job are high. Due to seasonal employment, community members have ample time to work on their own home, however they do not have ample finances to hire someone else to do the construction and welding for them.

Another added cost associated with a welded roof is waste of materials. The C-channels that compose the roof are cut to size depending on the room spans, which have no standardization. Excess materials are cut away and not usable for much else. Considering the low wages in the community this a very considerable waste of an expensive material and drives up the cost of construction even further. Due to the fact that the roof welder is hired, the person doing install does not have a particular interest in conservation of materials in their cuts. Villagers often feel these added costs put the higher quality building methods out of reach for them, and revert to lower cost adobe block construction.

In discussing the issue with Honduran Architect Mario Aguilar, he expressed his

belief that utilization of the higher quality construction methods would save locals money in the long run. While he was understanding of the upfront cost concerns, he stood firm in his belief that the added costs to maintain the adobe construction throughout its lifetime far outweighed the upfront cost to build with a higher quality method. He expressed concerns of common roof collapse due to unsatisfactory wood roof structures that would not occur in a metal truss roof condition. He also spoke much more highly of the second structural system in the case of earthquake, stating the reinforced concrete stood a far better chance of sustaining than the adobe. Its important to note that most locals know how to work with concrete very well, and it can be obtained in 90 pound bags within the village for reasonable prices.

One last general observation in regard to the community's current residential architecture was the excessive number of incomplete projects. There were many observable reinforced concrete structures with brick infill that were never completed with a welded metal roof. This can be seen as a result of the heavy cost of the metal roof in conjunction with lack of planning. The floor plans of these incomplete structures were often not done with any thought given to how the welded metal frame roof would eventually be done. When the time came for completion the projects were often out of funds or required excessive metal cuts with significant waste. The issue of welds presented itself as a prominent issue inhibiting better quality construction that could potentially be addressed.



## CHAPTER 5

### THE DESIGN PROCESS

#### 5.1 Concept Development

The issue of violence can be further understood as being caused at least in part by individuals in conflicting competition for the same scarce critical resources. Neighbors are competing with each other for the same jobs, land, building materials, and even water access that is so critically needed to support themselves and their families. With not enough resources to sustain everyone, individuals resort to violent tactics in order to attain what they need (see diagram in Figure 19). Violent conflict occurs between neighbors when there is interaction in an attempt to obtain the same resources. Violent behavior is extremely destructive to any attempt at positive community collaboration. It also drives residential planning in such a way that homes are designed to keep community out, and keep family safely in.

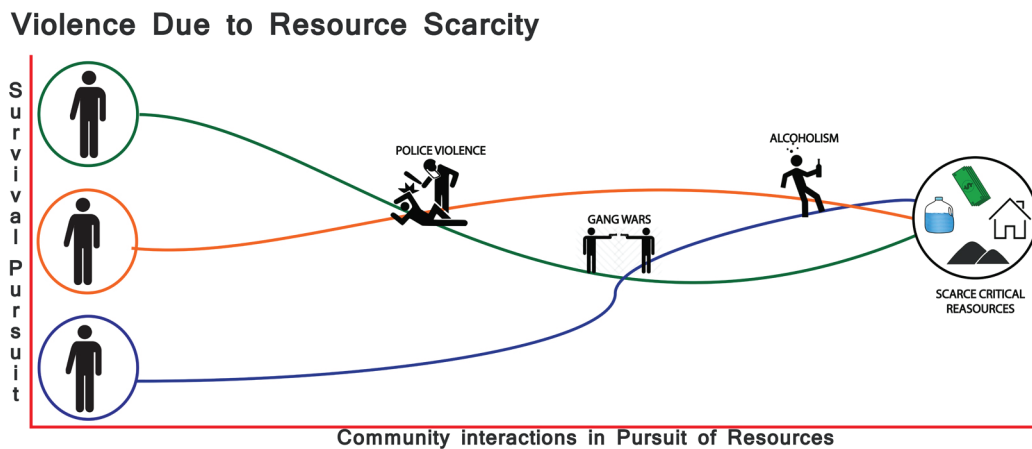


Figure 19: Violent conflict occurring between individuals competing for necessary resources. (Image credit by the author)

The major design concept seeks to address the lack of specific critical resources through the design and build of a community center model. The community center will address previously identified issues of resource scarcity and building construction through innovative design moves that respect the local culture and building traditions. The center will serve as a model that locals can use to study the effectiveness of the new ideas and replicate in their own home designs. In conjunction with the building replicability concept, it will also serve as a place for gathering and positive community interaction that provides for an immediate need on a large scale (see diagram 20).

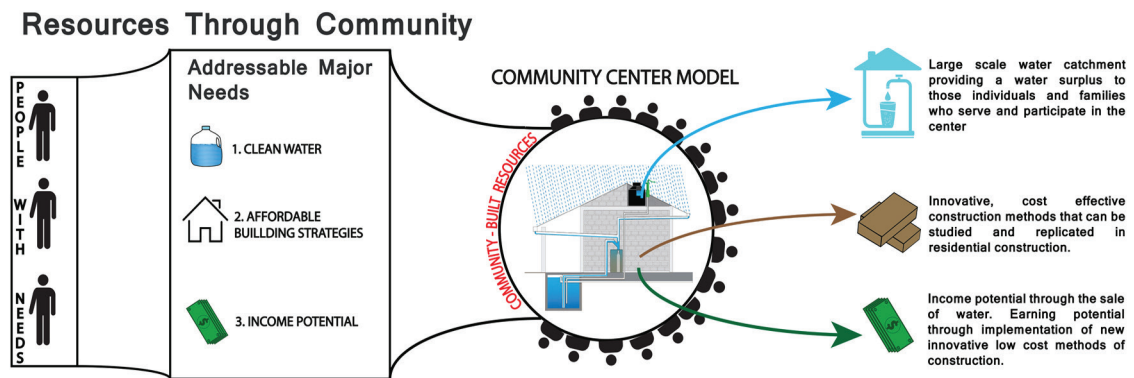


Figure 20: Resources through community model concept diagram. (Image credit by the author)

The critical issues identified to be addressed are specifically access to water, cost effective building methods, and job opportunities. Water has been a clearly defined area of need both locally in La Villa and also in the country as a whole. Given the quantities of rain the area receives, and the amount of financial resources expended on water, it became a clear area of intervention to be addressed in the design. New, innovative construction

methods also emerged as an area the center could improve and showcase. Considering the high quantity of makeshift houses being built in the area, and the welded roof structure identified as a major contributing factor preventing a better standard, innovative solutions to a roof design became a critical area to address. The last thing to be addressed was job opportunity and potential cost savings. Although cost savings is inseparably intertwined with the previous two issues, opportunities for new job potential was an area to seriously consider in the center's design. With all of these issues appropriately addressed. The center can then provide a wealth of new ideas, physical resources, and renewed sense of community.

## **5.2 Modular Design Innovation**

The design of the center seeks to create a modular system of construction for the people of the village and surrounding areas. Having an understanding of the financial and waste implications of a welded frame roof, this became a critical area of study for the new design. The design seeks to provide a way for locals to achieve the benefits of a higher quality construction method, without the added costs of a complicated welded structure a homeowner cannot install themselves. Given all the unfinished structures in the area, it became clear a modular system of design would be of great benefit as the roof spans and sizes would inherently be optimized in modular construction.

Another driving idea became phase based construction. Considering the roof is the most expensive part of the structure, it is often left uncompleted by locals who did not budget for their project appropriately. Phase based construction became a driving design idea to combat this problem. The idea is to build the expensive roof first at a scale that is

significant for the desired future full size of the building. Then, having spent upfront funds on a dependable roof, additional money can go towards infilling the walls under the roof in phases as finances allow. This provides a multitude of benefits to the building owner. One major benefit to this idea is that budget constraints will never result in an unusable, uncompleted building project. With the roof up first, the space underneath immediately becomes an occupiable space even with minimal walls infilled. Even in areas where walls are not yet infilled, the space provides a cooler area sheltered from the sun and rain that can be used for a multitude of purposes while funds are saved for additional infill.

Another significant benefit to the phasing is a much larger up front roof area for rainwater collection. While the project owner saves money over time to infill walls, they still have the opportunity to collect large amounts of rainwater the additional roof area provides for. The result is a system of saving for the future infilled walls. The initial covered roof area immediately allows for considerable additional rainwater collection. This translates to major financial savings in water budget for the owner, who typically spends 25% of their income on water alone. That money being saved on water purchased can be put away towards the future infill of the walls under the roof.

An example application of the modular's design can be seen in Figures 21 and 22. The new design borrows much from the higher quality construction method observed in the community. One major difference is the roof structure and installation, which will be addressed later on in the next section. The figures depict a module that is halfway through its phasing. The entire roof structure for the building is fully realized, and water collection for that entire area can occur immediately.

# Modular Design Benefits

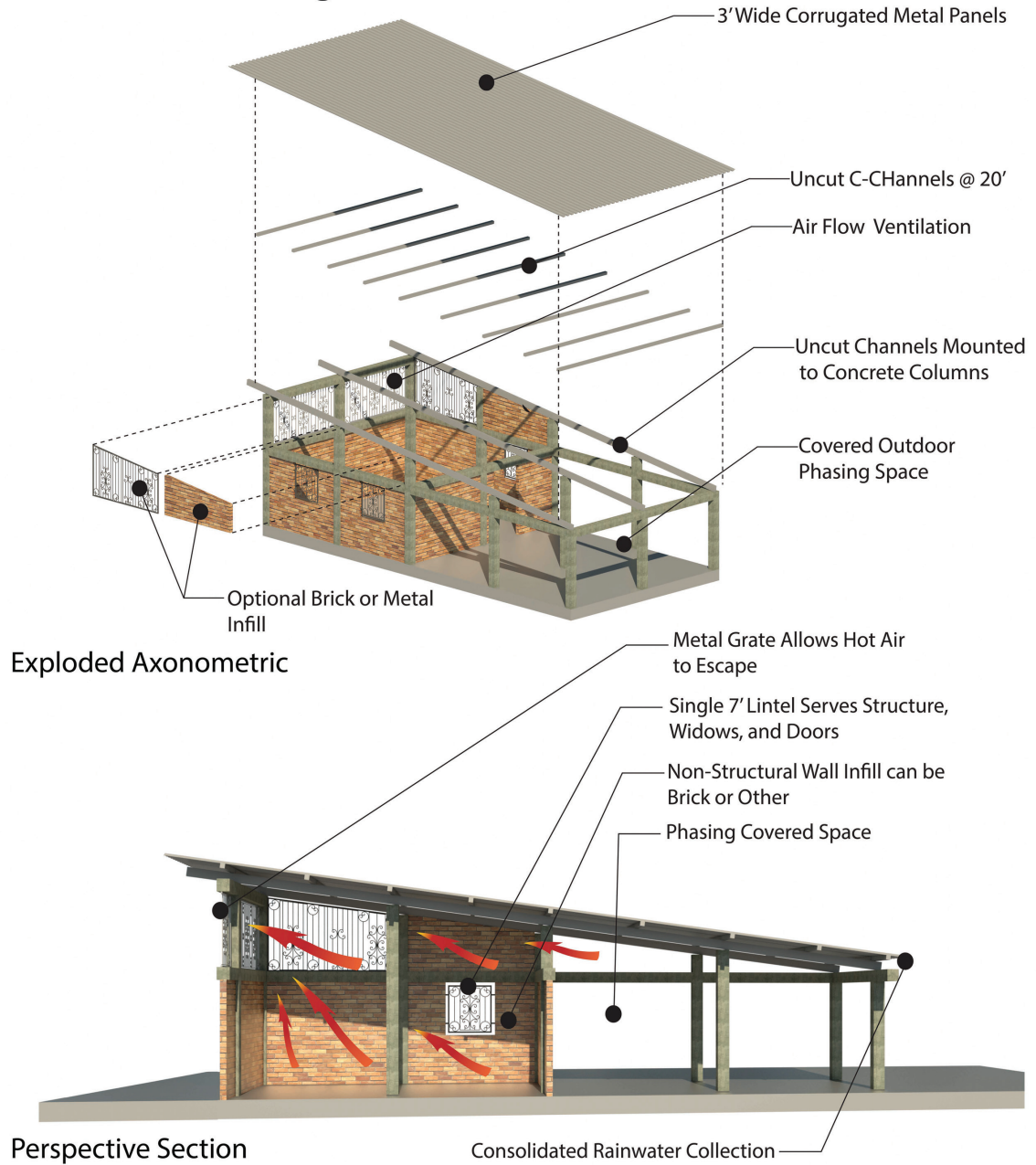
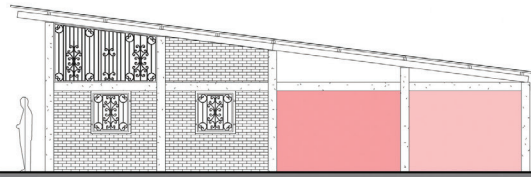
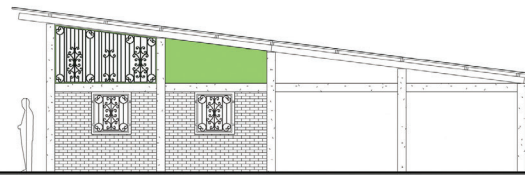


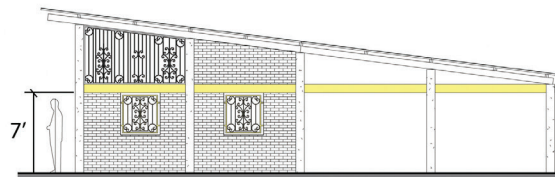
Figure 21: Design elements of the new modular (Image credit by the author)



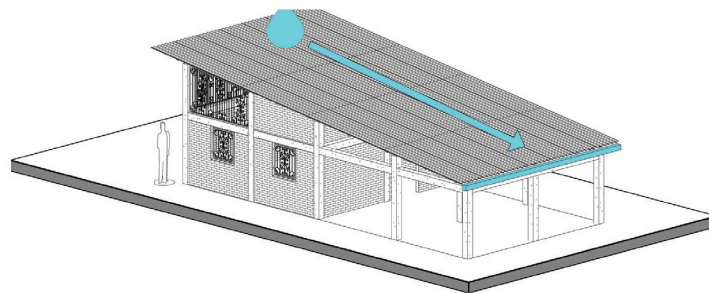
Phasing allows for the most expensive element (the roof) to go up first as a larger economically designed element. Water cost savings begin immediately with the extra roof area allowing for extra saving to complete future phases.



Upper Section is not structural and can be a solid fill or metal grate for ventilation.



Lower beam height of 7' allows for beam to serve as both a structural beam as well as a lintel for door and window openings.



Condensed rainwater collection area saves money through a minimal collection area requiring a gutter.

Figure 22: Design diagrams of the new modular (Image credit by the author)

Corrugated metal roofing was selected over the clay tile because it allows for rainwater collection which was deemed to be critical. In choosing the corrugated metal as roof material, consideration had to be made to address ventilation issues. The design's single slope form allows for the use of corrugated metal as a roof material, while also maintaining excellent passive cooling. The flow of heat travels upward towards the back of the modular, where the structural design allows for a large opening for ventilation.

Another considerable aspect of the single slope module is it allows for the condensation of rainwater collection into a single controlled area (see Figure 22). With the single slope roof all the water is directed linearly into one area. This is economical as it makes the rainwater collection system easier to install and there is less piping required. It also limits cost of installation because there are no long catchment runs, only one controlled area of gutter is required.

To both achieve the desired phasing options and also maintain cultural relevance, the design uses the same reinforced concrete material observed being used in the community. A major benefit to this is the infill walls become non structurally bearing. The non structurally bearing infill allows for the phasing process to be done at leisure, as its a non structural process. Although the design shows use of locally made brick, wall infill design becomes an area that could be experimental as its only job is separation of interior and exterior. Locals could try materials outside the cultural norm as they please without compromising the structure. Another area of opportunity is the openings above the lintel. These areas can be left open for ventilation or enclosed at the discretion of the builder.



The most innovative aspect of the modular design is its structural design. The design can be put together without making a single weld. The structure borrows ideas from both current observable methods of construction previously discussed. It uses the material palette of the higher end construction, consisting of reinforced concrete, local brick, and metal c-channel roof framing. It borrows the idea of a stepped bearing wall from lower quality adobe design where the adobe block is used as a structural bearing wall. The design steps the reinforced columns (see Figure 23).

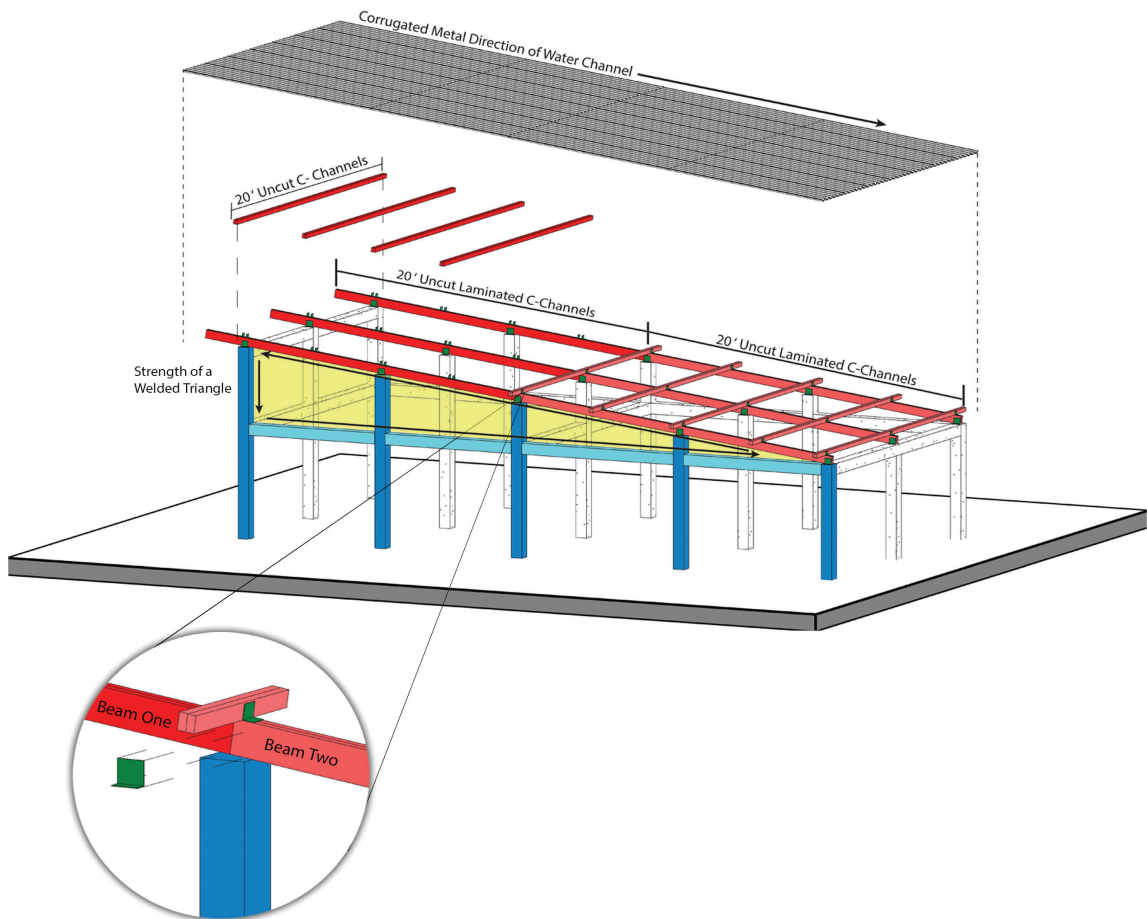


Figure 23: Structural diagram of the new modular (Image credit by the author)

The form maintains the strength of a triangular truss as depicted in the diagram. The stepping of the bearing wall allows for a slope without the need for an expensive welded roof structure. There is no welded frame required. The main connections required to be made are between the c-channels and the concrete columns. These connections are made through simply anchoring into the concrete and the use of a bracket. The secondary structural system supporting the corrugated metal roof is also attached using a bolted metal bracket.

Not only does the design eliminate the need for welds, it also entirely eliminates cuts and waste of the c-channels. In surveying local material providers, it was established that the c-channels in Honduras come in uncut lengths of 20 feet. This length was the main driving factor in the design spans in both directions. Figure 23 outlines how the uncut 20' lengths are incorporated into the design in such a way that the span will always fall in the centerline of a column where there is an opportunity to angle bolt the first c-channel to the next.

The system is engineered for ease of construction, requires minimal skill, and produces no waste of expensive materials. This is all achieved while maintaining local materials, building practices, and design aesthetic. The principles are almost entirely derived through a combination of current observable building strategies combined in such a way that the best aspects of each are included in the new design. The phase based structure could easily be built by a local without significant prior training or the need to spend money on expensive outside contractors.

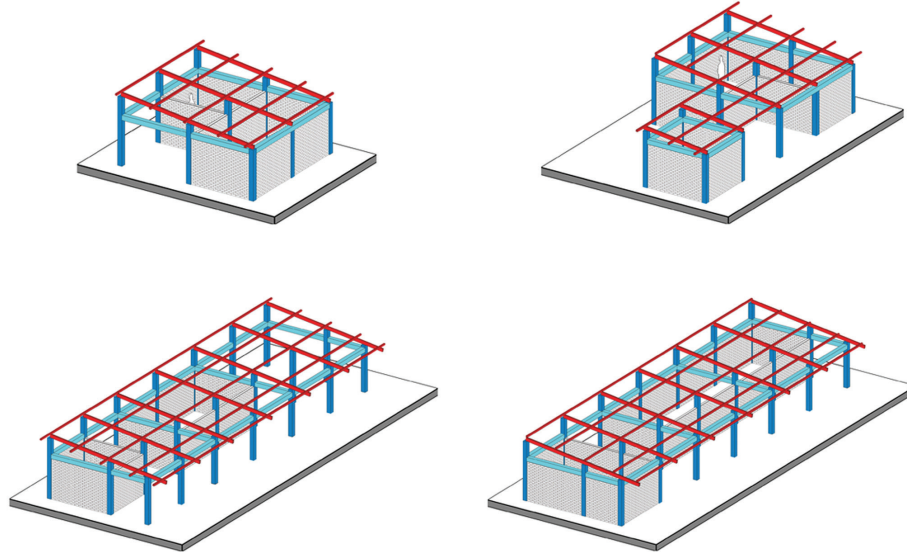
### **5.3 Modular Versatility**

Versatility of the modular was also something that was carefully considered. The design had to be able to expand in multiple directions. It was important the design be versatile enough to accommodate a variety of building orientations and scales. The use of a set span based on material lengths made helped make this achievable.

As shown in Figure 24, the design can grow both horizontally and linearly. Horizontal growth is virtually limitless and could be applied to everything from large scale building applications, to shared housing projects, to simple single family residential. The design can be adjusted to individual project need. Linear growth is slightly constrained due to growth in height, however there is allowable versatility in the number of bays. It was also critical that the phasing options be extremely customizable to the owner's specific needs. Phasing options are virtually limitless in combinations. Since the infill walls are non bearing they can be done in any way the builder sees fit. There is ample opportunity for everything from slow phasing, to covered corridors, to fully covered exterior space.

# Growth Potential

## Horizontal Growth



## Linear Growth

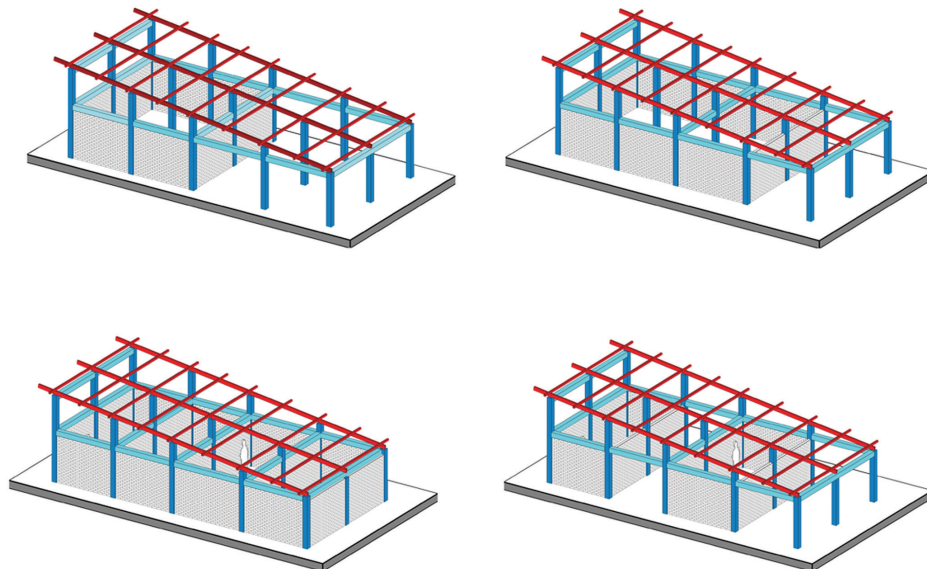


Figure 24: Versatility of the module. (Image credit by the author)

#### **5.4 Water Catchment System**

Water has clearly been established as a major issue in the community that the design of the center needed to address. An area of significant concern in designing the water catchment system was the attainable water quality from rainwater collection. The design needed to be able to attain the most purified rainwater possible, without the use of expensive systems requiring electricity. The intent was for the design to be easily replicable and inexpensive for locals to install in their own residential applications.

The chosen system (depicted in Figure 25) uses an entirely passive filtration system that can be constructed using easily attainable PVC pipe. Rainwater quality can be greatly improved by using what's called a first flush system in which the first 1-2mm of rain that fall on the roof area are caught and stored separately. The system takes advantage of the fact that the first rainfall is always the most dirty because it picks up and washes away all the leaves and dirt that have been built up on the roof in between rainstorms. By isolating that first dirty water into separate storage, only the much cleaner water that comes after the roof flush goes into large cistern, resulting in a higher quality. Estimations as to the level of purification achieved by this system vary, but are often stated at around 80% improvement in water quality

The first flush catchment are made of PVC and linked together in a series as shown in the diagram. They each contain a floating ball that rises as they fill. The dirtiest water flows into the first catch until ball rises to the top. At this point the ball seals the chamber on the water continues flowing to the next chamber where the process

is repeated. The number of these required varies dramatically depending on the PVC diameter used and the square footage of the roof area. The more flush chambers installed the greater the quality of water that makes it into the final cistern for storage. Although there is no measurable quality of the water being retained from the rain, it will still be a invaluable asset in comparison to the brown municipal water that often is contaminated with E. coli and other illness causing bacteria, and is simply not available at all during the dry season.

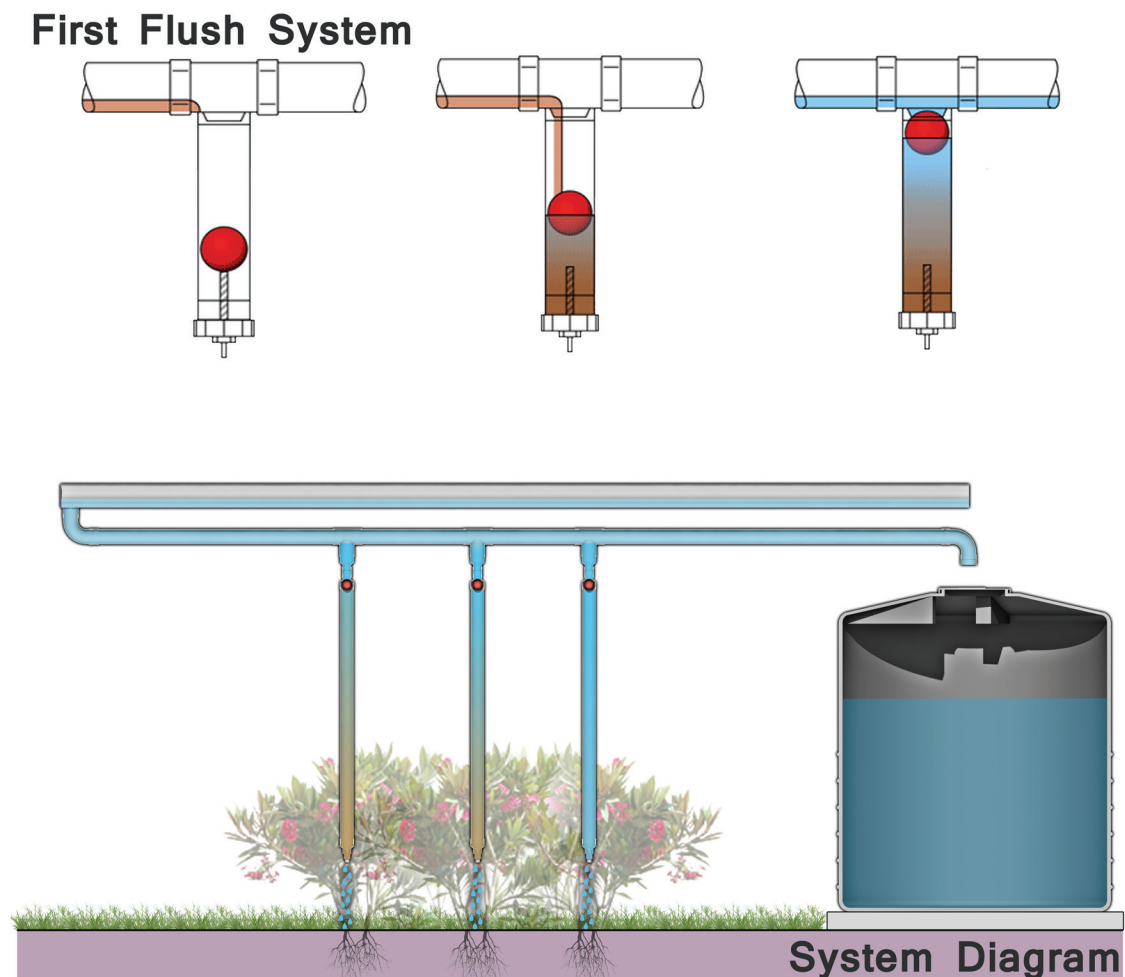


Figure 25: The Water Catchment System. (Image credit by the author)

Serious consideration had to be given to how the flush chambers disposed of the dirtier water they contained. In a manual valve system the building users are relied on to empty the chambers of their water after each rain storm. This poses concern as if the users forget to empty the chambers only one time, dirt water will contaminate the entire system. In contrast, the selected automatic drip systems is constantly emptying the chamber without user intervention eliminating all concern. Although the flush chamber water is of a lower quality, it is still a commodity for things like growing plants and vegetables. Often there is not enough extra water available for locals to properly water their gardens and plantings. This posed a considerable design opportunity for the center. By planting gardens and vegetation in the vicinity of the flush chambers, an automatic watering system is established, providing previously unachievable gardening results and extra community grown fruits and vegetables.



## CHAPTER 6

### COMMUNITY CENTER CONFIGURATIONS

#### 6.1 Configuration Options Overview

A specific site location within La Villa for the community center has not yet been selected. Extensive consideration is being taken to cost, location, and existing site conditions. Due to the modular nature implemented in the community centers construction methods, the design can be adjusted to meet a variety of site sizes and configurations. The designs implementation is adaptive to typical site configurations and a variety of conditions. In order to fully demonstrate the designs modularity, community center designs have been created that meet different typical site restrictions. The first design referred to as the courtyard design option is geared towards a larger more square site condition with a slightly larger budget. The second L-shaped design option is more appropriate for a constrictive narrower sized site, and scaled back budget. Combined these demonstrate the true versatility the components of the design allows.



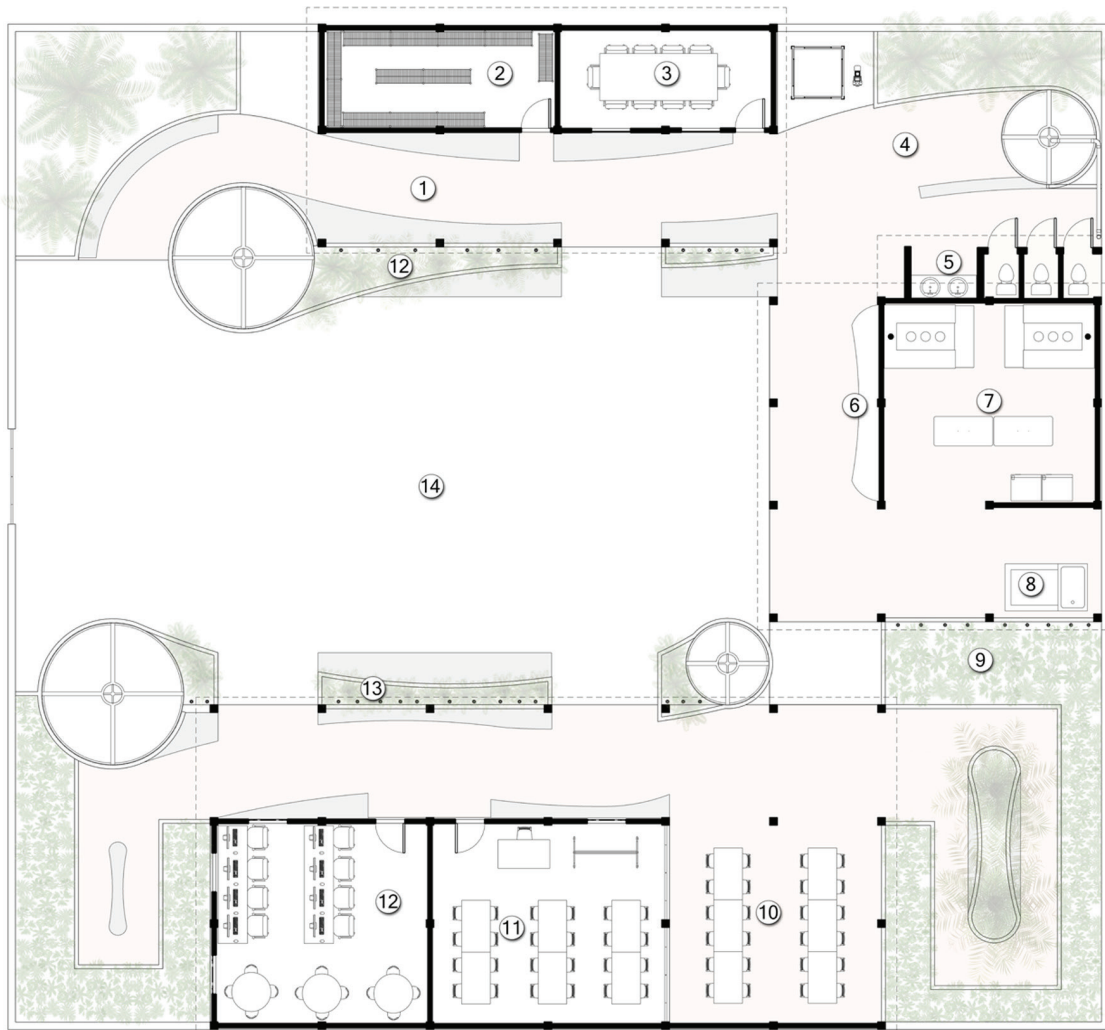
*Figure 26: Courtyard design rendering. (Image credit by the author)*

## 6.2 The Courtyard Design Option

The Courtyard design option shown rendered in Figure 26 is the larger of the two options, employing 2 horizontal modular configurations, and one linear module in between them for the kitchen. The entire design makes a U shaped courtyard shown in the plan drawing in Figure 27.

Defend-ability of the center was an integral part of the courtyard style design. After hours theft has been a considerable issue at the current center. This design seeks to make the center easily defensible in its layout. The structure makes a barrier in its design with a select central point of entry opens to a view of the whole facility and courtyard. Using the building as part of the barrier means less unwelcoming defensive walls are needed.

The program can be simply broken down into three parts. The North module is designed for staff and supporting spaces. It has a large scale storage space for the large quantities of donations the program receives. It also has a conference room that doubles as a communal office for the staff. The southern wing directly across contains the learning spaces for the kids attending the program. One classroom has computers and is geared more towards individuals studies. The second classroom is more of lecture space, and the third is an outdoor covered flexible space. Currently the lecture room and flex space have operable gates that open to allow them to combine in function as a large scale gathering area. The design intent is that the covered exterior space can eventually be phased into a closed interior space as the center grows and brings in the financial means. The kitchen is designed as an individual module due to the intense heat it generates.



**Floor Plan**



**Plan Legend**

1. Covered Donation Sorting
2. Donations Storage
3. Office / Meeting Rooms
4. Water Systems Display
5. Restrooms
6. Food Serving Station
7. Kitchen
8. Pila (Wash Station)
9. Flush Water Vegetable Garden
10. Covered Flexible Assembly
11. Classroom
12. Learning Center
13. Flush Water Plants
14. Exterior Courtyard

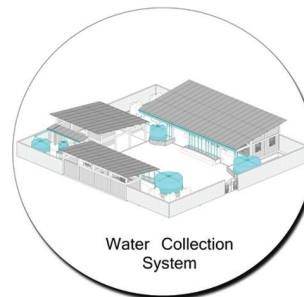
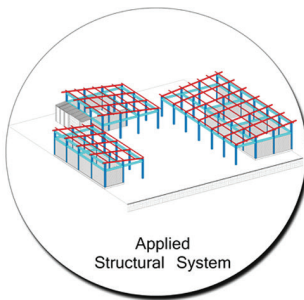


Figure 27: Courtyard Design Floor Plan (Image credit by the author)



Figure 28 shows a rendering of the interior of the learning center. The design took advantage of an opportunity to demonstrate the non structural characteristics of the brick infill through a perforated stacked brick pattern allowing air to flow through the space and exhaust out the back. The curving pattern to the brick perforations is a design component that directly relates to the flow of the water to the cisterns and the curvilinear built in bench designs that can be seen in plan. Since the metal window bars are custom made locally per order, they became an opportunity to add design aesthetic.



*Figure 28: Learning center rendering. (Image credit by the author)*



*Figure 29: Exterior covered area rendering. (Image credit by the author)*

Figure 29 shows the outdoor covered walkways and how they relate to the structure and also the water cisterns. Architecturally the modular is very defined and repetitive. The cisterns offered an architectural opportunity to break up the repetitive form by embracing their curvilinear nature in the design of the seating areas. Instead of seeing the cisterns as an ugly attachment to the structure, they are seen as an incorporable architectural opportunity that adds to the centers aesthetic. Due to the warm Honduran climate, outdoor covered space is much more valuable there than in other climates and cultures. The outdoor covered areas can act as extra learning areas, meeting areas, and discussion spaces. The covered area provides culturally usable space without the added

cost of addition walled rooms.

As the rendering in Figure 29 shows, the water catchment system places a very integrated part in the facilities design. The first flush system described earlier can be seen translated into enclosed planting areas along each facade. This offers opportunities to provide plants along the built in seating that could never be implemented without the excess water. First flush catchment water is also run directly into a large gardening area near the kitchen for irrigation. The existing community center currently cannot grow crops due to a lack of available water. This leaves them paying for food for the center and also the families. The water provided by the new model allows ample gardening and subsequently vegetables. It also provides an opportunity for kids and families in the program to help take care of the gardens in exchange for a portion of what's grown. Each structure has its own large scale cistern to service it as seen in plan. Cisterns are relatively inexpensive and adding one individually for each building module allows for simplicity in the catchment lines.

The flooring material shown in the rendering is of a locally produced paver. These paver's are cost effective and can go right over a compact soil base. The local Honduran people often expressed that concrete slab floors are preferable to the paver's due to an easier ability to clean and the fact that a slab generates less dirt. The negative to a concrete slab is the considerable added cost in comparison to the paver type floor. The design looks to balance both cost and ease of use through an application of the pavers in the covered exterior areas, and a slab in the fully enclosed interior areas. The difference in floor transition can be observed in the section drawings in Figure 30.





*Figure 30: Courtyard Design Sections. (Image credit by the author)*

The courtyard style design meets all the programs current need, while allowing itself room to grow. Elements such as the outdoor flexible space that can eventually be phased to interior space help meet current need while considering future growth. Exposed structural systems and celebrated water cisterns give occupants the ability to understand how the systems are being implemented.

### **6.3 L-Shaped Design Option**

The L-Shaped design option offers many of the same design elements of the courtyard style design in a more compact economical fashion. The L-Shape combines the more private storage and office areas within the same structure as the classrooms for a more linear design. The linear design implementation can fit into a much narrower site condition and still maintain the programmatic elements of the courtyard design. A floor plan of the L-Shaped option can be seen in Figure 31.



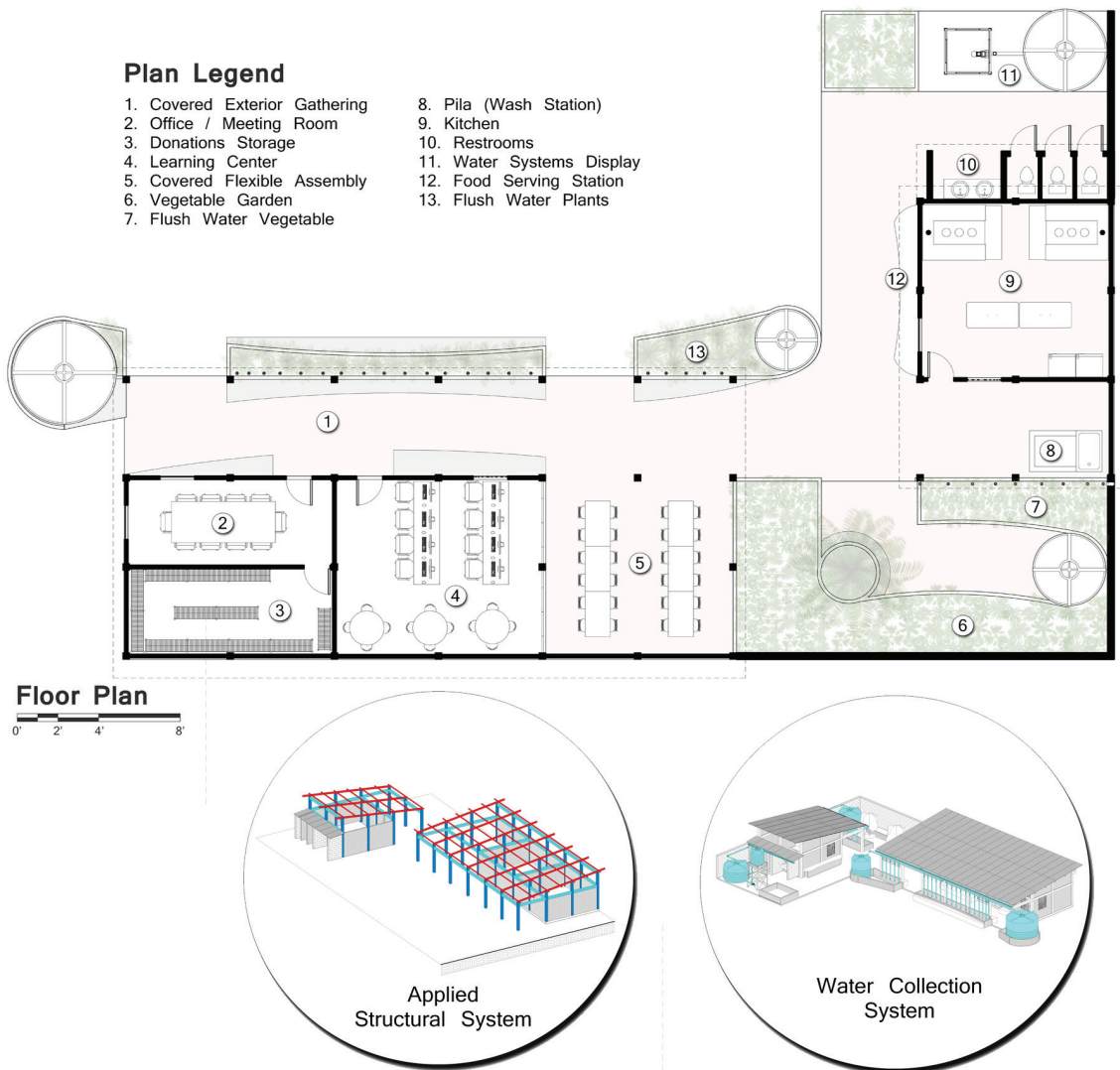


Figure 31: L-shape Design Floor Plan (Image credit by the author)

The L-Shaped design has to address issues of security in a different fashion than previously seen due to its layout. Since this design makes an effort to be more economical in its cost, security issues are addressed by looking at individual spaces as opposed to the whole complex. The entire complex cannot be secured without the construction of a large wall barrier around it. Instead of a wall, each room is looked at individually and determined if it needs to be secured. In this design the office, storage, and fully enclosed classroom need to be secured. All other areas can be open as they do not contain valuables after hours. By making the storage only accessible through the office, securing both the spaces is easier and more economical.

In general the design is very similar to the courtyard option as far as design components. Water catchment and outdoor seating areas are addressed in the same style as previously seen. The catchment flush system feeds both gardens and planting areas in a consistent fashion. One notable change is this design has one less enclosed classroom. The outdoor covered flex space would serve as both flexible use and the second classroom. As with the first design, it can eventually be enclosed. Another notable difference in the design is the relationship of the kitchen to the other spaces. This design pulls the kitchen down one modular bay to make a better fit for narrow site conditions. The design could be extruded linearly to allow for growth if need be. Sections and a rainwater rendering can be seen in Figures 32 and 33.

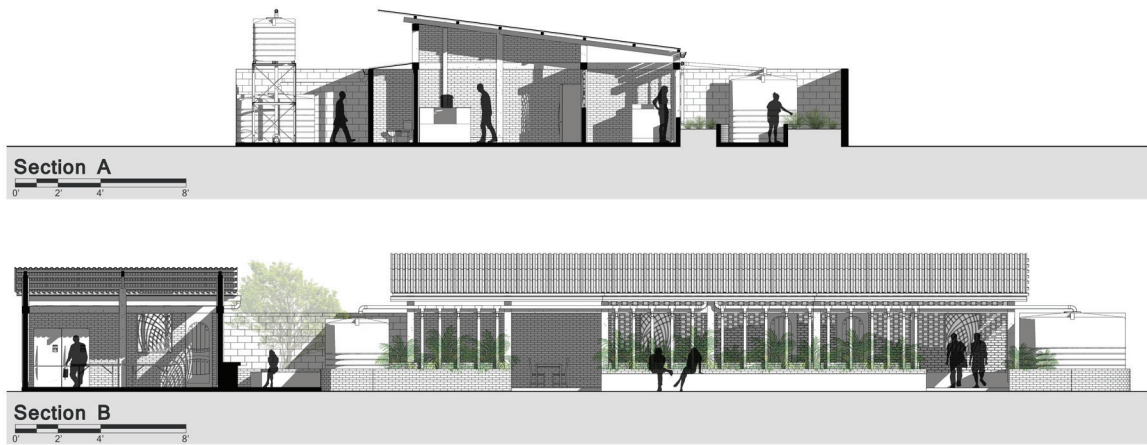


Figure 32: L-shape Design Sections. (Image credit by the author)



Figure 33: L-Shaped rain rendering. (Image credit by the author)

## CHAPTER 7

### POTENTIAL OUTCOMES

#### 7.1 Water Catchment Impact

The water catchment system is an inseparable part of the projects attempt to address the critical issue of clean water within the community. The solution works to address more than just clean water in its implementation. The water from the first flush allows for plantings and gardens that would otherwise be unachievable. The water allows for plantings to be incorporated into the facility designs that normally would be unrealistic due to their water consumption. The new gardens provide a multitude of opportunities. Instead of just handing out food to the families in the program. The program can now engage the families in maintaining enough food by having them take part in caring for the gardens. Families will see directly the benefits of implementing such a system, and how it can help them meet their needs. Food from the gardens can then be given to participating families, used for the kids at the facility, or even sold in town as a source of income.

Part of the design process has been to accurately analyze how much water each design can collect and store in comparison to whats needed for basic operations. Using the roof square footage of each design, combined with the average rainfall in the area, tank sizing requirements were developed. Since the scale of the project does not allow for the design of a system that would meet the needs of everyone involved, the cistern sizing for each design looks at how many gallons of water can be extracted daily while maintaining that daily available quantity of water everyday throughout the year.

The results for the courtyard design can be seen in Figure 34. The graph looks at monthly inches of rainfall in comparison to total roof area of the design to determine collectible quantities of rainwater. It then looks at monthly consumption in comparison to intake to determine what's left in the tank. The graph considers the month of April as a time to drain and clean the tank each year. This is an optimal time in the year to drain and clean as it is at the end of the dry season. For this design collectible quantities are limited to realistic tank sizing. Although larger tanks would have allowed more rainwater collection, a decision was made to keep tanks a standard purchasable size in an effort to maintain economic design and replicability. With the chosen tank sizes the total full capacity is at 13,834 gallons. This full capacity is maintained throughout the rainy months as shown in the graph. The intent of the graph is to show how much water can be used daily from the catchment system and still have water available throughout the year. The result shows the center was to extract 125 gallons a day (or about 3,750 gallons a month), the tanks would be able to continue to provide that quantity throughout the entire year. For the dry months the 125 gallons would be consuming more than is collected, however in the rainy months more is collected than would be consumed. This balances out to where the 125 gallon quantity is consistently available. If more were to be taken out daily the result would be dry months were the tank is depleted. We can see from the graph that in March at the end of the dry season, only a 27 gallon reserve would be left in the tank.

## Courtyard Design Water Inventory (13,384 Gallon Storage)

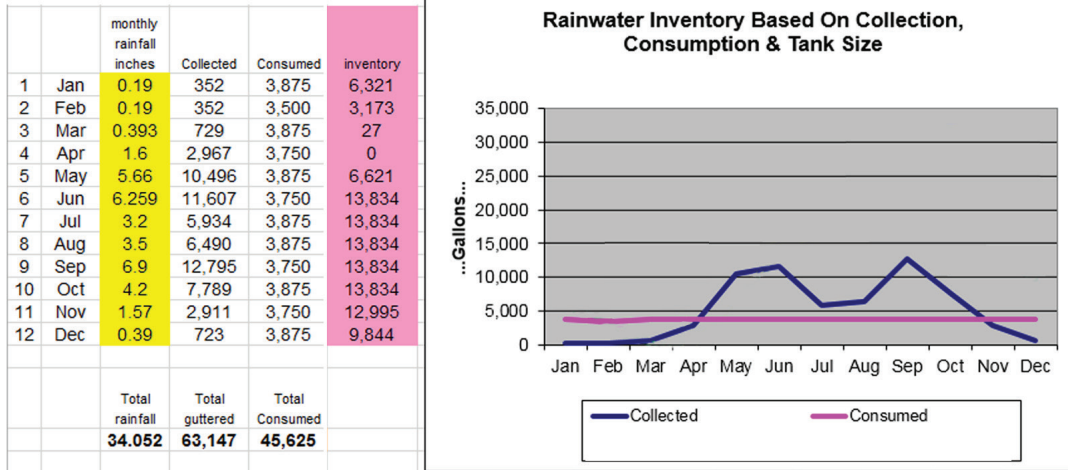


Figure 34: Courtyard water inventory. (Image credit by the author)

The same water impact analysis was completed for the smaller L-Shaped design. Since the design is a bit smaller, its roof area and cisterns are also proportionately smaller. The design's total full capacity storage is 7,590 as elaborated on in Figure 35. With all the same controls in place, the L-shaped design can consistently provide 72 Gallons per day everyday throughout an average rainfall year. This again is the maximum allowable daily extraction as at this level only 193 gallons are left in inventory before draining and cleaning in April.



## Courtyard Design Water Inventory (13,384 Gallon Storage)

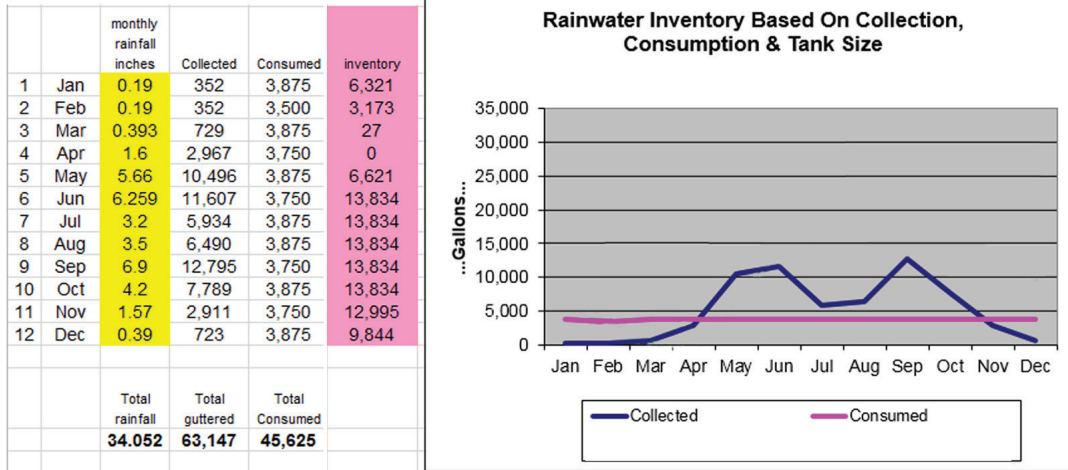


Figure 35: L-Shaped water inventory. (Image credit by the author)

As previously mentioned, a test was conducted at the current facility in which weekly water daily water consumption was measured for a full week. All water was measured out before it was used. The measurable result came out to the facility currently using about 36 gallons of water per day. It's important to understand that this quantity is what's being used in a mindset of strict conservation. It's also important to consider the quality of that water which is municipal and not drinkable without first being treated. When all these things are taken into consideration, the quantity of clean, usable drinking water either catchment system stands to bring to the facility is greatly impactful. A diagram to bring perspective on the impact of this can be seen in Figure 36.



# Daily Water Projections

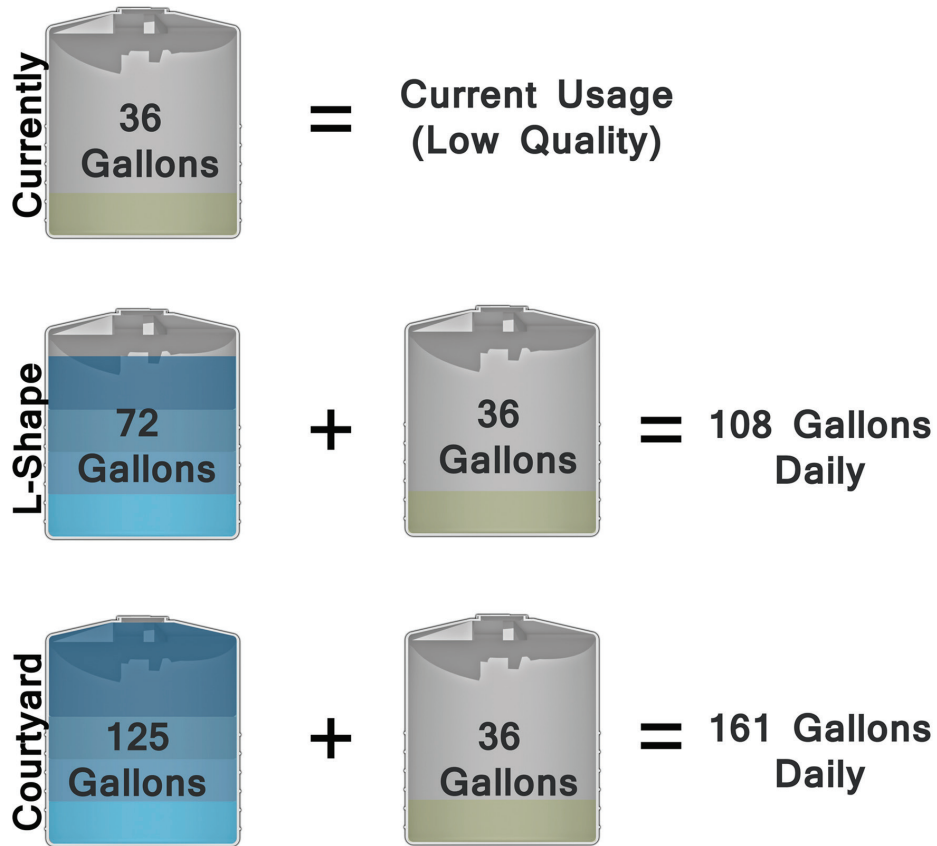


Figure 36: Daily water projections. (Image credit by the author)

The impact of the additional water the design provides extends past gardening, planting, and hygiene outcomes and can be seriously considered for its financial benefits. In thinking about the cost of water at \$1.50 for every three gallons, these design both stand to provide significant financial savings to the programs. The Courtyard design brings an extra 45,625 gallons of water a year, the equivalent of \$22,812 in savings. For the L-Shaped design it's 26,280 gallons of water a year translating to \$13,140 dollars saved annually. That's translates to funds the program can save on water expenses and allocate to other areas of need every year. If local people were to start to see the value in water catchment and begin to implement it residentially the impact becomes even more significant.

## 7.2 Construction Methods Impact

The new methods of construction brought forward by the design have measurable impact financially. First, the elimination of the welds makes for a design that most homeowners can now implement themselves. There is no longer a considerable financial restriction of hiring a welder that previously prevented many from building using higher quality construction methods. Not only is the new design more easily constructed, but it is also measurably more cost efficient.

During my time in Honduras I spent time meeting with the most widely used local roof welder and installer. He was able to provide a quote of \$23 dollars per square meter to install a typical welded truss frame roof. This quote includes all materials and labor involved in the roofing process. After designing the new system, I ran an analysis of the cost involved to implement its roof system. This analysis included costs of metal beams, corrugated roof sheets, rebar, and additional concrete needed to fully realize the system. All material cost numbers were taken from quotes provided by local shops in the community. The total cost of the new system of construction came out to be \$15 per square meter, as shown in Figure 37.

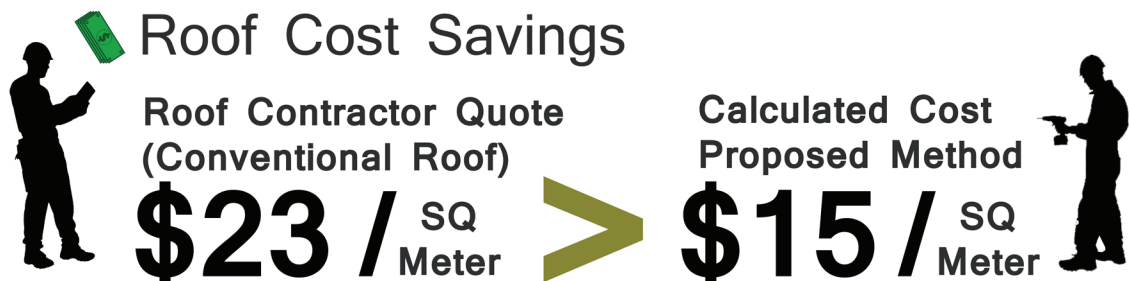


Figure 37: Roof cost savings. (Image credit by the author)

Another benefit to the system is an increased need for locally produced bricks. The implementation of this design, especially if replicated, will result in an increased need for the bricks typically implemented in the design. Since these bricks are produced by one of the few companies that is locally owned, it's a positive industry to support. Increase brick demand means more brick workers hired and more money back into the local economy. As discussed previously, the potential for phased construction and the design's ability to easily implement water catchment opens door for cost savings and homes that grow over time. The design is also done in a way that is more earthquake resistant than adobe construction methods previously seen. If the design module were to be widely implemented more homes would survive an earthquake should one occur.

### **7.3 Employment Impact**

Part of the project outcomes includes the potential for new employment. The new jobs created start with the construction of the center, and potentially continue on in the replication of the module. One area already discussed is new jobs in the brick industry. Another job market with the potential for growth is the local window bar industry. If the system is implemented, more homes will have larger ventilation openings previously unachievable with structural adobe. This will result in an increased demand for window bars for security. Considering the window bars are locally made and done custom per order, it's an industry that can hire more locals and grow the local economy. Another potential new industry is in the water catchment system installation. Locals will be trained on the system and its installation during the community centers construction. If locals replicate the system, trained individuals will be needed who understand how to calculate what's needed for the first flush system, and how to install it along with the cisterns.

## **CHAPTER 8**

### **CONCLUSION**

Public Interest design is unique in the architectural world as it works to address issues of more than just building function and aesthetic. It tests the notion that real world problems can be positively impacted through architectural intervention. The Building Hope project seeks to understand the critical issues facing the lives of Hondurans, and positively curb some of those issues through thoughtful design.

This project's process included deeply listening to the community needs, understanding and respecting why things are currently done the way they are, and searching for opportunities in which outside architectural ideas could positively support the community. By viewing the intervention opportunities through a lens provided by community members, the project has been able to make a real attempt at a positive impact.

The next phase for the project involves taking these ideas and implementing them in the actual construction. It is in this phase we will see the true outcomes of the projects theories tested in a tangible building. The ability of architecture to address issues like the ones this projects hopes to address has highly been debated. It is my hope that this project will demonstrate the ability of designers to positively impact world issues both in the projects concept and in the coming implementation.

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