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Residential Rebuilding in Rural Haiti Natural Disaster Recovery Strategies

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To the Graduate Council:

I am submitting herewith a thesis written by Mallory Lyn Barga entitled "Residential Rebuilding in Rural Haiti Natural Disaster Recovery Strategies." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Architecture, with a major in Architecture.

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Residential Rebuilding in Rural Haiti

Natural Disaster Recovery Strategies

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Abstract

This thesis focuses on an appropriate and applicable way to recover from natural disasters in a place where indigenous resources, building and construction technologies, and manpower are unlike those in developed countries. Overtime, Haiti has suffered from a multitude of natural disasters that have had devastating long-term effects on the safety and health of the country. As a result, it has become apparent that Haitians expanded their housing off of existing relief shelters through improper building techniques. These improper techniques lead to insufficient structural stability of their homes and increased vulnerability to future disasters. The proposal for this thesis focuses on a new disaster recovery process and new transitional houses for rural communities in Haiti. For a situational analysis, the community of Fond-des-Blancs, Haiti has been selected. The concept of the project challenges the existing disaster relief process and the three phases of relief housing; emergency, temporary, to permanent, by creating a new recovery process that incorporates community involvement and two phases of relief housing; emergency to transitional. The final design will demonstrate how housing after emergency solutions can plan for future expansion with strong connections, utilize locally available materials and resources, and empathize with the Haitian construction techniques all through the collaboration between the effected community, local government and aid agencies. The overall goal is to provide Haitians with flexible recovery housing that Haitian families can expand and personalize into a home that is reflective of their needs, traditions, and family dynamics.

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Chapter 1
Introduction

Natural disasters are a consistent occurrence that effect vast amounts of land, infrastructure, and people in a short amount of time. As architects, we must resolve an appropriate way to rebuild these devastated areas by understanding the success and failures of past disaster relief reconstruction strategies. How do we get things "back to normal" or create a "new normal" that is accepted by the local community in an area that has drastically changed in a few minutes or a few days? More specifically, what is the best process for rebuilding in a developing country that has apparent cultural limitations in construction techniques and availability of adequate materials? How is shelter provided for the thousands of millions of displaced families in a country where there is little assistance provided by the government to fund the rebuilding of their homes?

These questions need to be solved, and Haiti is currently struggling to find the answers. Since the earthquake struck Port-au-Prince on January 12th, 2010, there have been few signs that the disaster relief process is providing Haitians with safe, healthy, and sustainable living conditions. Most of this is a result of Haiti being one of the poorest countries in the western hemisphere that is also sited in a zone consistently vulnerable to earthquakes, hurricanes, and mudslides. This thesis focuses on the reasons why Haitian homes are reconstructed inadequately and addresses whether there is a better solution to disaster relief housing than progressing through the three phases of emergency, temporary, and permanent structures.

The first step in providing an efficient and successful residential reconstruction solution is to understand how the current relief aid process can be revised to further benefit the effected area. Various problems result from breaking the recovery process into emergency, temporary, and permanent phases in Haiti and developing countries of similar vulnerability. In order to "build back better", the reconstruction phasing needs to take into consideration specific site conditions and cultural traditions to enable a more sustainable vision for Haiti (Farmer 367). This vision can be accomplished through a revised housing approach of transitional relief housing.

The remaining text will provide an overview of the disaster relief process and how the relief housing within this process can be restructured to best meet the cultural, social, and environmental needs of Haiti and its people. The positive and negative aspects of both emergency and temporary housing will be critiqued in order to indicate the features that need to be considered and revised in the design of a transitional house, which I will call Phase 1 Housing. The design of this house is meant to be implemented after a future natural disaster in rural Haiti. In order to create a prototype situation for the implementation of this transitional house, the rural town of Fond-des-Blancs, Haiti will be studied. The infrastructure and community traditions of Fond-des-Blancs will be researched, as well as a specific family compound that will serve as the site for the final design scenario.

Chapter 2
Existing Disaster Relief Aid Process

"A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (Lizarralde, Gonzalo, and Johnson 3)." When a country is devastated by a natural disaster that is beyond the national government's realm to recover, the leader of the country must appeal for international assistance. The relief operations and assistance is then broken down into five phases: search and rescue, treatment and survival, relocation and rehabilitation, early recovery, and long-term reconstruction (Donlon 9). The following text in this chapter compares the phases of a typical relief process to the process that happened in Port-au-Prince, Haiti after the January 12th, 2010 earthquake.

For example, when Haiti was struck by the magnitude 7.0 earthquake on January 12th, 2010, President Rene Preval appealed for international assistance. Preval stated his country was in a state of "unimaginable" devastation and a post-disaster assessment reported that over one third of the countries population, 1.3 million people, were effected and a value of $11.5 billion was needed for recovery and reconstruction (Schuller and Morales 101). Figure 1 on the next page shows the severity of the earthquake and the vast area it effected. This brought about a need for international support. Thus, a conference was held to present global donors with Haiti's action plan for recovery (Donlon 1).

In a typical relief situation, one of the first global organizations to step in and provide relief assistance to an effected population is the United Nations. There are various programs within the United Nations that assist in specific types of aid such as health, nutrition, safety, and shelter but the first step in providing effective assistance is establishing a headquarters to organize the incoming search and rescue and aid teams (UN 2013). The United Nations' first step in assistance is done through their Disaster Assessment and Coordination program (UNDAC), the Coordination of Humanitarian Affairs teams (OCHA), and the Onsite Operations and Coordination Centers (OSOCC). These headquarters assist local authorities, coordinate the search and rescue teams, and work with military forces. The main task of these three programs is to coordinate programs, resources, and plan facility locations. In an ideal situation, the United Nations would be able to draw from the effected areas prepared relief management plan (Donlon 11).

Often times, initial aid assistance is delayed depending on the severity of the disaster and the infrastructure destroyed. Haiti struggled to provide immediate assistance in the aftermath of the earthquake due to the epicenter striking Port-au-Prince and destroying hospitals and government buildings (Donlon 3). It took two days for aid to arrive in Haiti so the first wave of assistance was left to Haitians helping Haitians (Schuller and Morales 103). Many of the government officials and United Nation's personnel were already in Port-au-Prince at the time of the earthquake. Unfortunately, they could not provide immediate assistance because they were among those that were missing or dead. The Port-au-Prince airport control tower was also destroyed thus delaying international aid (Donlon 3). These setbacks resulted in a delayed coordination of programs, resources, and facilities by the United Nations.

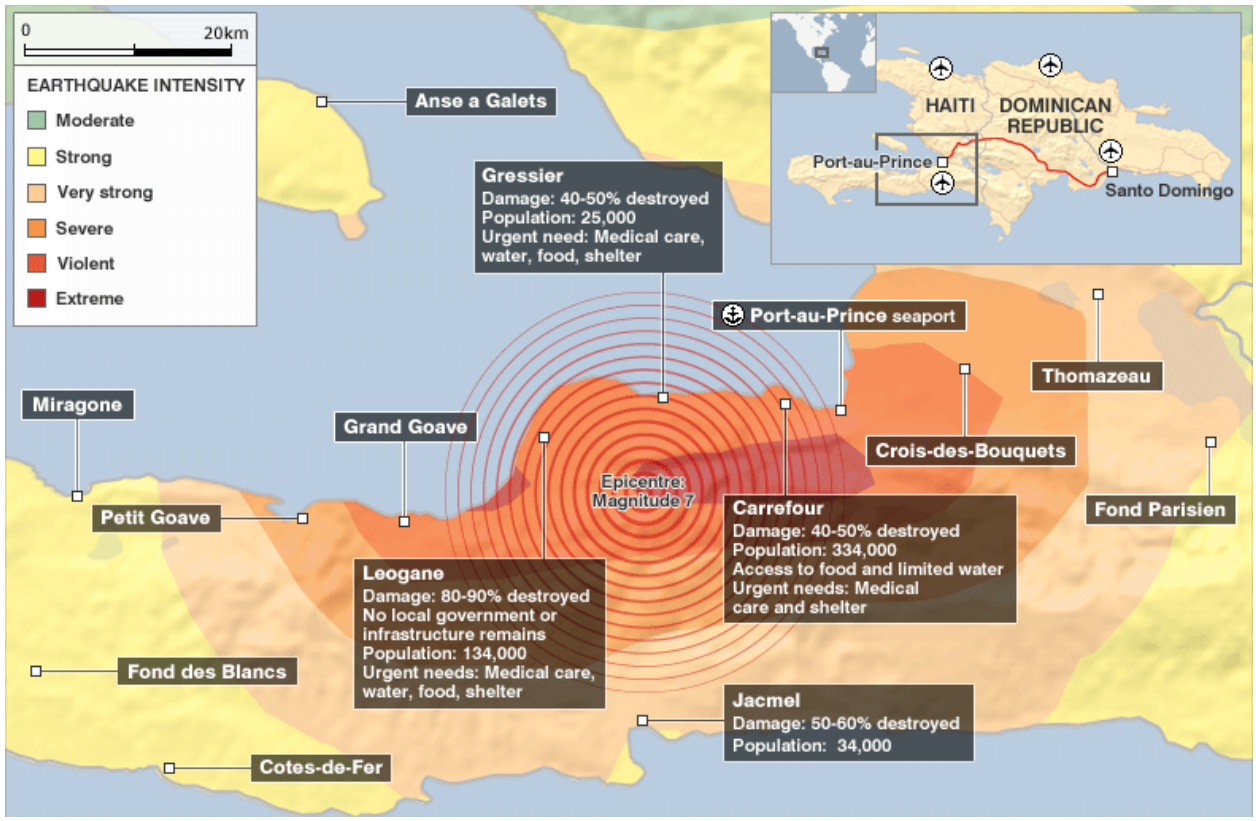


Figure 1: Earthquake Intensity Map ("Haiti Earthquake Maps")

Search and Rescue

Once teams have been organized and a needs assessment completed, search and rescue teams are sent out in the hopes of finding and assisting as many survivors as possible. The first wave of assistance is provided by local emergency services and first responders in the disaster area. The next wave of help is from the arrival of non-governmental organizations (NGOs) and volunteers who are eager to assist where needed. Heavy-lift equipment is often needed to remove large debris off of those who are trapped under collapsed infrastructure and medical teams are on site to provide immediate assistance to the injured and to distribute supplies to medical camps(Donlon 11). The search and rescue phase of assistance can last days after the disaster or up to a few weeks depending the severity of the disaster (Crutchfield 2013).

For Haiti, Preval's top priority was to conduct search and rescue operations. This proved to be a challenging task because the United Nations headquarters collapsed in the shock of the earthquake. Hospitals in Port-au-Prince were also destroyed and of those that were still intact, they had lost electricity. Therefore, an offshore vessel medical unit was set up to assist survivors. In addition, due to the loss of electricity, government officials were in dire need of communication equipment to better coordinate response efforts (Donlon 6). As previously mentioned, local Haitians and Haitian medical teams conducted the first two days of search and rescue until the airport was up and running to receive international aid and equipment (Schuller and Morales 103).

Treatment and Survival

Treatment and survival is the second phase of the relief process which starts during the search and rescue phase and continues for a few weeks to a few months depending on the countries preparedness, availability and accessibility to resources, and the magnitude of the disaster. At the start of this phase, many survivors are in need of immediate medical attention and will need repeated treatments to completely recover from their injuries. Medical teams and camps are strategically set up to assist as many people as possible. Substantial transportation is often needed at this time to distribute supplies, medicines, and patients to various camps and hospitals (Crutchfield 2013). In addition, aid agencies such as the World Food Program and the Food and Agriculture Organization begin to distribute food and water to the effected population. Plans are also made to set up sites for safe water sources and clean sanitation systems (Donlon 11).

The United Nations organized twelve relief sectors in Haiti to prioritize partners and resources. The chart in Table 1 lists the aid organizations and the sector that they lead.

Table 1: Aid Sectors in Haiti (Donlon 12)

Aid Organization		Sector
FAO	Food and Agriculture Organization	Agriculture
IOM	International Organization for Migration	Camp Coordination and Camp Management
UNDP	U.N. Development Program	Early Recovery
UNICEF	U.N. Children's Fund	Education
IFRC	International Federation of Red Cross and Red Crescent Societies	Emergency Shelter and Non-Food Items
WFP	World Food Program	Emergency Telecommunications
WHO/PAHO	World Health Organization/Pan American Health Organization	Health
WFP	World Food Program	Logistics
UNICEF	U.N. Children's Fund	Nutrition
OHCHR	Office of the High Commissioner for Human Rights	Protection
UNFPA	U.N. Population Fund	Gender Based Violence
UNICEF	U.N. Children's Fund	Water, Sanitation, and Hygiene

Relocation and Rehabilitation

The next phase of the relief process is relocation and rehabilitation of the internally displaced persons (IDPs). During this phase, survivors who are forced to leave their homes due to damage or instability are relocated to a safe area and provided emergency shelters which are arranged in camps (Donlon 9). These emergency housing camps are provided and set up by the UN High Commissioner of Refugees and the International Organization for Migration (UN 2013). It is at this time when the focus shifts from imminent survival to recovery and rebuilding (Crutchfield 2013).

For Port-au-Prince and surrounding areas, reports indicated that 1.3 million people lost their homes. 97,000 homes were destroyed and 188,000 were damaged. With a devastation of this magnitude, there was a lack of emergency shelters (Donlon 12). IDPs were moved to approximately 1,300 camps, 800 of which were located within Port-au-Prince's city limits and only a few families were fortunate enough to receive tents. The remaining IDPs were left to construct their own shelter from wooden posts, bedding sheets, plastic, and sheet metal. Immediately following the earthquake before the tent cities were created, Haitians met in front of the National Palace and various public

areas to try and reunite with loved ones. Figures 2-5 show the unfavorable conditions of these camps. In addition, Haitians also found shelter from the harsh sun and rain in schools and churches (Schuller and Morales 111-115). The remaining IDPs, an average 482,000 people, were forced to relocate outside the city and stay with host communities or family and friends (Donlon 13). The Haitian government provided free transportation to evacuate survivors to these locations not damaged by the earthquake (Donlon 6).

Figure 2: Aerial view to one of the 1,300 camps in Port-au-Prince and surrounding areas ("Haiti Survivor Camps")

Figure 3: Coleman tents provided to displaced populations in Haiti ("Haiti Survivor Camps")

Figure 4: Makeshift tent cities constructed of wooden posts and bed sheets ("Haiti Survivor Camps")

Figure 5: Haitians gather in front of the National Palace following the earthquake ("Haiti Survivor Camps")

Early Recovery

Refugees remain in emergency shelters for a few weeks or months until temporary houses are provided in the early recovery phase. At this point, the displaced population has a more stable shelter that can better withstand climate and provide increased privacy and security. Sources of food and water have also been set up so families can begin to go about their daily lives. During this phase, men and women attempt to create a "new normal" for themselves. They search for available jobs and send their children to schools that are set up as temporary accommodations to their camps. These conditions can last weeks, months, or even years depending on the vulnerability of the effected area and its ability to start the reconstruction process (Cruthfield 2013).

Haitians were forced to leave emergency shelters provided by educational buildings when schools sought to reopen and resume classes. More than 1,750 families were moved to two temporary relocation sites at the edge of Port-au-Prince in April, four months after the earthquake (Donlon 13). Not all families staying in tent cities were granted the opportunity to move to planned relocation sites with temporary shelters, known as T-shelters. Those that did move, transitioned into shelters made of treated plywood or repurposed shipping containers. The sites were supposed to provide social services such as security, patrols, water, maintained toilets, clinics, and a shelter for a school, but most camps lacked these amenities. Figure 6 and 7 are examples of T-shelters and temporary camps constructed by Catholic Relief Services to transition people from the distress of emergency tent cities. Within three months, NGOs had constructed 20,000 temporary houses (Schuller and Morales 111-119). The American Red Cross configured a three year update to the earthquake response in Haiti that reported 193.2 million dollars had been spent on the construction of temporary shelters (McGovern 4).

Figure 6: T-shelters built by Catholic Relief Services (Hirano 32)

Figure 7: Prefabricated T-shelters arrive on site by Tap Taps (Hirano 28)

Long-Term Reconstruction

Long-term reconstruction is the last phase of the disaster relief process and it's at this point when permanent structures are rebuilt. Permanent homes start to replace temporary housing structures and new public buildings enable men and women to return to work and children to school. As the community is rebuilt, the social fabric of the community is strengthened and survivors begin to recover in a new stable environment.

Plans for long-term housing are addressed by not only outside agencies but also Haitian ministries who work out of makeshift offices (Donlon 6). In most cases, especially in developing countries such as Haiti, temporary structures often become unintentional permanent structures. Many Haitians were simply too scared to return home because they feared the stability of their concrete constructed homes. The collapse of concrete structures is what killed so many Haitians during the earthquake. Thus, some families prolonged their stay in temporary camps (Jean Thomas). This causes numerous problems in terms of infrastructure, land, and space that will be discussed later in the text. Those remaining in the camps were forced to evict a year later and some had no choice but to return to their original homes even though they were still damaged and in unsafe conditions. Only 4.7% of IDP families left the camps voluntarily because their homes had been repaired or rebuilt (Schuller and Morales 146). In Haiti and developing countries of similar distress, it is rare that displaced families have the opportunity to recover in stable environments.

A diagrammatic representation of the overall typical aid process in Haiti can be seen in Attachment 1 of this document. The diagram parallels the five phases of Haitian housing and the role the government, aid agencies, and community played throughout each phase of the recovery process.

Inefficiencies in the Process

The ideal disaster relief process described and the process witnessed in Port-au-Prince, Haiti following the January 12th, 2010 earthquake differ greatly. This is due to the various social, political, and economic factors that can dictate the efficiency and success of aid and reconstruction programs. Haiti has faced long-term political and economic turmoil as well as social problems such as violence and class discrimination that have slowed recovery efforts.

Lack of infrastructure to support sanitation systems and clean water sources set up by aid agencies cause emergency and temporary camps to move from ideal relief housing to places of despair and insecurity. In addition to the local problems that exist in the devastated area, NGOs are at fault for creating a dependency on foreign aid. NGOs commonly fail to inquire local participation, responsibility, and leadership from the government and IDP population (Schuller and Morales 122-5). A gap also exists between incoming aid and the population in need. Haiti has received 9.9 billion dollars in aid since the January 12th, 2010 earthquake, but adequate housing and infrastructure has failed to reach a majority of the effected population (Schuller and Morales 216). There are several issues that still exist with the disaster relief process in general and specifically in Haiti.

Since Haiti is located in an area at high risk for earthquakes, hurricanes, landslides, floods, and tsunamis, relief organizations and Haiti's government need to learn from past disaster responses and prepare a new recovery plan for future disasters; especially in terms of emergency and temporary housing solutions. The following text will discuss the positive and negative aspects of emergency and temporary housing solutions and IDP camps around the world and in Haiti.

Chapter 3
Current Strategies in Emergency Housing

As previously mentioned, emergency housing is provided during the relocation and rehabilitation phase of the recovery process. For the majority of a population effected by a natural disaster, emergency houses exist as canvas tents that are set up in rows creating tent cities or camps. Various emergency tents have provided relief to IDPs around the world and continue to do so today. Emergency tents are successful strategies to the relief process as long as they are strong, durable, and only used for a few weeks to a few months. Emergency tents hinder the relief process when IDPs prolong their stay causing an inefficient transition to temporary housing.

The most successful tents are those that are wind and rain-resistant. The dome tent in Figure 8 was designed by Shelter Systems and is considered the strongest tent of its kind. These tents are made of strong, tear-resistant fabric that utilize tarp fasteners that guarantee a leak proof skin. Structurally, these tents are sound due to their curved form which diminishes weak points caused by corners (Shelter Systems 2011). The United Nations also provides tents to displaced populations through their UN High Commissioner for Refugees (UNHCR) organization. These tents come in various sizes and a vast amount can be delivered to camps via shipping containers and aircraft (Salaheddin and Karam 2013). Figure 9 shows the UNHCR tent being distributed to Syrian refugees in a camp in Irbil, Iraq.

Figure 8: These Shelter System dome tents were set up in Lake Maracaibo, Venezuela after floods had displaced families (Shelter Systems)

Figure 9: Tents provided to refugees in Irbil, Iraq by the UN High Commissioner for Refugees (Salaheddin)

In addition to the tent solution for emergency housing, shelters can also be located inside public institutions. Often times there are not enough tents to provide shelter for all of the IDPs effected by a natural disaster so people take relief inside schools or churches. This type of shelter is effective in the disaster relief process because it ensures that IDPs will move to a temporary shelter after a few weeks or months depending on when

the school or church resumes its classes or services. Figure 10 shows Japanese IDPs taking shelter in an elementary school after Japan was struck by a 9.0 earthquake followed by a devastating tsunami (Tritten 2011).

The last resort for IDPs who have unfortunately not found shelter in tents or public institutions is to build their own makeshift tents in open public spaces. These tents are constructed from materials shifted out of the rubble and are hardly sufficient in protecting them from harsh environmental conditions. These shelters are hazardous to the disaster relief process because these self-constructed camps commonly evolve into shantytowns that displaced families never leave. The people located in these camps are eventually forced out by the local government or landowners who want their property back and are left to find shelter once again.

Figure 10: Japanese IDPs take shelter in the Watanoha Elementary School in the heart of the demolished city of Ishinomake, Japan (Tritten)

Figure 11: A shantytown made of scrap and recycled materials in Manila, Philippines (Reporter)

Figure 11 shows a camp in Manila, Philippines where IDPs have constructed their own relief structures. In 2009, a typhoon devastated the city of Manila resulting in hundreds of deaths. The flooding forced tens of thousands of people to flee their homes for higher ground (Reporter 2013).

The relocation of an effected population into emergency housing is an important phase in the disaster relief process. Emergency shelters help provide fast relief for IDPs from harsh environmental conditions and provides a place where they can rehabilitate as the clean-up and reconstruction process begins. Emergency tents and public shelters provide the most successful situation for this process. Unfortunately, self-constructed tents and shantytowns will always result as long as there are not enough tents and public shelters to house the entire displaced population.

The three different emergency housing projects described and referenced in various relief camps around the world have also been present in Haiti since the January 12th,

2010 earthquake. Looking back at Figures 2-5 on page 5, displaced Haitians found relief in emergency tents provided by NGOs and in open public spaces where they constructed their own makeshift tents. Haitians also found relief at schools and churches within Port-au-Prince's municipal area (Thomas).

The most important next step after emergency housing is set up is to have a plan for the relocation of IDPs to a more stable environment. The traditional next step in the relief process is the relocation from emergency housing to temporary housing.

Chapter 4
Traditional Temporary Housing

The early recovery phase brings about temporary housing solutions. These housing projects are meant to remove internally displaced persons from emergency houses that are inadequate for long-term rehabilitation. Temporary housing is the phase where IDPs find relief from emergency shelters and await the reconstruction of their permanent homes (Cruthfield 2013). Temporary houses are set up in camps similar to the emergency tent cities, but families have access to clean water, toilets, security, medical clinics, and schools that make their day to day lives easier. (Schuller and Morales 111). Architects and engineers around the world have worked to design temporary housing solutions that are fast and easy to build as well as cost efficient. The following temporary shelters have been designed to best meet the needs of internally displaced people in disaster relief situations.

Precedents

Shelter in a Day is a temporary housing solution that provides safe and secure homes that are termite, water and rust resistant. These disaster relief homes are very efficient because they can be easily erected in one day without tools or electricity. The shelter is made from prefabricated and recycled wood fiber that is assembled using tool free joints and locking pegs. Figure 12 shows the fully constructed prototype. These shelters can be built on top of existing concrete slabs or of local materials such as stone or concrete block. Screw-type earth anchors are installed around the base or cast into a concrete slab. Steel straps then connect these anchors to exterior wall members that secure the shelter for high winds, as seen in Figure 13. The shelters are dimensioned at 12’ X 12’ but can be increased in size by increments of four feet (Shelter in a Day 2013).

Shelter in a Day would be a good solution to a temporary housing project because it does not require tools or electricity in its assembly. Displaced families do not have access to this equipment, so a design that enables them to build it themselves is an important step in integrating relief projects with the community. Another positive feature of this prototype is that it can be taken apart when a family moves to a permanent home and can be reused in another relief situation.

Figure 12: In one day, Shelter in a Day's temporary housing prototype can be constructed (Shelter in a Day)

Figure 13: Steel strips anchor the walls to the ground (Shelter in a Day)

Another temporary housing solution called Shelter for Refugees was designed by the Ikea Foundation and the United Nations High Commissioner for Refugees (UNCHR). The design is a step-up from a canvas tent, yet it is still relatively cheap. The shelters are flat-packed and can be constructed by refugees in four hours once they have reached the site. The shelters also come equip with electric-generating roofs. These new Ikea-inspired shelters are built to last 10 times as long as the UN canvas tents and they're also twice as large. During the day, an external screen on the shelter's roof provides 70% solar reflection and cooling, and at night it keeps heat in. When mass produced, UNCHR hopes to get the price down to less than $1,000 per shelter. Figures 14 and 15 show an interior and exterior view of the Shelter for Refugees ("Shelter for Refugees").

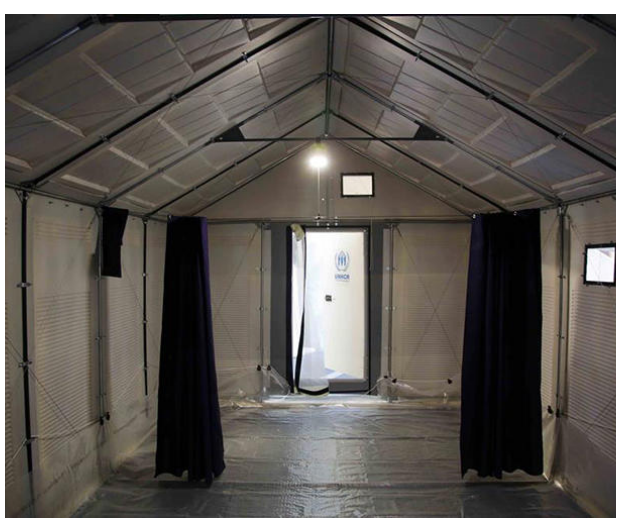


Figure 14: Interior view of Shelter for Refugees. Curtains allow the unit to be divided into separate rooms ("Shelter for Refugees")

Figure 15: An exploded axon of how each shelter is constructed ("Shelter for Refugees")

Shelter for Refugees is successful in that it can be constructed by IDPs in approximately four hours. The exterior screen that reflects heat during the day and maintains it at night is another effective aspect of it's design. Temporary housing prototypes are made to be shipped globally to any place in need of shelter, so it's important that the design can deal with varying climate conditions.

Focusing on temporary housing examples that have been implemented in Haiti, the Catholic Relief Services (CRS) have designed a prototype for displaced persons after the 2010 earthquake. This design was previously mentioned on Page 6, Figures 6 and 7 when discussing the early recovery phase of the relief process. The T-shelters were divided into easy-to-handle prefabricated components that were designed for standard plywood sheets. Figure 17 below shows the components of the T-shelters when assembled. The components included wall panels, trusses, doors, and shutters. The dimension of the unit is 12' x 12' to allow for implementation on the smallest of plot sizes. The front wall permits light and ventilation but can be closed up by an adjustable tarp for additional shelter and privacy. The shelter is anchored to the floor by a concrete mud slab with six piers. To resist high winds, the roof is reinforced by galvanized iron straps (Hirano 20).

Figure 16: T-shelters being constructed at a site in Haiti (Hirano 20)

Figure 17: An assembled T-shelter designed by Catholic Relief Services (Hirano 27)

The components for the T-shelters were built in prefabrication yards in Haiti (Hirano 22-23). Providing work for the displaced population in the fabrication of a temporary house is a constructive way to not only provide shelter but to provide economic stability. By limiting the prototypes dimension, CRS was able to provide shelter for Haitians that were limited by small plot sizes.

Another temporary shelter designed for Haiti was provided by Haitian Relief and Missions. The houses are 8'x16' with a door, two windows, and a built in bed frame. They were built on site in Haiti by skilled volunteers from the United States after the earthquake. The shelters are referred to as "house kits" because they include a full size

mattress, two roll up sleeping pads, a table, two folding chairs, blankets and bedding, and a tote full of kitchen utensils. The goal of the house is to permit a Haitian family to move in and immediately have the basics they need to live. The approximate cost for a "house kit" including shipping to Haiti and all the items included is $2,075 per house (Haitian Relief & Missions).

Figure 18: Multiple "house kits" set up in a camp in Haiti (Haitian Relief and Missions)

Figure 19: A woman and her children inside their T-shelter (Haitian Relief and Missions)

A positive attribute of these shelters is they provide Haitian families with everything they need to go about their daily lives. Often times when survivors move to camps, they come with nothing but a few valuables they were able to salvage from the rubble. Therefore, providing the essentials for daily life will help Haitians move forward in their recovery and rehabilitation process.

The temporary housing solutions presented above are all successful designs that have unique features to provide a more stable and comfortable living environment for IDPs transitioning from emergency housing. Although these solutions are adequate temporary housing solutions, these shelters cause problems in the disaster relief process and the transition of displaced persons to permanent homes. The following text will highlight the problems associated with temporary housing and why another solution may be more appropriate.

Common Problems

Temporary structures are successful in bridging the gap between emergency housing and what seems like the distant construction of permanent homes. While it is important that displaced families have a place to call home, it does not mean three phases of housing are needed in order for them to go about their daily routines (Lizarralde 7). Temporary structures implemented in developing countries often hinder the transition of displaced persons to permanent homes, causing temporary structures to become unintentional permanent homes. When these temporary homes become permanent, it

causes negative impacts on the relief process and the rebuilding of healthy and sustainable communities. The following are environmental, technical, social, and economic issues that have arised from using temporary housing in developing countries.

Environmental

One problem with temporary housing is it often times does not meet the needs of displaced families (Lizarralde 6). Although temporary housing camps are said by relief agencies to be equipped with clean water and sanitation systems, medical clinics, a school, and security patrols, it's a common phenomenon in these camps for this infrastructure to be inadequate for the number of IDPs located in the camps. For example, Figure 20 shows post-disaster houses in Honduras. These houses were ill-adapted to local needs and lifestyles, thus beneficiaries dismantled the roof, door, and windows and abandoned the house. Figure 21 shows temporary housing at the Nueva Choluteca camp in Honduras. This housing settlement was without proper infrastructure and did not take into consideration the hot weather climate. The camp had low economic recovery which led to crime and poor health.

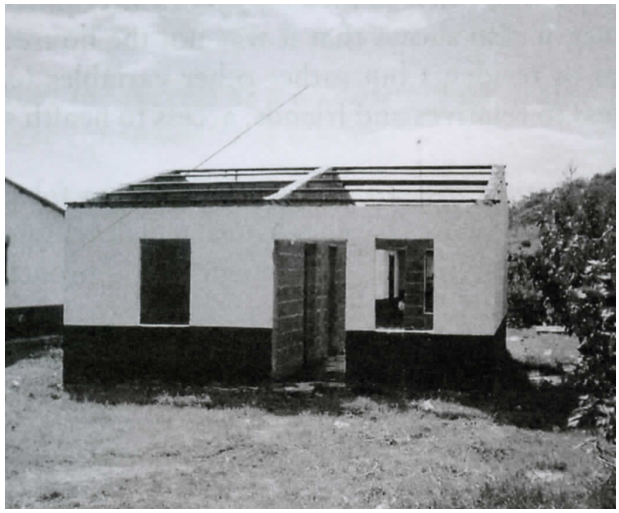


Figure 20: Abandoned houses at a temporary camp in Honduras (Lizarralde 8)

Figure 21: The Nueva Choluteca camp in Honduras that did not have the infrastructure to sustain a healthy recovery (Lizarralde 8)

In Haiti, seven months after temporary camps were set up following the earthquake, forty percent of camps still did not have access to clean water and thirty percent did not have toilets. The temporary camps set up in front of Haiti's National Palace had toilets but only thirty toilets for 30,400 people (Schuller and Morales 122). If the camps are remote from social and economic needs that foster healthy day to day living, those that have the opportunity to leave, will abandon these structures. Those that are forced to remain because they do not have the resources to provide a better life for themselves elsewhere are left to suffer in poor conditions (Geneva 9). This often leads to a technical problem associated with temporary housing; temporary housing that becomes permanent.

Technical

Temporary structures sometimes become permanent because for some families living in poor countries such as Haiti, the shelter is nicer than their previous home. Shelters also become permanent when families have nowhere else to go. Unfortunately, temporary structures that become permanent are often added on to because the temporary structure itself does not meet the needs of the displaced family. This results in weak connections between the temporary house and the addition increasing the structures vulnerability to future disasters. This is often due to the lack of reinforcement used to strengthen the connection between the new and existing materials. When the region of Bhuj, Gujarat was devastated by an earthquake, temporary houses built of stabilized china clay blocks with thatched roofs are now being extended with brick walls and concrete roofing, as seen in Figure 22. The main problem with this extension is there is a lack of reinforced concrete columns to support the concrete slab roof (Lizarralde 54). Figure 23 shows bhungas reconstructed by an NGO in the district of Kutch, Gujarat after the earthquake. The bhungas were designed in a circular form to be earthquake resistant. Traditionally, IDPs began to extend these structures using technology and materials that were affordable and available. This resulted in poor connections that ended up making the structures vulnerable to future earthquakes (Lizarralde 54).

Figure 22: And addition to a temporary structure using clay block and stones in Bhuj, Gujarat (Lizarralde 55)

Figure 23: Bhungas being extended using stones and solid blocks in Kutch, Gujarat (Lizarralde 55)

The temporary housing solutions implemented in Haiti by Catholic Relief Services and Haitian Relief and Missions that were previously discussed on pages 14 and 15 were not designed for additions. It has been three years since the earthquake struck Port-au-Prince and Haitians are still living in these temporary houses. Adding to the permanence of a temporary structure, It is in Haitian culture for families to add on to their homes once they can financially support additional materials (Thomas). Once these materials become available to those living in the temporary houses, expansions will be made without structurally sound connections due to the improper building techniques

of Haitian contractors. Figures 24a and 24b below are camps in Port-au-Prince, Haiti that Haitians have started to expand using locally available materials.

Figure 24a: Relief shelters that have been expanded using local building materials in Port-au-Prince, Haiti (Author)

Figure 24b: Relief shelters that have been expanded using local building materials in Port-au-Prince, Haiti (Author)

It is clear from the examples presented that additions to temporary structures that are not designed to be expanded create hazardous living conditions for the displaced population. Catholic Relief Services learned from the temporary houses they provided that whenever possible, agencies should avoid a two-phased shelter and settlement strategy. They realized that creating temporary settlements on "borrowed land" and then creating permanent settlements prolongs the rehabilitation process and the return of IDPs to their place of origin (Hirano 12). Once these camps become permanent villages, more threats arise than just structural instability and a prolonged relief effort.

Social

Along with these environmental and technical issues, the displaced population living in temporary camps face many social difficulties such as crime and forced eviction. Since these temporary camps lack the infrastructure and security to meet the needs of the families living in them, crime and violence become a constant threat. Most IDPs do not feel comfortable leaving what few belongings they have unattended during the day for fear of intruders and their safety (Hirano 7). Violence by gangs is also a common threat to these camps. Gender-based violence against women and girls being the most prevalent. Women and girls in IDP camps in Port-au-Prince are at risk to rape and sexual violence. One year after the earthquake, 640 rapes had been reported. These camp communities are at risk of crime and violence due to "the collapse of social infrastructures, the erosion of family and community networks, inequitable access to social services, absence of law and order, lack of secure housing or safe neighborhoods, and dependence resulting from economic dislocation" (Schuller and Morales 158-9).

When IDPs fail to relocate to their original home-sites, they face further violence from angry landowners who want these temporary camps off their land (Hirano 9). The main reason Haitian families are still living in temporary camps in Port-au-Prince is because they were renters before the earthquake. Haiti's Neighborhood Return and Housing Reconstruction Framework left out Haiti's poor, the renters, and provided only landowners with reconstruction aid. This left the poor, more than half of the 1.3 million IDPs, with no shelter to transition to because they are supposed to rent. Consequently, Haiti's temporary camps still remain today (Schuller and Morales 100-1). NGOs in Haiti set up "Know Your Rights" trainings for IDPs so they could stand up against eviction by landowners because forced evictions are illegal under Haitian law (Schuller and Morales 138). The battle between the constitutional rights of IDPs and the violent threats for evictions by landowners will be prevalent in Haiti until all of the IDPs find permanent shelter outside of the temporary camps.

Economic

Incorporating temporary housing into the housing reconstruction plan results in a waste of materials and economic resources. Building temporary housing and then permanent housing amounts to building a families home twice. The resources used on building temporary structures could have been used on the reconstruction of IDP homes that were destroyed in the disaster. For this reason, temporary houses are considered extremely expensive due to their planned short life spans. Ultimately, the need for temporary housing can be reduced if the reconstruction of permanent housing can be accelerated (Lizarralde 73-81).

To conclude, temporary housing causes many challenges for the IDPs living in them and the government and international agencies that try to keep the rehabilitation and reconstruction process in motion. Instead of breaking the relief housing process into three phases of emergency, temporary, and permanent housing, it may be beneficial to displaced persons, the government, and relief agencies to implement a new process for disaster relief housing reconstruction. Instead of implementing a middle and third phase to the housing process that stand alone in their construction and timing, a transitional phase can be used to link temporary and permanent housing constructions. The next chapter will discuss the positive effects of moving from emergency tents to transitional houses, which will be called Phase 1 Housing, that can be slowly and successfully constructed into permanent homes by IDPs as materials and resources become available to them.

Chapter 5
Proposal

A Revised Approach

A transitional housing approach challenges the phasing of emergency, to temporary, to permanent housing in the current disaster relief process by creating a solution that phases the rebuilding process from emergency to Phase 1 Housing. The Phase 1 House can plan for future expansion that incorporates strong connections, utilizes locally available materials and resources, empathizes with indigenous construction techniques, and provides business to help IDPs rebuild the economy of their community. The overall goal of this type of housing is to provide the displaced population with flexible relief housing that families can expand and personalize into a home that is reflective of their needs and family dynamics. Phase 1 Housing can ultimately "balance and integrate the needs of the emergency with long-term requirements of sustainability" (Lizarralde 19).

These houses have the capability of providing sustainable solutions that respect the environment, culture, and society of the effected area. These structures will help keep the housing relief projects on track (Lizarralde 24). Resources and materials will no longer have to be divided between temporary and permanent structures, but rather used to transition the first phase of a structure into a permanent home. In this way, families can move away from the monotonous prefabricated structures by personifying their relief home through size, form, material choice, ornamentation, and color.

The proposed disaster recovery process shown in Attachment 2 of this document demonstrates a new approach that implements Phase 1 Housing. This diagram illustrates the transition of the existing disaster recovery process at Phase 3: Emergency Housing into the new recovery process. In the new process, emergency camps will be set up within the community. Providing IDPs with local shelter enables families to complete Phase 4 of the housing recovery process. IDPs will be the first to initiate reconstruction by returning to their compounds daily to clean up the rubble of their existing homes and salvage materials for their Phase 1 House. An important aspect of this new strategy is the involvement of the affected population in the reconstruction of their community. The best results occur when the community takes an active role in the process. Phase 5 of the housing recovery process is when Phase 1 Housing will be implemented. Now that IDPs have cleared their sites of rubble, the Phase 1 House can be constructed in the place of their existing home. This important step keeps the displaced population from moving to unfavorable temporary camps and allows them to begin personalizing their new home to meet their families needs and preferences.

Implementation in Haiti

In order to study the process of the proposed disaster recovery strategy, rural Haiti has been selected for the example scenario. Transitional housing is not a new concept to Haitian culture and building practices. It is Haitian tradition to save and build ones home in sections and this is why Haiti is an appropriate site to implement transitional relief housing. Haiti's 1987 Constitution states that the "obligation of the state is to construct provisional housing to guarantee housing for everyone victimized by a natural

disaster or anyone in an extremely precarious situation. It's a state obligation to take all necessary measures to put in place a good strategy to turn the right to housing into a reality in the rural as well as urban sectors, certainly in the most vulnerable zones" (Schuller and Morales 137). Phase 1 Housing provides the opportunity to meet the obligations of the state by providing adequate housing and environments that meet the needs of displaced populations in Haiti.

The typical process for construction of Haitian homes starts with the saving and purchase of building materials. Once a family has collected all of their building materials, a contractor is hired to build the core of their homes. When the family is in need of more space and they have the resources to make an addition, a room can be added on either side of this core (Thomas). Figure 25 represents this process. In order to connect the core and the additions, it is in Haitian building practice to leave the rebar hanging out of the concrete columns and slabs of the structural core. Figure 26 shows rebar extending past a concrete slab at a home in rural Haiti. This traditional construction practice results in structural instability and reiterates why a transitional house that plans for future expansion with strong connections is so potent.

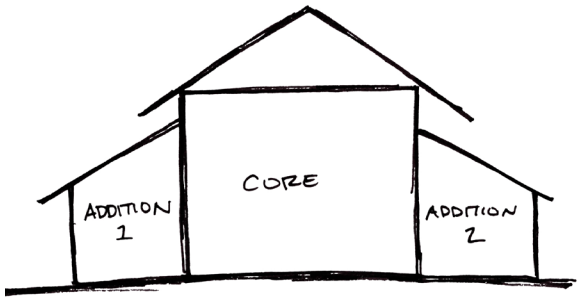


Figure 25: The process of the expansion of a Haitian home (Author)

Figure 26: Rebar extends out from a concrete slab (Author)

Research shows that the proposed disaster recovery process has strong potential in Haiti. Since Haitians are already conditioned to transforming their homes to meet their needs, the Phase 1 House will not be a new concept. Haiti is also sited in a zone vulnerable to various natural disasters and past patterns show that Haiti will suffer from another disaster that will force a displaced population in search of shelter. The new recovery process has the potential to improve the rehabilitation and reconstruction after a future disaster. The next chapter will further study Haiti in order to identify key social, environmental, technological, and economic traditions that hold value in the design considerations of a Phase 1 House.

Chapter 6
Site Context

Haiti occupies the western third of the island of Hispaniola sharing it with the Dominican Republic. Haiti is a small country of around 17,400 miles and is sited in the Caribbean Sea between Cuba and Puerto Rico. The terrain in Haiti is mostly mountainous with only fifteen percent flat land. The country is divided into nine departments; the west, the north, the northwest, the northeast, the Artibonite, the center, the south, the south-east, and the Grand'Anse with the city of Port-au-Prince as it's capital (Coupeau 1-2).

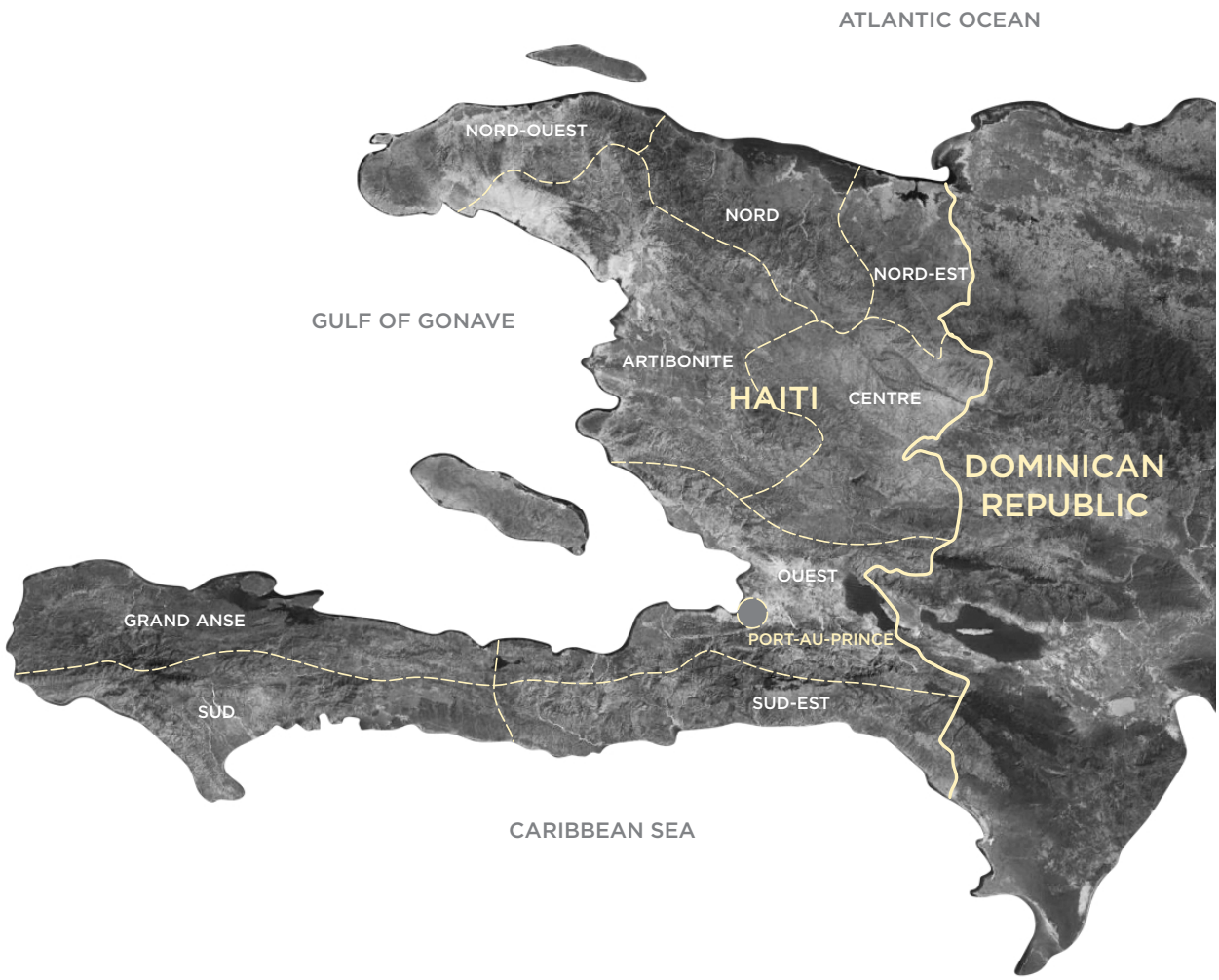


Figure 27: The nine departments of Haiti (Author)

History

Haiti is considered one of the poorest countries in the western hemisphere due to the decline of agriculture and exports. Haiti used to be the Pearl of the Antilles and produced seventy-five percent of the worlds coffee, but the countries prosperous agricultural sector was ruined in the 19th century when the country was shunned by the rest of the world. Slave armies in Haiti revolted against the French government and gained their independence in 1804. Other countries feared the slave revolt in Haiti would inspire slave revolts in their own countries, thus they shut off all connections with Haiti. Without international trade opportunities and the lack of a stable government, Haiti quickly faced economic and political turmoil that would become a consistent pattern for the country. The loss of agricultural exports led to the devastation of rural Haiti. Living standards are marginally worse in these areas than in Port-au-Prince due to the inequalities in wealth distribution between countryside and the capital (Coupeau 7-12). This caused a migration of rural Haitians to Port-au-Prince because jobs and infrastructure became centralized in the urban capital (Coupeau 2). As a result of these high densities, the government of Haiti is now strategically planning the decentralization of Haiti.

Decentralization

The government of Haiti saw the 2010 earthquake in Port-au-Prince as an opportunity to decentralize the capital by "building back better" (Farmer 367). The redevelopment plan was to rebuild the agricultural sector in rural Haiti to create jobs that would persuade IDPs relocated outside the capital from returning back to their homes in the city (Donlon 7). Unfortunately, the post-earthquake emergency response posed serious challenges to the decentralization action plan because a lack of investment and infrastructure was taken in rural camps. IDPs were forced to return to devastated portions of Port-au-Prince because the resources needed to survive were distributed by relief agencies in the capital and not in their rural camps. The government developed Haiti's Action Plan to help with the decentralization challenges throughout the country. Like previously mentioned, Haiti is divided into nine departments and the government hopes to invest in infrastructure and regional development projects for each of these communal municipalities. The expansion of roads, ports, schools, and jobs will create a network throughout the nine departments that will connect the countryside and capital through economic development and infrastructure (HAWG 1-2).

It is extremely important for redevelopment in Haiti to provide resources and infrastructure that meet the needs of Haitians living in both urban and rural areas. It is only in this way that Port-au-Prince will find relief in decentralization. When considering the design and construction of the Phase 1 House, it will be important to consider the opportunities it can provide for job creation and economic sustainability.

History of Natural Disasters

Haiti will always have more opportunities to "build back better" because the country is sited in a zone consistently vulnerable to earthquakes, hurricanes, floods, and landslides that destroy thousands of homes every year (Farmer 367). Attachment 3 of this document shows a timeline of past natural disasters in Haiti and the number of homes

destroyed by each tragedy. Haiti is very prone to earthquakes like the one that struck Port-au-Prince on January 12th, 2010 and Figure 28 highlights the fault lines that run through Haiti which further proves the countries vulnerability.

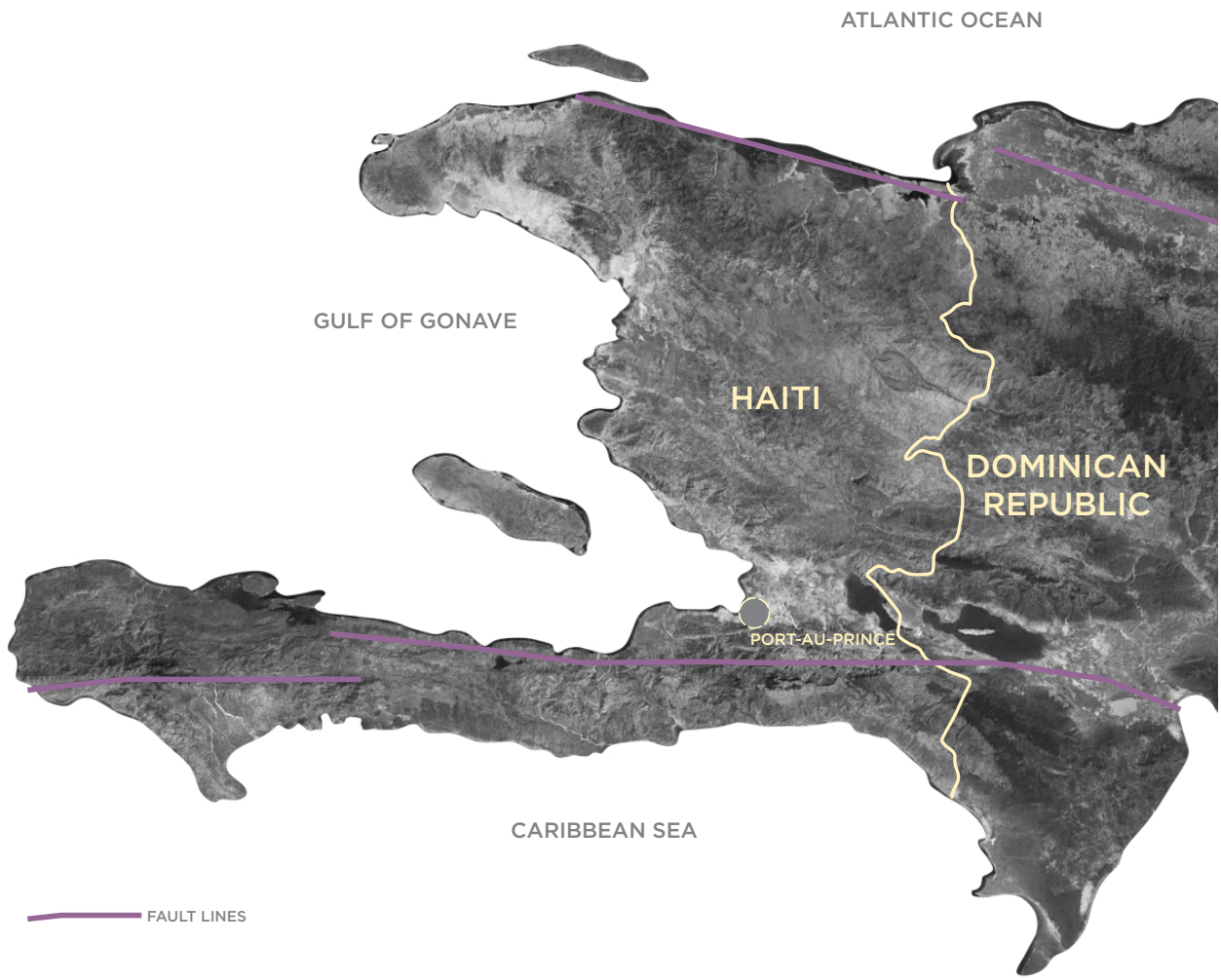


Figure 28: Fault Lines in Haiti (Author)

In addition to the threat of earthquakes, Haiti also faces flooding and landslides during the rainy and hurricane seasons. Figure 29 shows the four months out of the year where heavy rainfall makes the country at an increased risk to these disasters. In addition, Haiti's tropical climate results in heavy rainfalls that cause flash flooding within low lying communities. Therefore, as patterns of history have shown, it will not be long before another natural disaster devastates the structural and economical stability of the country. As a result, housing reconstruction and redevelopment is an ongoing process and issue in Haiti. This is where the long term sustainability of a phased house and recovery process becomes very important. In order to provide a housing solution that does not add to the total number of destroyed homes in future disasters, the shelter must be structurally resistant to wind, rain, and seismic forces. In this way, the Phase 1 House will be unlike the existing temporary shelters that have been made permanent

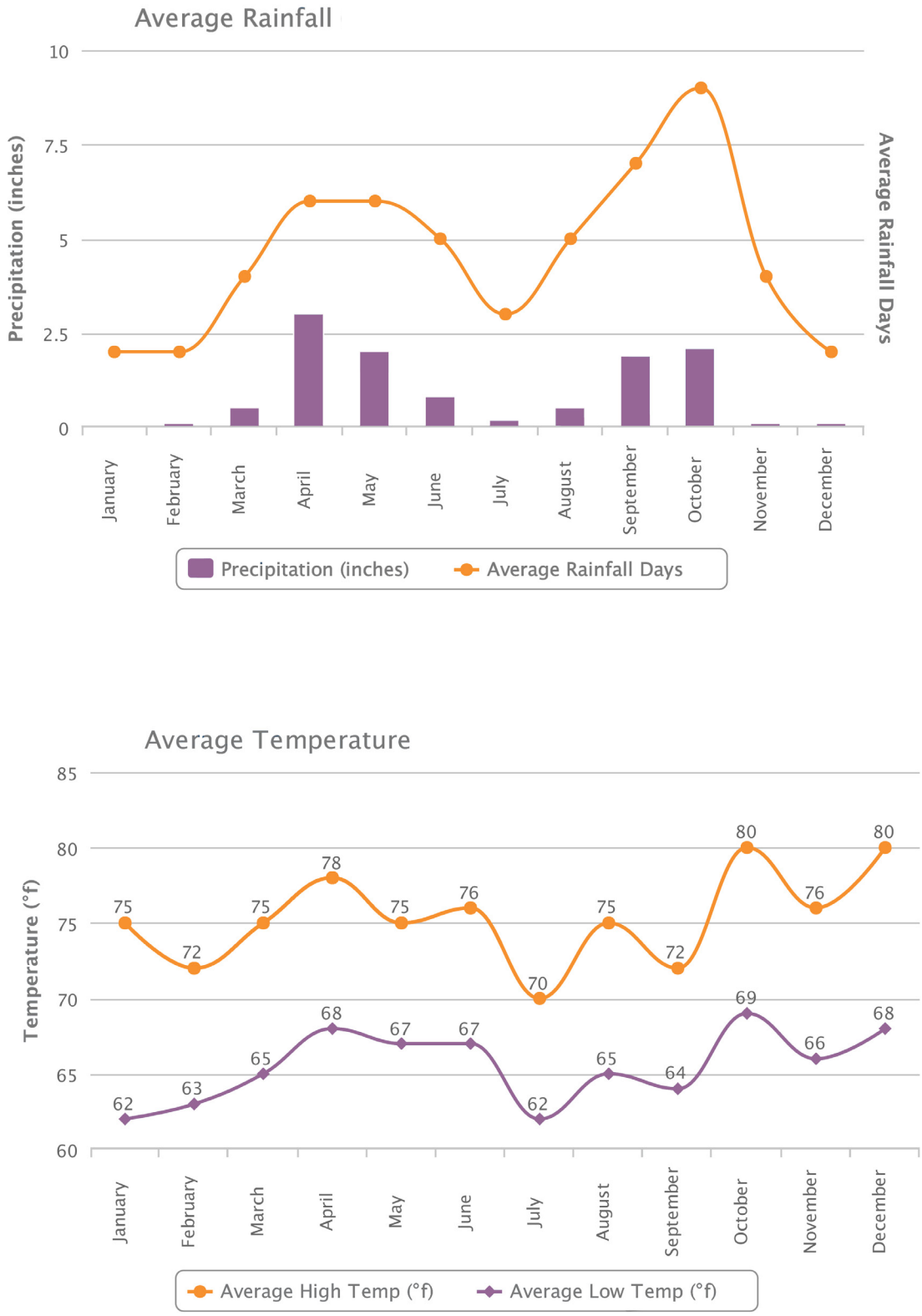


Figure 29: Average Monthly Rainfall and Temperature (WorldWeatherOnline)

by IDPs in that they are no longer vulnerable to future disasters. The goal for the new recovery process is to reconstruct damaged and destroyed homes to a state better than what they previously were to reduce the vulnerability of these houses to future natural disasters.

Deforestation

Deforestation is another problem in Haiti that leads to increased devastation of land and infrastructure when a disaster strikes. The landscape of Haiti is facing major deforestation because Haitians are constantly cutting down trees for fuel and charcoal because they are unable to afford imported oils. Figure 30 shows the border between Haiti and the Dominican Republic which contrasts the deforestation in Haiti to the abundance of forestry in the Dominican Republic (Than 1). With the disappearance of forests and the countries steep terrain, Haiti is at a heightened risk for landslides. Trees provide a natural buffer from wind and rain and their roots keep the topsoil in tact. Since Haiti lacks the tree-cover to adequately provide these buffers, shelters are placed at an increased vulnerability to environmental threats. Agricultural production is also on the decline due to the absence of stable topsoil to promote abundant harvests (Than 2). Although deforestation is a current problem for Haiti, millions of trees have been and continue to be planted by Haitians and international organizations to help with the reforestation of the country.

Figure 30: A satellite view of the border between Haiti (left) and the Dominican Republic showing deforestation in Haiti (Than 1)

In choosing materials for the Phase 1 House, it is important to take into consideration Haiti's deforestation issues and limit the amount of wood materials used in its construction until the terrain in Haiti see's an increase in tree-cover.

Haiti has many site specific conditions that need to be considered when planning the placement of the Phase 1 House. Since Haiti is looking to decentralize its capital, the next chapter will study a rural site, Fond-des-Blancs, Haiti, that will be used as the example community for the proposed disaster relief process. A family compound was selected within this community where the Phase 1 House will be implemented in different ways by the different family generations on the compound.

Chapter 7
Site Location

Fond-des-Blancs, Haiti

Fond-des-Blancs, Haiti is a rural community located in the SUD department of Haiti and is 72 miles southwest of Port-au-Prince. Due to the poor conditions of roads, vehicular travel time ranges anywhere from three to four hours from the capital to this rural community. There are four major nodes within the community that will play a vital role in the example scenario for the proposed disaster recovery strategy. They are highlighted in the map below.

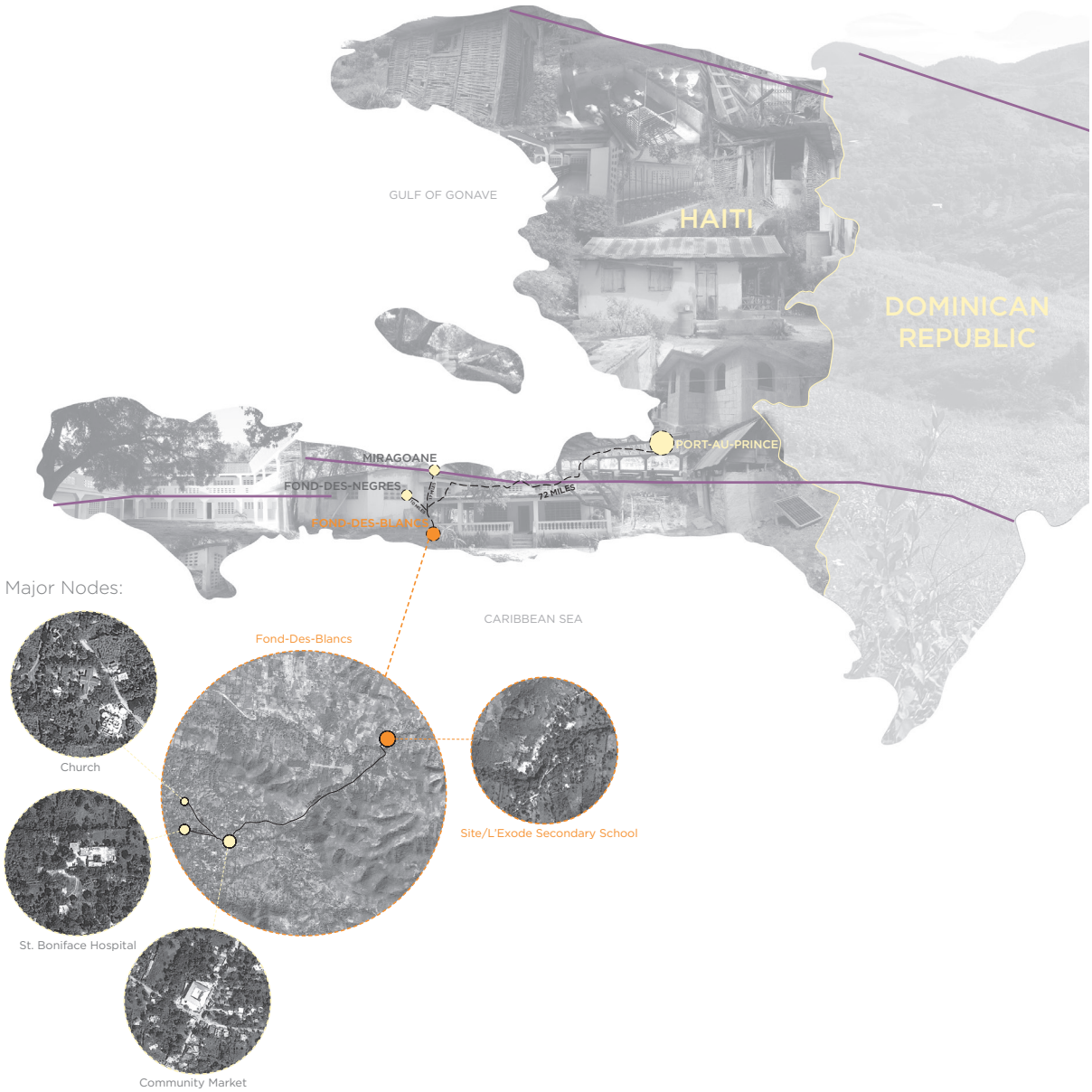


Figure 31: Fond-des-Blancs, Haiti (Author)

Limited Networking - Limited Resources

Due to the lack of infrastructure to create a strong network between Fond-des-Blancs and Port-au-Prince, this community has limited resources in terms of availability and variety. The only clean water source for this community is a natural spring that empties into the river. Haitian women and children retrieve daily buckets of water from this spring to provide clean drinking water for their families. The river and spring is also the site for bathing and laundry because only one percent of those living in Fond-des-Blancs have access to indoor plumbing (Thomas).

Since clean water is scarce in these rural regions, it is beneficial for Haitian families to collect rainwater. When visiting Haiti, cisterns were used by wealthier families to collect water. A cistern is another important element the Phase 1 House can incorporate to improve the life of IDPs.

In addition, due to the lack of infrastructure between urban and rural Haiti, the building materials and equipment in Fond-des-Blancs is not as diverse or readily available as in Port-au-Prince. Those building in the capital have access to more construction equipment and supplies compared to those in rural Haiti.

One can buy materials such as cement and corrugated metal from either of the two small local hardware stores, Kankaylee and Quinquaillerie, in Fond-des-Blancs. Haitians can also find small items such as nails, hammers, pvc pipes, and iron in these hardware stores. Since Haitians do not have their own personal supply of tools, they will have to travel to one of these stores to do even the simplest of tasks or repairs. Builders may also find more variety in supplies and materials at hardware stores located in the neighboring towns of Miragoane, Haiti and Fonds-des-Negres, Haiti. These neighboring towns are demonstrated on the map in Figure 31.

If one was looking for wood or large construction equipment, they would have to travel to Port-au-Prince to buy or rent these items. Many materials are sold on the side of the road in Port-au-Prince as seen in Figure 32. There is also a CAT warehouse located in the capital where Haitians can rent equipment for larger construction projects.

Figure 32: Wood being sold along a street in Port-au-Prince (Author)

Figure 33: A CAT Warehouse (Author)

Port-au-Prince has the most variety of resources available, but due to the lack of infrastructure between the capital and rural Haiti, these supplies do not get distributed to locations such as Fond-des-Blancs. This leaves rural Haitians to rent a vehicle that can support their transportation load of materials and supplies from Port-au-Prince to their rural communities (Thomas). Traveling to Port-au-Prince for building materials is not so much a problem for wealthy rural families, but for the rural poor, this may not be an affordable option. This often results in families building with structurally instable materials such as tree branches, because they can't afford to buy prepared wood or other materials from Port-au-Prince. Figure 34 shows a home in rural Haiti constructed of tree limbs and other locally available materials. In addition to the use of tree branches, some other prominent building materials for the construction of houses in rural Haiti consist of cmu block, woodweave, adobe thatch, wood panel, and corrugated metal. The following images show the quality and technique of the use of these materials.

Figure 34: Tree branch house structure (Tarovella and Godwin)

Figure 35: CMU block construction (Author)

Figure 36: Woodweave construction (Author)

Figure 37: Adobe thatch construction (Author)

Figure 38: Wood panel construction (Author)

Figure 39: Corrugated metal construction (Tarovella and Godwin)

When considering the building materials of the Phase 1 House, it's important to take into consideration materials that are available in rural Haiti verse the variety that can be found in Port-au-Prince. The relief shelter needs to be available and transitional for not only the wealthy rural families but also for the rural poor. As mentioned in an earlier chapter, under the Haitian Constitution, all Haitians have the right to adequate housing. Relief housing "needs to be recognized as a human right with concrete, immediate steps to empower people to return to a safe home and basic services made available to all, regardless of residency status" (Schuller and Morales 121). The Phase 1 House needs to meet these criteria in order to prosper healthy and sustainable living after a natural disaster.

Rural Haiti vs. Urban Haiti

As stated previously in this chapter, there are various deficiencies rural Haiti faces compared to urban communities in Port-au-Prince in terms of infrastructure and availability of resources. Although urban communities have access to more of these technologies, rural Haitians are in the process of addressing their needs by improving infrastructure in their communities. This in turn keeps with the overall countrywide plan for the decentralization of Port-au-Prince. In addition, compared to urban communities, rural communities in Haiti benefit from the abundance of land and space.

Improving Fond-des-Blancs, Haiti

The community of Fond-des-Blancs, through the leadership of Jean Thomas, has taken many steps in improving the infrastructure and networking of this remote area. In October of 2013 I had the opportunity to travel to Fond-des-Blancs, Haiti to study the community and the Haitian culture. Jean Thomas hosted my stay and provided valuable information on the daily life of a Haitian living in Fond-des-Blancs and the construction process of homes in this area. After visiting with Jean Thomas, I learned about all of the great work he was doing within the community to facilitate its growth.

Fond-des-Blancs is growing through the improvment of community networking and by gaining recognition throughout Haiti for it's schools, hospitals, and leadership programs.

To improve connections to other communities, a bridge was constructed over the river that runs through Fond-des-Blancs and across the main road. This bridge has made vehicular travel easier through Fond-des-Blancs which has thus initiated more traffic on this road. With heavier traffic moving through this community, their economy has the opportunity to prosper. Ultimately, this improved economy will begin to stabilize the community independent of outside aid. Another benefit of the bridge has been the improved water quality of the river the road once passed through. Removing vehicular traffic that once drove through the river has helped remove gases and oils from the water Haitians drink and bathe from.

The construction of the L'Exode Secondary School has also improved the community of Fond-des-Blancs. For the schools grand opening, the judge from the department came and gave the key address. The school has created a beacon of opportunity for Fond-des-Blancs and the judge applauded the work the community has done to create an educational facility that will strengthen the knowledge and communication skills of the people. The recognition Fond-des-Blancs has gained for the school has brought more families into the community who want their children to have a good education. Creating a strength such as the school in Fond-des-Blancs entices families to move to this rural location, thus contributing to Haiti's plan for decentralization.

Another strength of Fond-des-Blancs is its catholic hospital, St. Boniface. The hospital has gained recognition across the country for spinal cord rehabilitation. Those in Port-au-Prince that had spinal cord injuries after the earthquake have been brought to this hospital to receive therapy. By creating an expertise within the community, urban dwellers will be enticed to move to this rural location in search of the best medical care or for a career in this specialization.

The Caleb Program has also created a strength for Fond-des-Blancs and many other rural communities that will help lead to the decentralization of Port-au-Prince. Jean Thomas started the program to improve community leadership in rural towns. Figure 40 shows the young men who are currently enrolled in the Caleb Program and Figure 41 is an image of Jean Thomas and his wife Joy. The program seeks to train young men in leadership and religion in Fond-des-Blancs whom are then sent out to perform their work in rural communities across Haiti. Strengthening rural communities in Haiti will lead to a strong rural network that will support the core of Haiti, Port-au-Prince, which will ultimately strengthen the country as a whole.

In addition to all of these improvements and strengths in Fond-des-Blancs that are leading the way for promoting movement of Haitians from Port-au-Prince to rural communities, land and space is another strength these rural communities have to entice Haitians to move from unfavorable urban conditions.

Figure 40: Caleb Fellows (Thomas)

Figure 41: Jean Thomas (Thomas)

Land and Space

As stated previously in this section, those living in urban communities have access to more technologies in terms of infrastructure and available resources, but those residing in rural Haiti have access to other beneficial technologies such as solar orientation, wind, and passive systems that create more favorable living conditions then those in the capital.

Families in urban developments in Haiti are unable to take advantage of these passive systems due to their limited plot sizes. Most plot sizes are not larger than the footprint of the home. This causes a condition of overcrowded housing communities which has ultimately led to the need for decentralization in Port-au-Prince. Since these communities are built up one house next to another, there is little opportunity to position the home to take advantage of solar orientation and prevailing wind directions for natural ventilation. These densities also result in a lack of vegetation that can provide sunshading for the home. In the urban condition, these families are unable to take advantage of passive systems that have the opportunity to provide more comfortable living conditions.

In rural Haiti, structures have generous site conditions that enable families to take advantage of passive systems from wind and sun. Plots are spacious and vegetation plentiful. Since these lots are large, there are adequate open zones around structures to take advantage of prevailing winds and Haiti's climate is one thing that's working in its favor. The average temperature in Haiti year round is between sixty and eighty degrees. These favorable temperatures make cross ventilation an appropriate passive system to use throughout all months of the year.

In terms of orientation, these lots permit the structure to be placed in such a way that solar heat gain can be brought to a minimum. Families can also utilize the native vegetation on site to shade their homes during the intense hours of the day. These rural sites are also strategically laid out by Haitian families. The land is divided into family compounds that encompass generations of a Haitian family and are situated parallel to a road or step up the side of a mountain. Family compounds start when a Haitian family builds a home, a kitchen, and an outhouse on a plot of land. Once the children of this

family grow up and marry, they buy a plot of land next to their parents and build their own home and kitchen. If a member of the family dies, a grave site is started on the families land (Thomas). These compounds continue to grow over time creating strong support systems for all members of the immediate and extended families. Families living in rural Haiti have the potential to create healthy and sustainable living conditions for themselves through the support of their families and by designing homes that respond to specific site conditions and by utilizing proper building techniques.

As stated above, there are many factors that families constructing homes in rural areas have the opportunity to take advantage of to improve their quality of life. The availability of space on these rural compounds make an interesting study of why Haitian's position structures and develop their sites as they do. Amos Rapoport, former professor in the School of Architecture and Urban Planning at the University of Wisconsin, Milwaukee spent his career studying how culture, human behavior, and the environment affect house form. Four of the main determinants of dwelling settlements that he found most important were site, climate, defense, and economics (Rapoport 28-39). These four determinants have a strong presence in how Haitian compounds are planned out and structures built.

The next chapter will begin the study of the proposed disaster recovery process by starting with Phase 1: Existing Haitian Housing. While visiting Fond-des-Blancs, I had the opportunity to study two family compounds, the Labady family compound and our driver, Toto's family compound. For Phase 1, I will study these two sites in terms of Amos Rapoport's form determinants of dwelling settlements.

Chapter 8
Phase 1: Existing Haitian Housing

Two Types of Family Compounds

Throughout rural Haiti there are two types of family compounds that develop. Compounds that develop alongside a main public street and compounds that develop up the side of a mountain. The main difference between these two compounds is the way in which the families living on these compounds find business in correlation to their site location. Families along a main road usually sell goods, such as drinks and vehicular oil to travelers on the road. These families usually have a small shelter that resides at the end of their private lane so they can more easily sell the goods they bought from Port-au-Prince. Families that live in more remote locations usually farm the land, raise animals, and make charcoal. These families bring their produce to the community market in Fond-des-Blancs, one of the major nodes noted in Chapter 7, to sell and barter with. The next section will study a compound that develops along the main road in Fond-des-Blancs, the Labady family compound.

Labady Family Compound

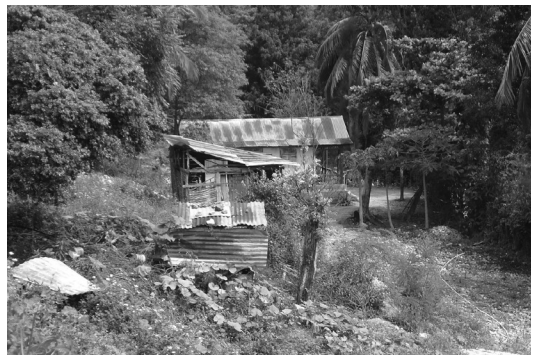
The Labady compound is located east of the L'Exode Secondary School on Fond-des-Blancs, Road. A lot of traffic goes by this compound because it is sited along a main road and is right by the school which is a major node within the community. Figure 43 on the following page shows a site plan and the relationship of these two locations. Just south of the Labady compound and the L'Exode Secondary School is the natural spring where all members of the community go to seek clean drinking water. They also use the spring to do laundry and bathe.

Zooming in to the Labady compound, Figure 45 on page 38 shows the layout of this compound. There are two generations living on the compound, Jonas Labady's family and Jonas Labady's mom. Below is an image of Jonas Labady's family.

Figure 42: Jonas Labady's Family (Labady)

Figure 43: Site Plan of Labady Compound and L'Exode Secondary School (Author)

1. Labady Compound



2. Jean & Joy Thomas' Guest House

3. L'Exode Secondary School

4. Cafeteria

5. Teacher's House (Lola)

6. Material Shed

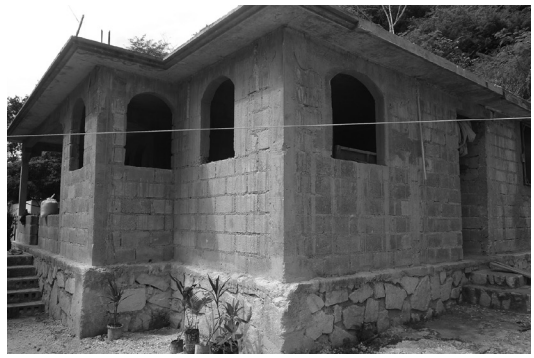
7. Neighbors House

8. Natural Spring

Figure 44: Correlating Site Images to the site plan in Figure 43 (Author)

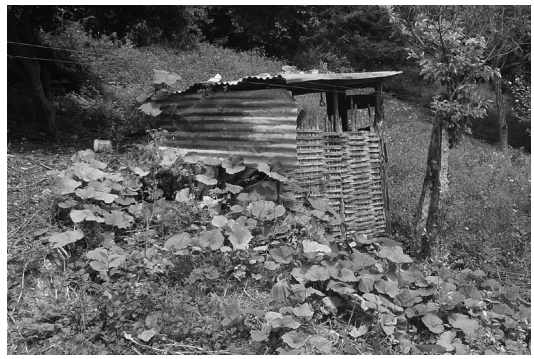
Figure 45: Site Plan of Labady Compound (Author)

1. 2nd Generation Labady House

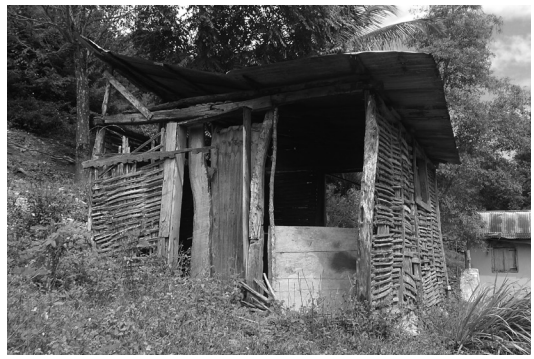


2. 2nd Generation Labady Kitchen

3. Outhouse



4. 2nd Generation House/Kitchen



5. Grave Site

6. 1st Generation Labady House

7. 1st Generation Kitchen

8. Street Shop

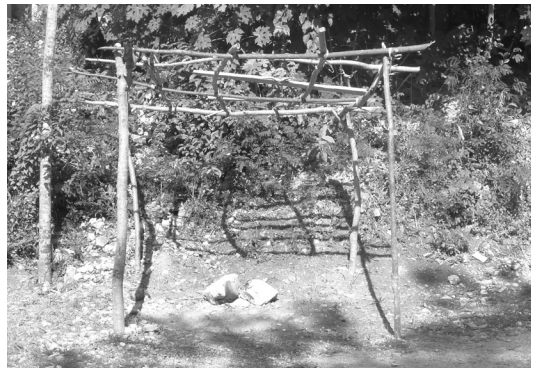


Figure 46: Correlating Site Images to the site plan in Figure 45 (Author)

Figure 47: Cross Section through Labady Compound (Author)

Toto's Family Compound

In comparison to the Labady family compound, Toto's family compound developed up the side of a mountain. The first generation house, Toto's parents, is located near the public street and Toto's second generation house is located near the top of the mountain. This layout can be seen in the section and site plan of the compound in Figures 48 and 49.

Figure 48: Longitudinal Section through Toto's Family Compound (Author)

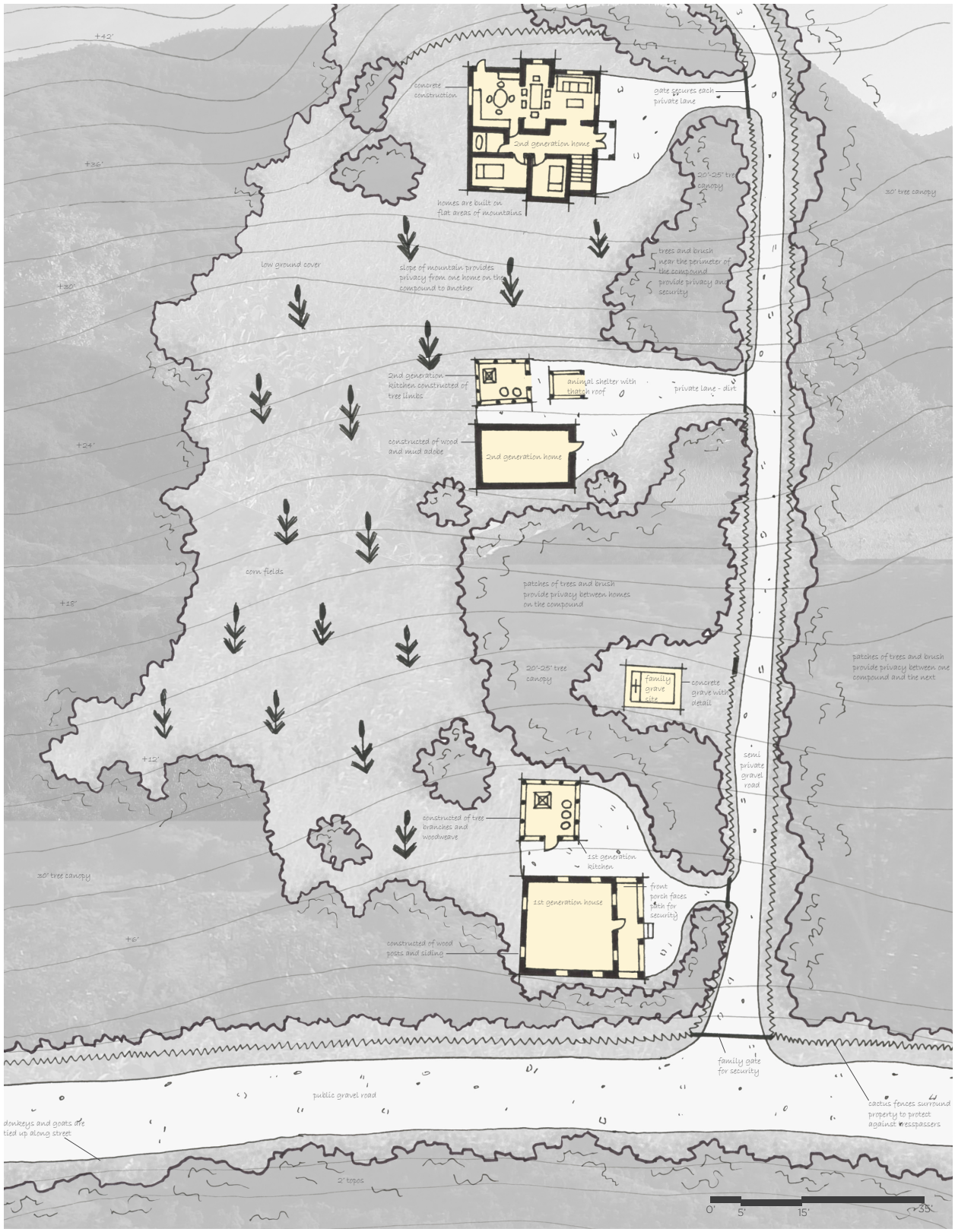


Figure 49: Site Plan of Toto's Family Compound (Author)

Form Determinants

Now that the Labady compound and Toto's family compound have been introduced, the development of both can be studied under Amos Rapoport's four main determinants of dwelling settlements. The compounds will be studied in parallel through diagrammatic representation for each determinant to show the differences and relationships between the two types of family compounds.

Site

Site will be the first determinant to be analyzed. As previously discussed, compounds develop in two ways in relationship to a main road. This comparison can be seen in Figure 50. The Labady compound is featured on the left and Toto's family compound on the right.

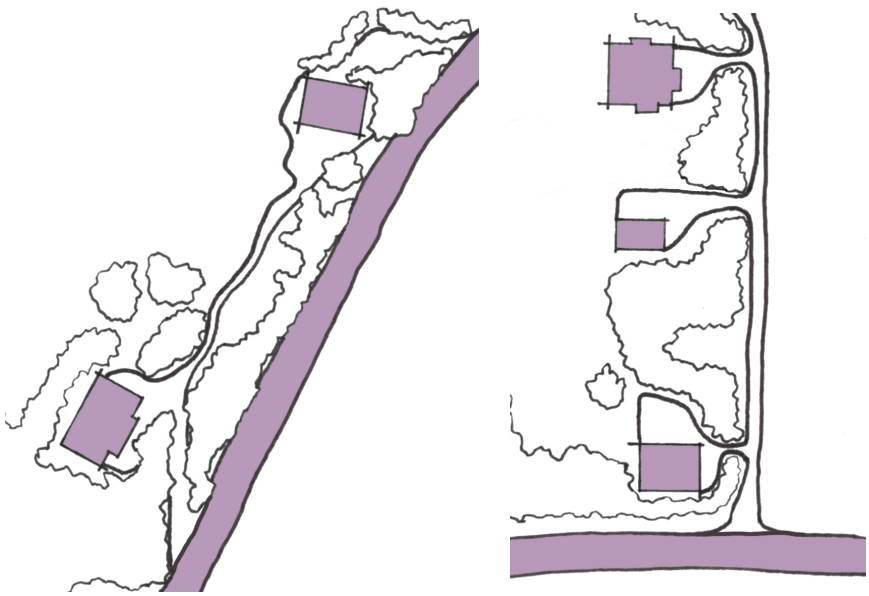


Figure 50: Relationship to Main Road (Author)

Existing vegetation on a site has a major impact on the placement of homes on the compound. Haitians are very strategic in ensuring the privacy of their homes. Thus, Haitians rarely cut down the vegetation between their compound and the public road. The members of the family also place their homes so their is some privacy between each member and generation of the family. This is done by placing homes on either side of a wooded area or using topography to block views from one house to another as was done in Toto's Family Compound. Figure 51 illustrates how vegetation and topography can provide privacy for the families compound and their individual houses.

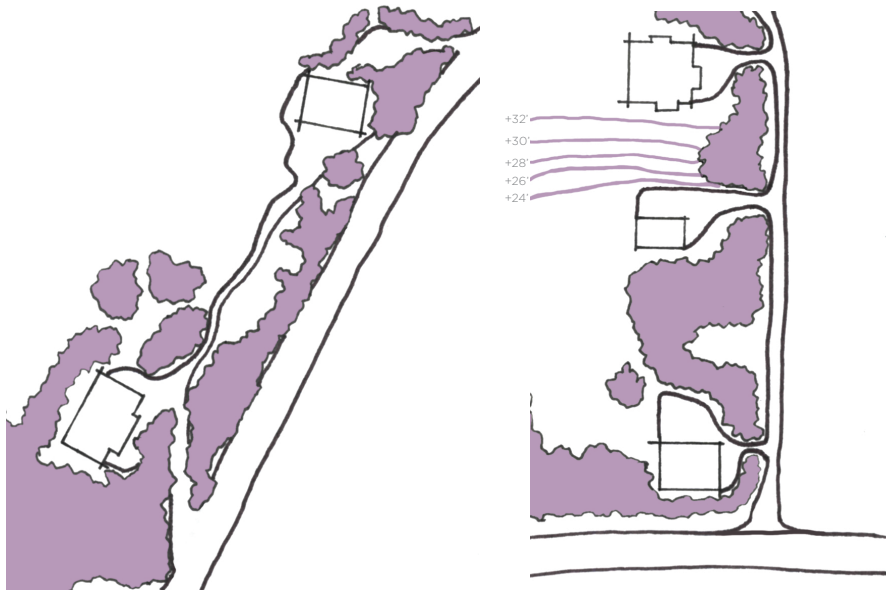


Figure 51: Privacy through Vegetative Buffers and Topography (Author)

Climate

Another factor that determines the layout of a compound and the orientation of houses is climate. As in the site determinant, vegetative buffers play a vital role. Since Haiti is vulnerable to hurricanes, houses are constructed behind existing vegetation to help protect against strong winds that could damage the home. This technique was used in the placement of all the homes on both the Labady and Toto's family compounds and is diagrammed in Figure 52.

Figure 52: Vegetative buffers protect against prevailing winds (Author)

In addition, vegetation provides shade which is a major determinant for where homes are placed on a compound. Since Haiti's climate is very warm for most of the year it is important for homes to be constructed near or under trees to take advantage of the shade. Homes in Haiti lack amenities, such as HVAC that make the interiors of the homes thermally comfortable living environments. This is why placement of homes under or near site vegetation is so important. Since Haiti is near the equator, the sun is directly overhead at noon. Therefore, shading is only possible when the sun is rising in the east and setting in the west if homes are only constructed near vegetation and not under. The homes on the Labady compound and Toto's family compound, as show in Figure 53, are all placed near vegetation. The purple fill shows how much of the homes can be shaded when the sun is in the east. With the direct sun overhead at noon, these homes become very warm, especially if not all of the rooms are receiving ventilation. It is not always possible for every home on every compound to be constructed under vegetation or shade all of the time, so it is important for the family of the compound to take the initiative to plant trees near their homes. This not only helps protect their homes from solar heat gain, but also helps with the countrywide initiative to combat the deforestation of their country.

Figure 53: Houses constructed in shade (Author)

Along with the placement of the homes on the compounds, the orientation of the homes were also determined by the prevailing wind direction. The front of all the houses, the side with the most apertures, faces the prevailing wind direction to provide ample ventilation into the home which is represented in Figure 54. Although the families did well in placing their homes in such a way to take advantage of natural ventilation, many of the houses have interior walls that prohibit air flow throughout the entire home.

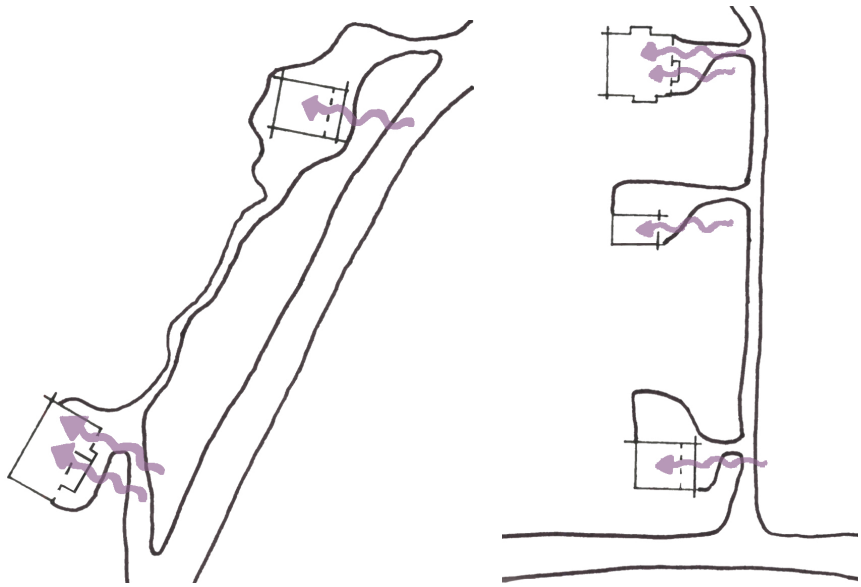


Figure 54: Entrances to home face prevailing wind directions for ventilation (Author)

Defense

Another determinant of dwelling settlements that Rapoport found to be very influential is defense. Family compounds in rural Haiti are developed for defense and protection in several ways. All of the compounds have a private path that is solely used by the family. This keeps public traffic from passing right by their homes. As discussed earlier, vegetation is placed between the main road and the homes on the compound for privacy but it also provides security for the family. In most instances, the vegetative buffer will include a cacti fence that inhibits intruders from passing through the brush. This is diagrammed in Figure 55 in Toto's family compound. Many compounds will also have wrought iron gates that block off the entrances to the private path to further secure the compound. Defense also determines how houses are oriented and placed on the compound. Houses are placed on the site so that their is a house at each entrance to the private path of the compound. This provides security through visibility to the compound and can be seen in the diagram of the Labady compound in Figure 55. Security through visibility is also made possible through the orientation of the homes. Haitian's spend a majority of their lives living outside the home in the yard or on front porches. Thus, front porches face the main road or entrance to the compound so families can see and control who is entering their compound.

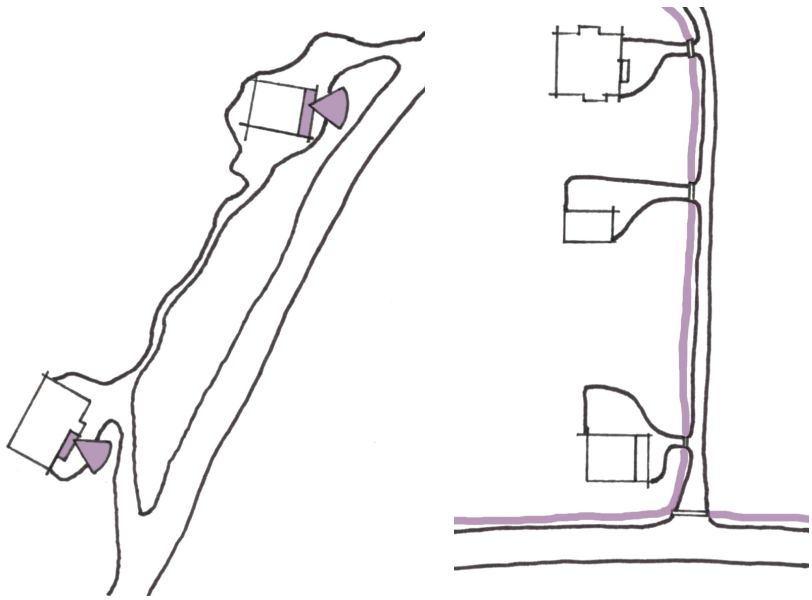


Figure 55: Security through visibility, cacti fences, and gates (Author)

Economics

The final determinant that impacts the development of Haitian compounds and house form is economics. As previously stated in the text, it is in Haitian culture and tradition to add additions to ones home as resources and materials become available to them. This is partly because Haitians can not afford to build a large home at one time. Most oftenly, rooms are added to a house as the family grows and more space is needed. There are two main forms of traditional houses in Haiti, the Kay style and Creole style house. Both of these houses start at their simplest form with a salle (dining room) and chambre (bedroom). The main difference is the location of the front porch and how the house expands. In the Kay style the front porch is located on the short side of the home as opposed to the Creole style where the front porch is located on the long side of the house (Stouter 21). Figures 56-60 shows sketches by landscape architect Patti Stouter of her research on Kay and Creole style housing in Haiti.

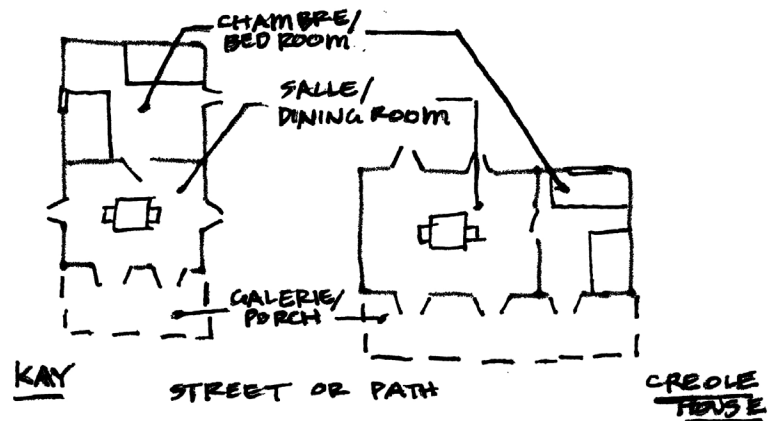


Figure 56: Traditional Style Housing in Haiti (Stouter 21)

For the Kay style house, additional rooms are commonly added on to the back of the home. Sometimes the last additional room is larger with a level above it. The Kay style can also expand on either side incorporating a larger porch or more rooms. The growth of this style of house can be seen in Figure 58.

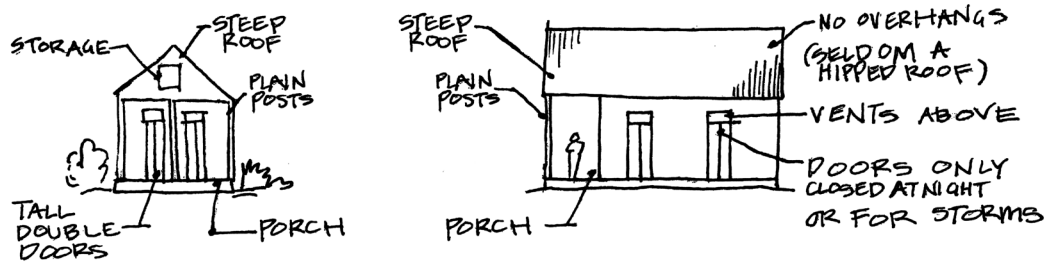


Figure 57: Elevations of Kay style house (Stouter 22)

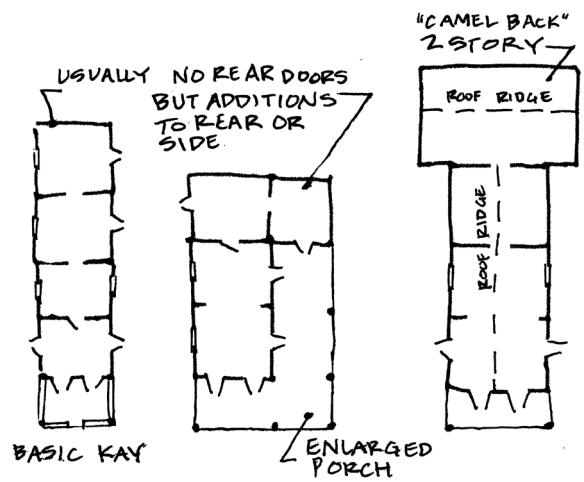


Figure 58: Expansion of Kay style house (Stouter 23)

Additions for the Creole style house can be added on to either side of the original form enlarging the house and the front porch. Haitians also add rooms on to the back of the house duplicating its size. Figure 60 on the following page shows the expansion of this traditional style house.

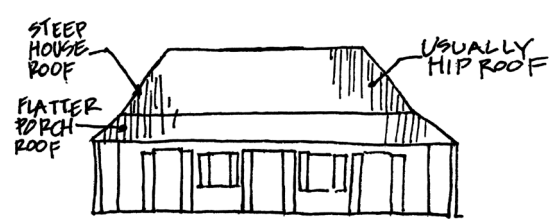


Figure 59: Elevation of Creole style house (Stouter 24)

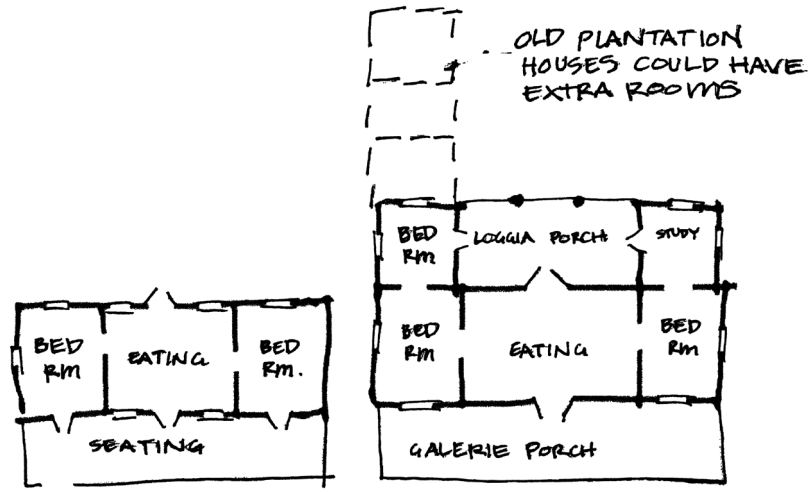


Figure 60: Expansion of Creole style house (Stouter 25)

In summation, there are many determinates taken into consideration when Haitian families are developing and expanding their compounds and each of them play a vital role in the health and sustainability of the houses and compounds.

Chapter 9

Proposed Disaster Recovery Strategy for Fond-des-Blancs, Haiti

This chapter will focus on the implementation of the proposed disaster recovery strategy for Fond-des-Blancs, Haiti in the event that a natural disaster devastates the community. For this situational analysis, the Labady compound will be the focus for reconstruction and the application of the Phase 1 House.

Phase 2: Destruction to Housing

In order to implement the proposed disaster recovery strategy, the community of Fond-des-Blancs will be hit with a natural disaster scenario. For this study, Fond-des-Blancs has been hit with heavy rainfall and due to the deforestation of the landscape, a landslide has destroyed all of the houses on the Labady compound. The existing houses on the compound were not protected from the steep topography to the west of the site because the family has not constructed any retaining walls. Due to the steepness of the topography, a landslide will have devastating effects to these existing structures.

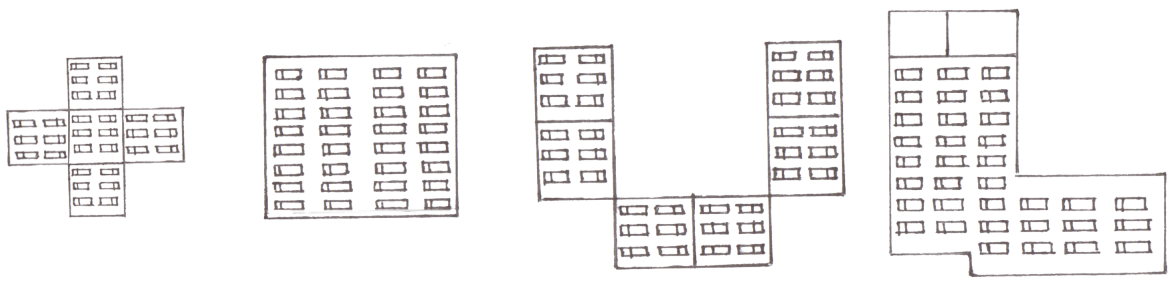
Immediately following the landslide, medical teams from St. Boniface Hospital and local Haitians begin the search and rescue phase. Once outside aid arrives, organizations such as the Red Cross, United Nations (UN), and Non-Governmental Organizations (NGOs) assist the community in search and rescue. These organizations are usually equipped with tools that help move and lift debris off of those trapped under the rubble.

As the search and rescue phase is underway, the Caleb Fellows work with the local and national government to begin the implementation of this disaster recovery plan that they have reviewed prior to the disaster. The Caleb Fellows can also set up headquarters at the major nodes in the community, such as the L'Exode Secondary School, the market, and the church where local Haitian's can go to figure out what the next steps are for their families. Since the Caleb Fellows will ultimately be sent out to lead other rural communities in Haiti, if the disaster effects multiple communities, it allows the Caleb Fellows to work together simultaneously through the recovery process. This creates a strong network throughout rural Haiti that will improve the effectiveness of the overall recovery plan. While the Caleb Fellows are assisting the community of Fond-des-Blancs, the current president, Michel Martelly, makes an appeal for outside aid. Martelly works with the United Nations to conduct initial needs assessments in order to mobilize relief efforts.

In addition, along with search and rescue and the strategic planning for outside aid and the mobilization of the recovery process, treatment and survival is also ongoing. If the St. Boniface Hospital is not destroyed in the landslide, then injured survivors can be taken to this local hospital to receive immediate treatment. If the hospital is destroyed, outside organizations, such as the UN and Red Cross can set up medical camps where medical teams can treat the injured. These field hospitals can be set up in public locations near the existing hospital or at other nodes within the community.

Phase 3: Emergency Housing

The next phase of the Labady's housing situation is emergency housing. Since the landslide destroyed all of the houses on the Labady compound, the family will need shelter for the next few weeks to months until the Phase 1 House can be constructed on their site. Depending on the severity of the disaster, if the classroom and cafeteria spaces of the L'Exode Secondary School are not damaged or destroyed, the IDPs of Fond-des-Blancs can find emergency shelter in these places. Haitians can also find emergency shelter in the local market and church if they are not destroyed as well. Figure 61 below diagrams the openness of these buildings and how beds can be placed so IDPs have shelter to sleep under and a place to keep their remaining valuables.



Church Market L'Exode Secondary School Secondary School Cafeteria

Figure 61: Emergency Shelter (Author)

In addition to the emergency shelters provided by the local community, the International Federation of Red Cross and Red Crescent Societies (IFRC) coordinate emergency camp clusters with the help of the United Nations Human Settlements Programme (UN-HABITAT). The magnitude of the disaster will determine the amount of temporary camps and tents that will be needed. Organizations such as the World Food Programme provide food and basic services to the displaced population of these camps. Figure 66 shows a color-coded map for the location of emergency shelters and camps within Fond-des-Blancs in the event of a landslide. The key for these color codes can be found below in Figure 62. Emergency housing maps for the community of Fond-des-Blancs have also been created in the event of an earthquake and a hurricane. These maps can be found on pages 53 and 54. The coordination and set up of these camps and shelters will be a combined effort from the Caleb Fellows, the local community, and aid organizations. The Labady family can seek emergency housing in any of the following locations identified on the map on the next page.

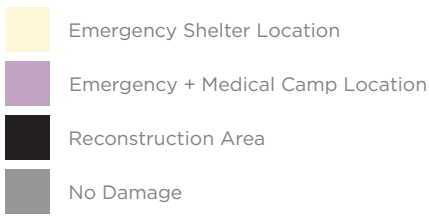


Figure 62: Color-Code Key for emergency housing location maps. Figures 63-65 (Author)

Figure 63: Location of emergency camps and shelters in the event of a landslide (Author)
Large map is of L'Exode Secondary school and Labady compound

In the event of an earthquake, the structures made of concrete masonry will likely collapse if not reinforced adequately or lack rigidity. For this case, we will assume a worse case scenario where the majority of the structures in Fond-des-Blancs are destroyed. Open land around the major nodes in the community will be used for emergency camp sites for the internally displaced Haitians in Fond-des-Blancs. The location of these emergency camps is show on the map in Figure 64.

In the event of a hurricane, The structures made of concrete masonry will likely withstand if properly reinforced. This includes phase 1 of the secondary school, the cafeteria, Jonas Labady's house, the teacher's house, the market building and St. Boniface Hospital. The remaining structures made of wood post and wood truss roofs covered with corrugated metal sheets will likely see moderate damage if not total destruction due to the structures weak fastening and light roofs. The emergency housing map for this scenario can be found on page 54.

Phase 4: Site Clean-Up/Material Storage

Once IDP families have found emergency shelter and have been treated for their injuries, they have the opportunity to return to their compounds daily to clean up their site and salvage materials for their Phase 1 House. Since the emergency shelters and camps are planned locations within the community, it gives IDPs the ability to travel to and from their compounds as needed. Phase 4 is an important phase for the proposed disaster recovery process. Unlike the existing phase, IDPs are taking the first initiative in the rebuilding of their homes and community. Aid agencies in Fond-des-Blancs will be able to assist families in the clean-up of their site.

For the Labady family, they have the potential to salvage many different materials due to the variation in construction materials of their existing structures. Jonas Labady's house was constructed with a concrete structural frame and infilled with cmu block. His kitchen was constructed of tree branches, infilled with adobe thatch, and the roof structure consisted of wood lumber and corrugated metal. Jonas Labady's sister house consists of a tree branch frame with woodweave panels set inside. It has a wood frame roof covered with corrugated sheet metal. Jonas Labady's mothers house is constructed of a wood lumber frame infilled with wood panels. Her kitchen was built using a tree branch frame that was infilled with woodweave panels and covered with a wood frame roof and corrugated metal. Images of these structures can be viewed again in Figure 46 on page 39. Therefore, the Labady family can potentially salvage materials such as woodweave panels, tree branches, corrugated metal sheets, wood panels, and wood lumber to use in their Phase 1 House. The existing concrete slabs can also be crushed up to use as aggregate in the concrete mix for the new slabs.

Figure 64: Location of emergency camps and shelters in the event of an earthquake (Author)
Large map is of L'Exode Secondary school and Labady compound

Figure 65: Location of emergency camps and shelters in the event of a hurricane (Author)
Large map is of L'Exode Secondary school and Labady compound

Phase 5: Phase 1 of House Reconstruction

Now that the Labady compound has been cleaned up and materials sorted and salvaged, the Phase 1 House can be constructed in place of the families existing homes. While in the emergency camps, the IDPs work with the Caleb Fellows to organize and plan their new homes. IDPs inform the Caleb Fellows of the number of people in their family, how many bedrooms they will initially need, whether they would like a Kay or Creole style house, and if they would like a concrete or wood structural frame for their house. All of the Phase 1 Houses will be based off of the Kay and Creole style houses and each house will start with a salle and one or two chambres depending on the size of the family. The structural grid for the Phase 1 House design was based off of a three foot grid. The three foot grid can be patterend to develop nine and twelve foot modules for individual rooms. This grid was determined by studying the grid patterns of existing houses in Haiti. Figure 66 shows the grid pattern of Jonas Labady's mothers existing house. The enclosures and apertures of the house were based off of a three foot grid pattern.

Figure 66: Typical Haitian Housing Grid (Author)

The first phase of the Phase 1 House is the construction of the concrete slab, structural frame, and wood frame roof. In order to ensure that proper construction techniques are used in the construction of these houses, local Haitians and contractors can use the guidance of the LIFEHouse publication. LIFEHouse is a User Construction Manual meant to teach and guide local Haitians in safe, healthy and sustainable building

practices (Tarovella and Godwin). The publication has been a joint effort by local Knoxville, TN architects, editor Susanne Tarovella, coeditor Andy Godwin, contributors Joleen Darragh and Chris King and by University of Tennessee College of Architecture and Design Faculty, John McRae and David Matthews. Figure 67 below show illustrations from the LIFEHouse publication.

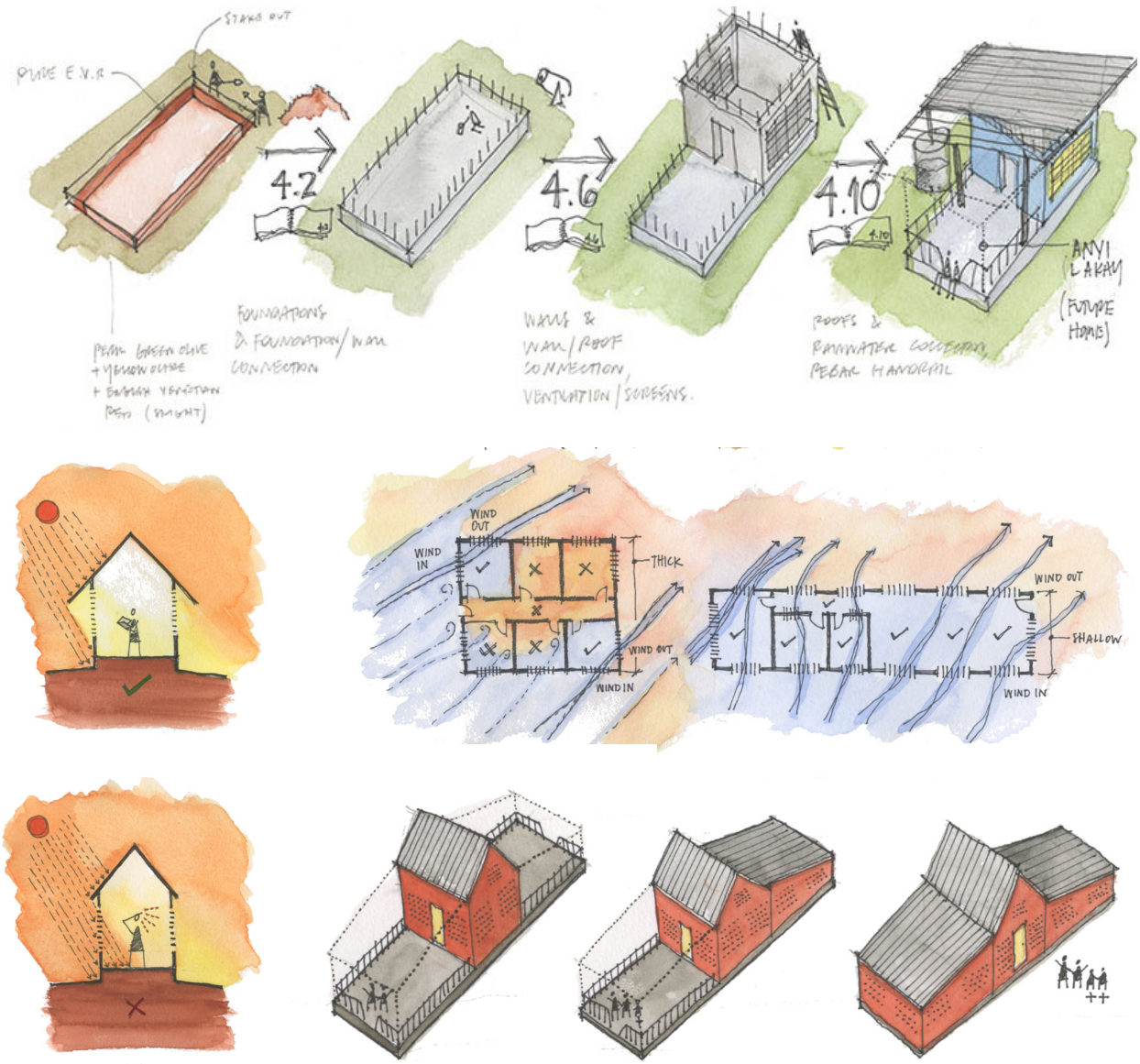


Figure 67: Illustrations from LIFEHouse (Tarovella and Godwin)

Once the structural frames for the Phase 1 Houses are constructed, fabricated wrought iron panels that are 9'x10' and 12'x10' can be attached to the structural frame. These modular panels have wood furring strips on their vertical members so IDPs, such as the Labady family can attach their salvaged materials and enclose their homes. The panels give the families the freedom to create doorways and window openings where they see fit and allows them to personalize their house. Wherever there is a lack of salvaged

materials to cover the panels and enclose the house, sheets or plywood can be used to cover the remaining openings. Figure 68 below shows the two types of fabricated panels that are available in a nine foot panel, twelve foot panel, and front door panel. The first panel is the one previously described and made from wrought iron with wood furring strips mounted to the front. The second panel, which would be the suggested first option for the panel system, is the use of salvaged tree branches that are connected into a modular frame by flat stock steel. These panels would reduce material costs in the construction of the panels and IDPs can attach salvaged materials directly to the frame. Attachment 4 of this document demonstrates the steps in the construction of the fabricated panels and their integration in the Phase 1 House.

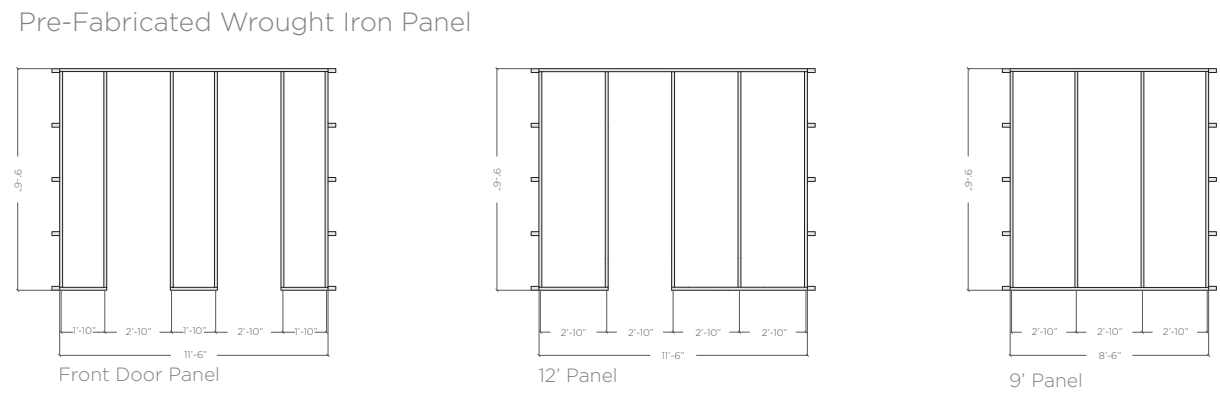


Figure 68: Panel System Construction and Options (Author)

For the Phase 1 Houses on the Labady Compound, Jonas Labady's second generation house will be a concrete structural frame based off of the Creole style House. Jonas Labady's sister second generation house will also be based off of the Creole style house but constructed of a wood structural frame. Lastly, Jonas Labady's mothers first generation house will be built of a wood structural frame and based off of the Kay style house. Figures 69-79 represent Phase 5 of the housing process and the implementation of the Phase 1 Houses on the Labady compound.

1st generation Labady House_Jonas's mothers house

2nd generation Labady House_Jonas's sisters house

2nd generation Labady House_Jonas's house

Figure 69: Proposed Site Plan for Labady compound (Author)

Figure 70: Plan of 1st generation home_Phase 1 (Author)

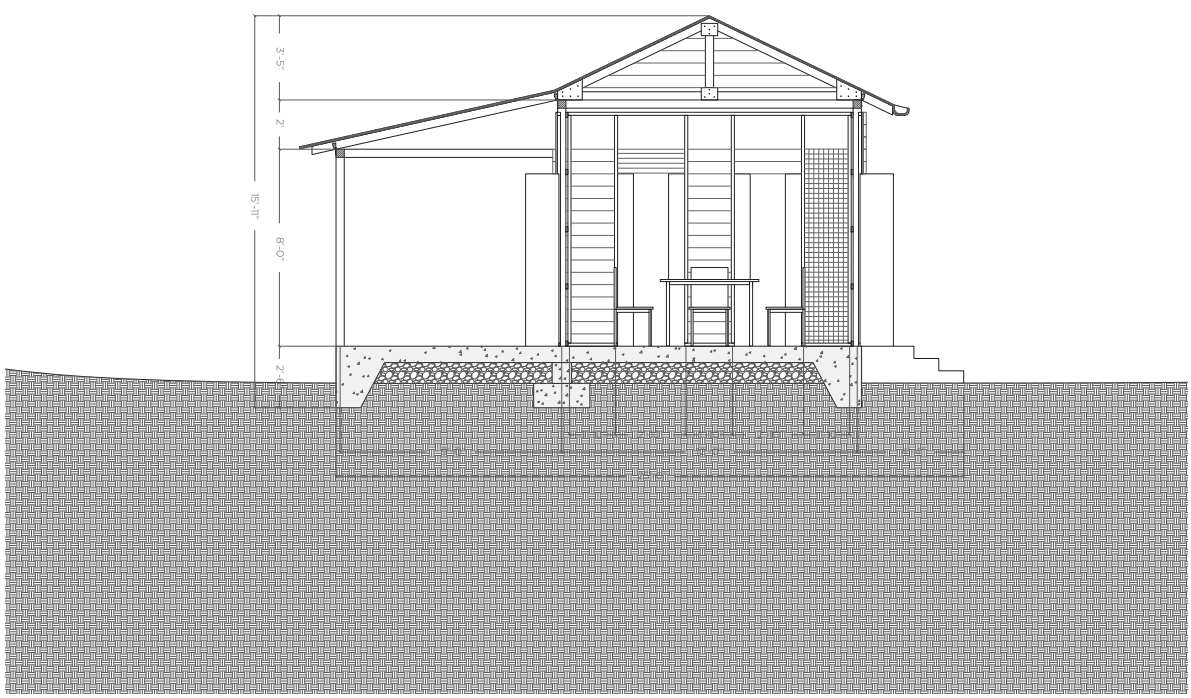


Figure 71: Section of 1st generation home_Phase 1 (Author)

Figure 72: Exterior perspective of 1st generation home_Phase 1 (Author)

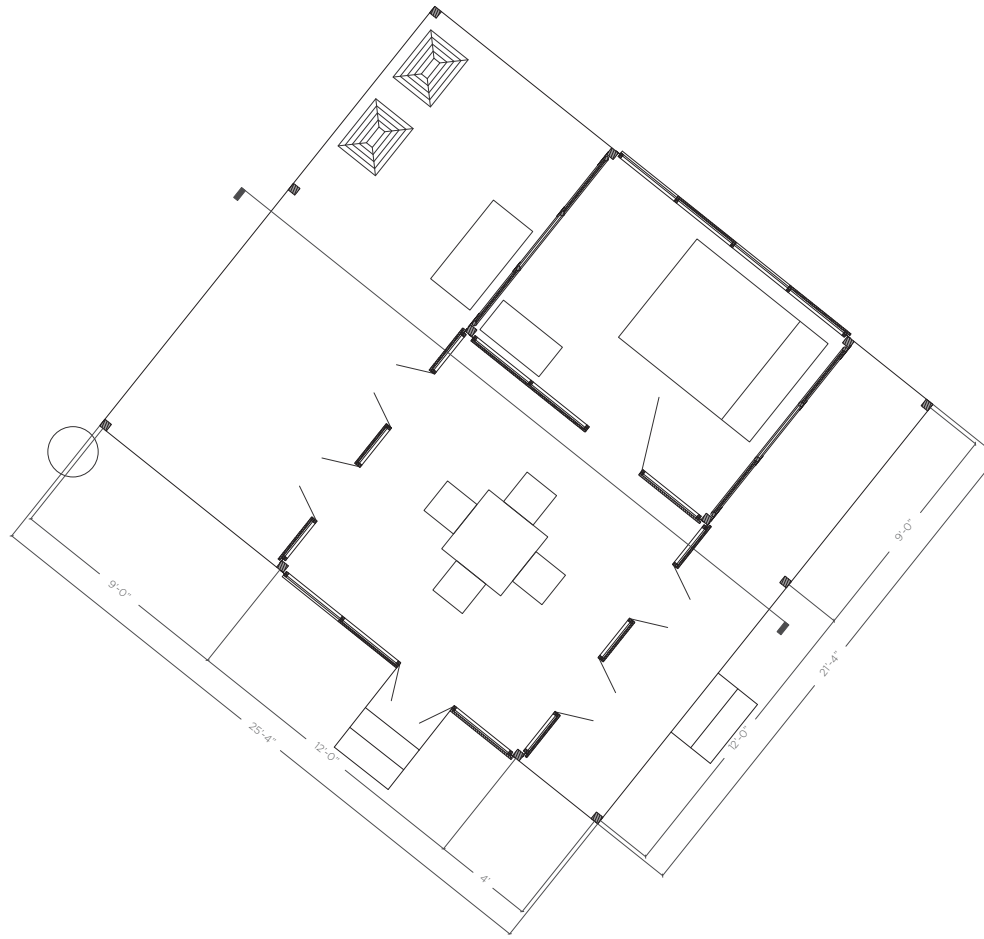


Figure 73: Plan of 2nd generation home_Phase 1 (Author)

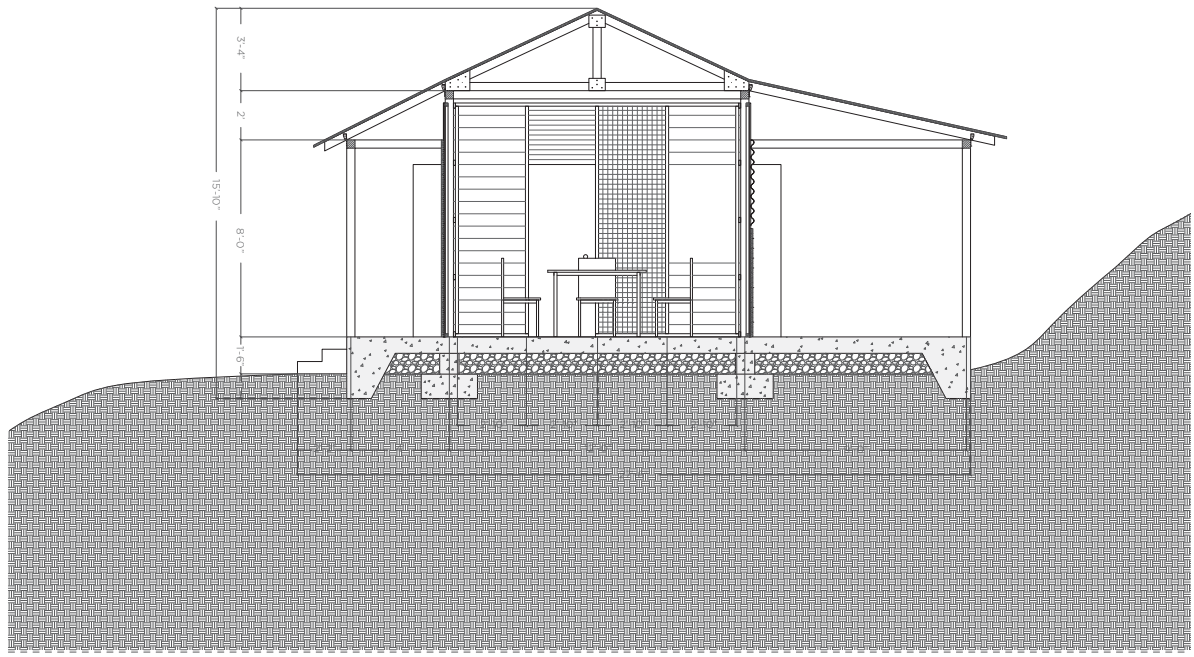


Figure 74: Section of 2nd generation home_Phase 1 (Author)

Figure 75: Exterior perspective of 2nd generation home_Phase 1 (Author)

Figure 76: Plan of 2nd generation home_Phase 1 (Author)

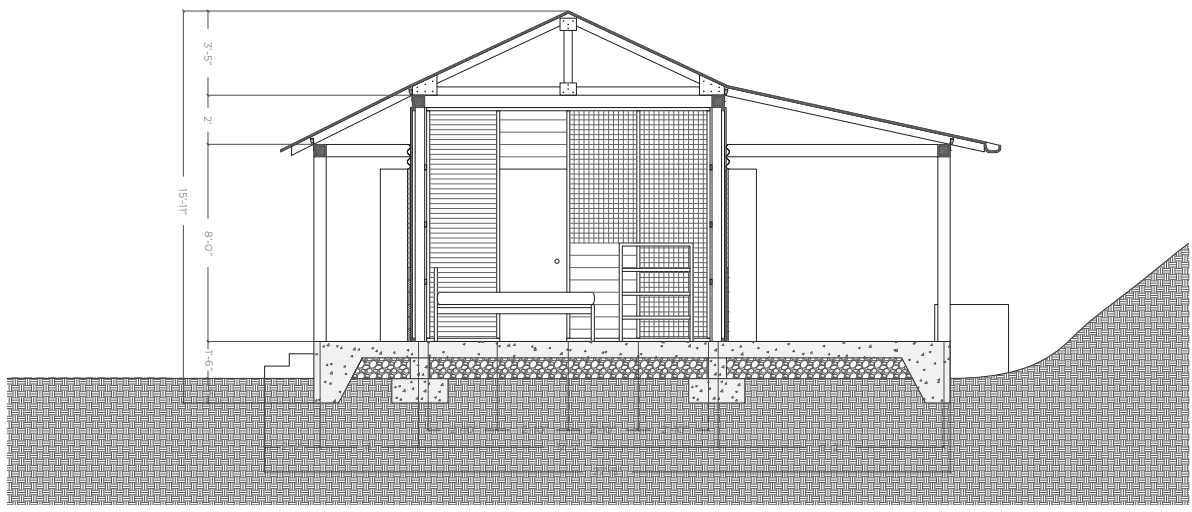
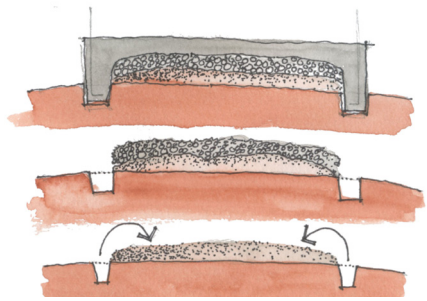


Figure 77: Section of 2nd generation home_Phase 1 (Author)

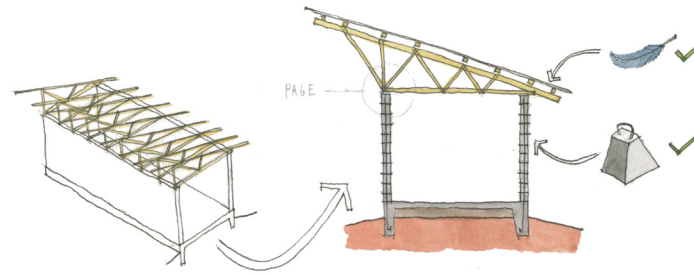
Figure 78: Exterior perspective of 2nd generation home_Phase 1 (Author)

Figure 79: Sectional-axon showing panel application and interior salle_Phase 1 (Author)

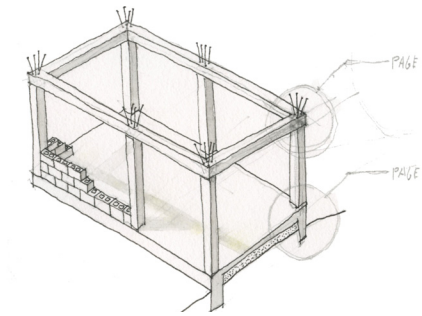
For the construction of the first phase of the Phase 1 House, the following LIFEHouse illustrations have been selected as conducive. Organizations such as the United States Agency for International Development (USAID), the Office of U.S. Foreign Assistance (OFDA), the National Military, NGOs, and small volunteer groups can also help contractors and IDPs in the construction of their homes by assisting in the development, analysis, and promotion of post-disaster best practices.



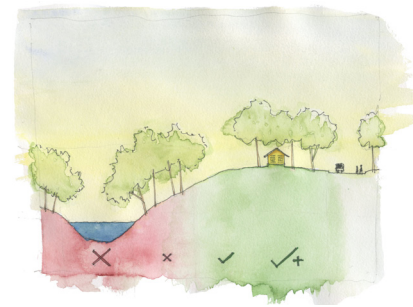
Concrete Foundation



Light-Frame Roof Structures



Concrete Construction + Reinforcement



Site Selection

Figure 80: LIFEHouse illustrations that are applicable in Phase 5 (Tarovella and Godwin)

The Phase 1 House is very beneficial to the reconstruction process. This new house reduces the need for temporary camps and houses, it provides business to the local steel shop, it reuses salvaged materials, it is structurally sound, and gets the community actively involved in the reconstruction process and the personalization of their home.

Since the Phase 1 House replaces the need for temporary houses, the money used for these structures can now be invested into the construction of the Phase 1 House. This funding is provided by International Financial Institutions (IFIs), the World Bank, Regional Develpoment Banks, and private donors. Although the upfront costs for the Phase 1 House is more than most temporary shelters, the long-term costs of the Phase 1 House is cheaper. The Phase 1 House reduces the need to build a permanent house because it is permanent. Figure 81 shows a cost analysis between the Phase 1 House and a temporary shelter that was constructed by Catholic Relief Services after the January 12th, 2010 earthquake in Port-au-Prince Haiti.

Catholic Relief Services_Temporary Housing
Constructed in Port-au-Prince, Haiti following January 12th, 2010 earthquake

1st Generation Labady House
$3,000

2nd Generation Labady House
$3,000

2nd Generation Labady House
$3,000

Total Cost to Build Temporary Shelters on Compound = $9,000

Proposed Phase 1 Housing_Permanent Housing
Phase 1 Housing constructed instead of temporary shelters

1st Generation Labady House
$6,000

2nd Generation Labady House
$6,000

2nd Generation Labady House
$6,000

Total Cost to Build Permanent Houses on Compound = $18,000

Total Construction Costs of Rebuilding Labady Compound

Following Existing Disaster Relief Strategies:

Temporary Shelters $9,000 + Permanent Housing $18,000

Total = $27,000

Following Proposed Disaster Recovery Strategies

Temporary Shelters $0 + Permanent Housing $18,000

Total = $18,000

Figure 81: Cost Analysis of temporary shelters vs. Phase 1 House (Author)

The Phase 1 House also saves in construction costs because salvaged materials are being used to infill the structure. A 4x8 sheet of plywood In rural Haiti cost around $150.00 (Thomas). Reducing the need to use a large amount of this material in the initial phase makes a large difference in the overall cost of the house. Using salvaged material in the construction of the house also gets the community involved in the reconstruction of their homes. Having the ability to personalize the openings and enclosures in their homes makes each house unique and unlike the monotonous rows of temporary shelters. The panel system also improves the economy of Fond-des-Blancs. The local steel shop has the opportunity to construct the wrought iron panels that will be used in numerous Phase 1 Houses throughout Fond-des-Blancs.

In addition to the above benefits of the Phase 1 House compared to temporary houses, the Phase 1 House is also structurally sound. The entire structure for the first phase of the house as well as all additional rooms is completely constructed during phase 1 of the Phase 1 House. Existing temporary shelters only consist of one to two rooms. IDPs will expand these shelters in order to add additional rooms. Often times their new structures are not securely connected to the existing temporary shelter, thus making the house and family vulnerable to future disasters. Since the Phase 1 House takes into account future expansion, IDP families only have to infill between the existing structure to add another room. This makes the longevity of the house secure and safe for Haitian families.

Phase 6: Phase 2 of House Reconstruction

Phase 2 of the Phase 1 House involves the addition of rooms and the beginning of the replacement of the wrought iron panels. In this phase, the panels that are replaced in the house by new permanent materials can be moved and attached to the structural frame of a kitchen. This allows the family to slowly rebuild all of the structures on their compound. For the Labady family, Jonas and his mother were able to replace panels from their house and use them for their kitchens in this second phase. Figure 82 on the next page shows the transformation of the site plan from phase 1 to phase 2 of the Phase 1 House. The wrought iron panels are very beneficial to the later phases of the rebuilding process because they are not permanent. If families want to infill the exterior walls to create an additional room, the now interior panel can be removed to create a space that is the size of two rooms. Other transformations that are happening during this phase is the addition of retaining walls to protect the Phase 1 Houses. The aggregate for these walls can come from the leftover broken up material of the existing slab. Gutters can also be added to the roofs of the Phase 1 House so the families can begin to collect rain water. The transformation of each house on the Labady compound can be viewed in Figures 82-93 on the following pages.

1st generation Labady House_Jonas's mothers house and kitchen

2nd generation Labady House_Jonas's sisters house

2nd generation Labady House_Jonas's house and kitchen

Figure 82: Site Plan for Phase 2 of Labady Compound

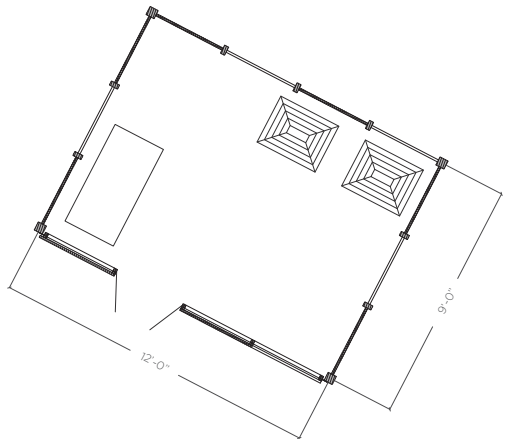


Figure 83: Plan of 1st generation kitchen_Phase 2 (Author)

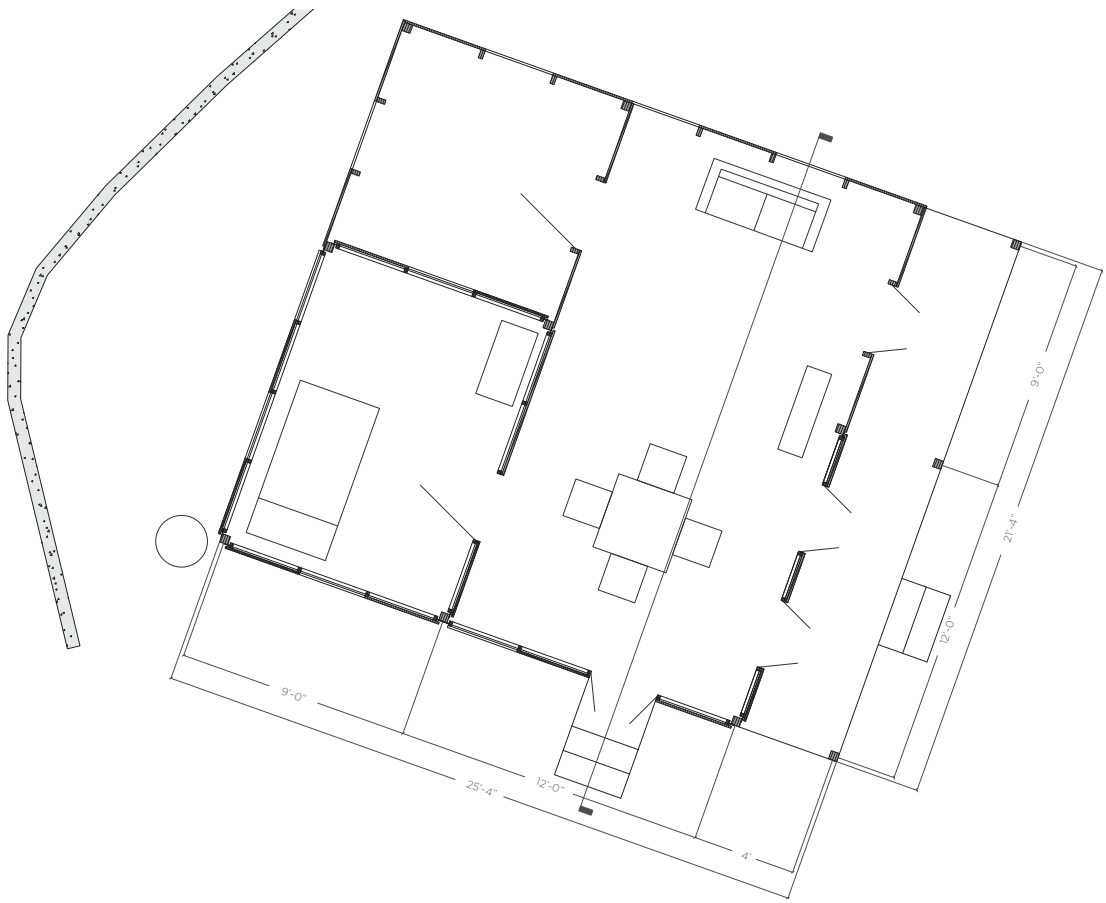


Figure 84: Plan of 1st generation home_Phase 2 (Author)

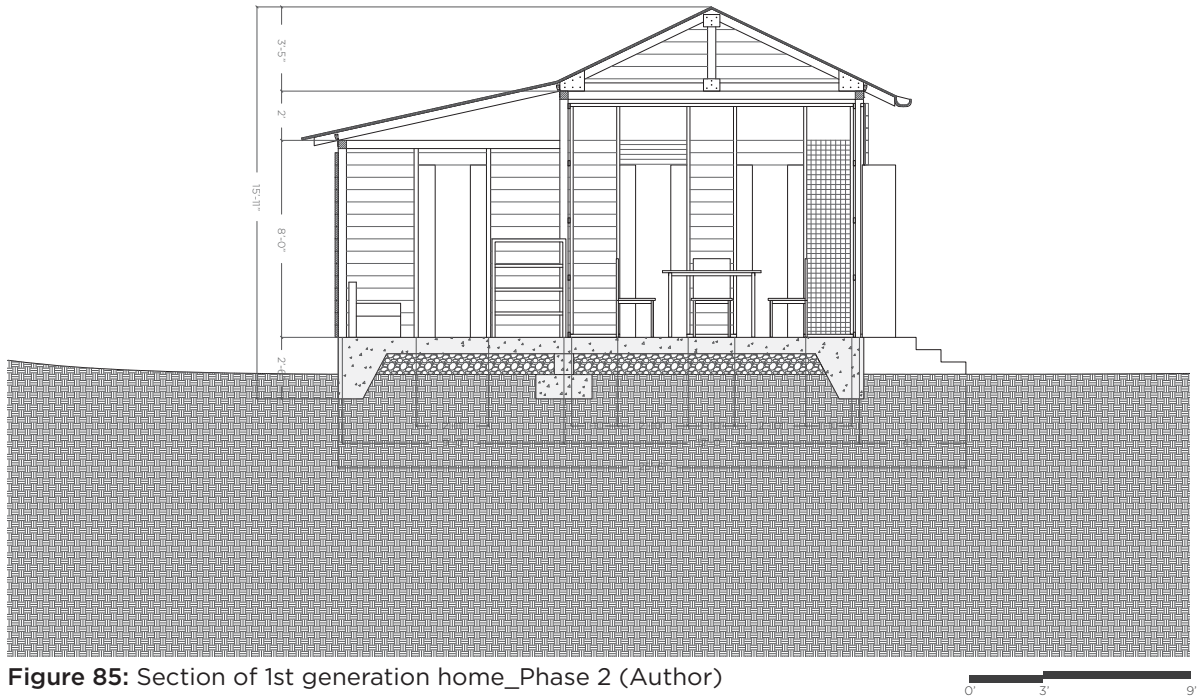


Figure 85: Section of 1st generation home_Phase 2 (Author)

Figure 86: Exterior perspective of 1st generation home_Phase 2 (Author)

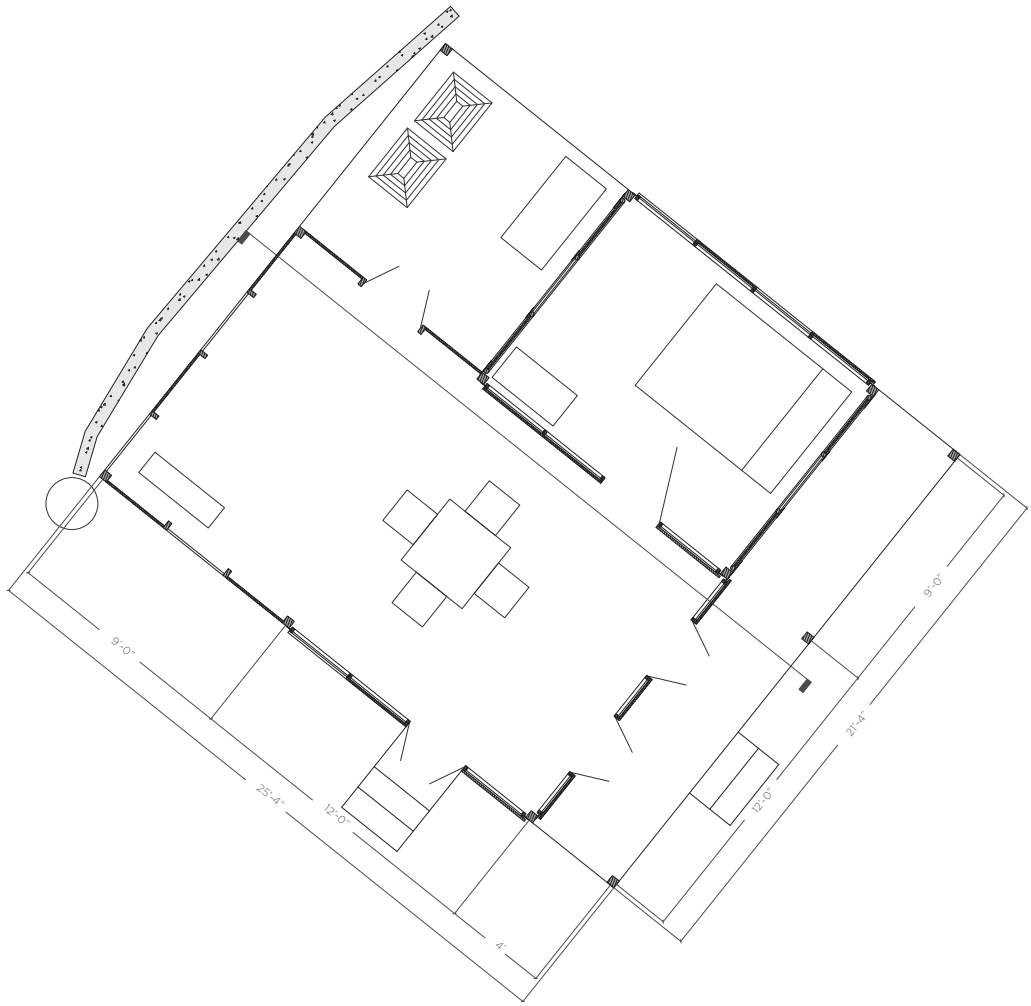


Figure 87: Plan of 2nd generation home_Phase 2 (Author)

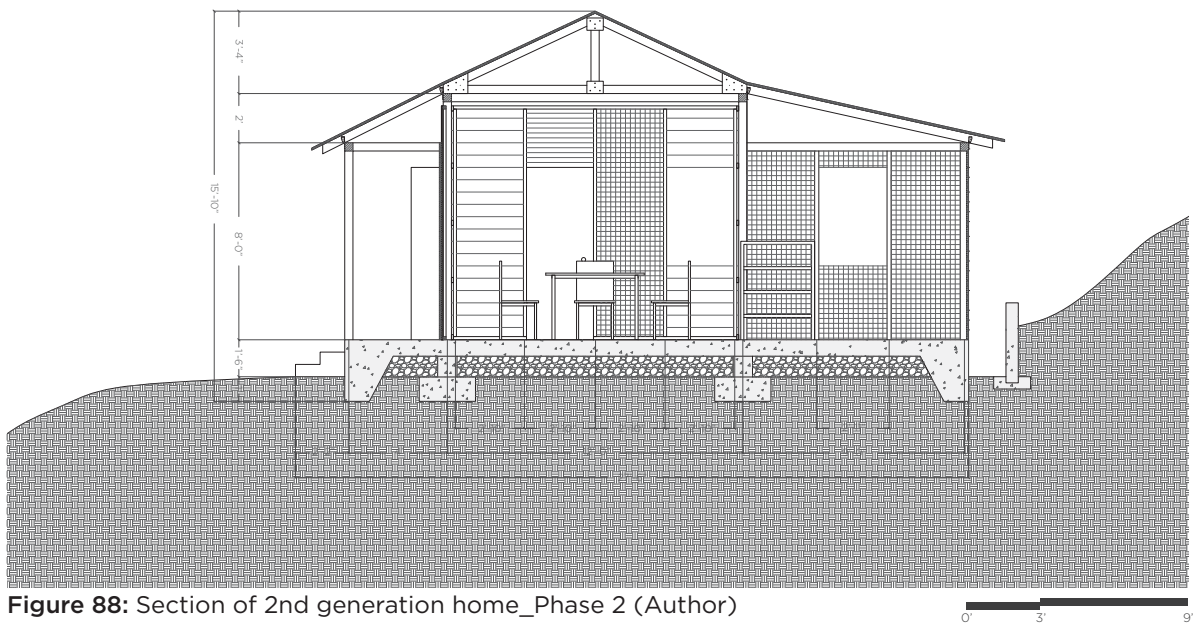


Figure 88: Section of 2nd generation home_Phase 2 (Author)

Figure 89: Exterior perspective of 2nd generation home_Phase 2 (Author)

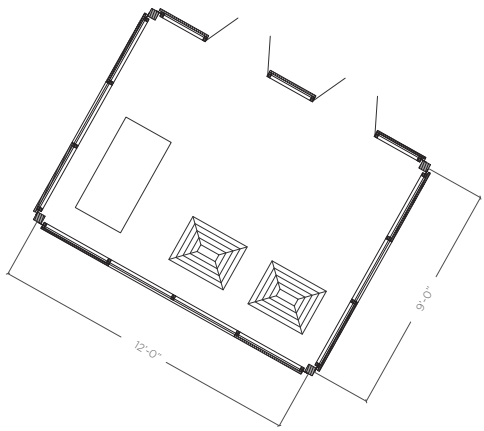


Figure 90: Plan of 2nd generation kitchen_Phase 2 (Author)

Figure 91: Plan of 2nd generation home_Phase 2 (Author)

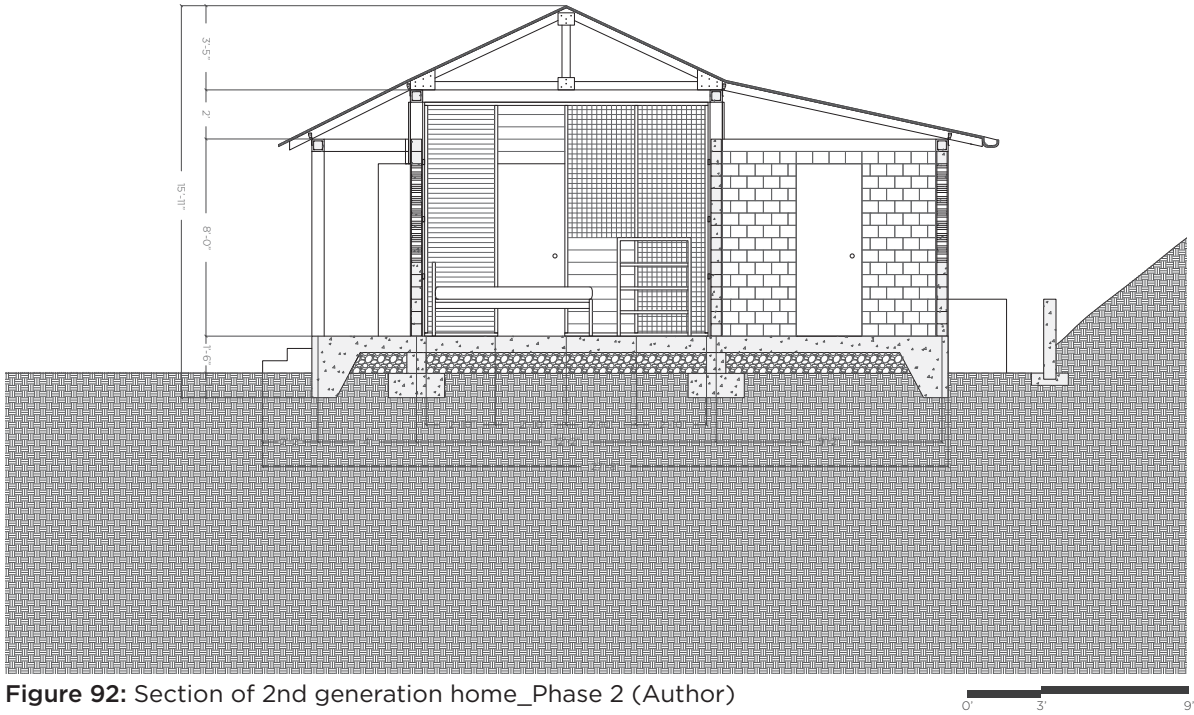
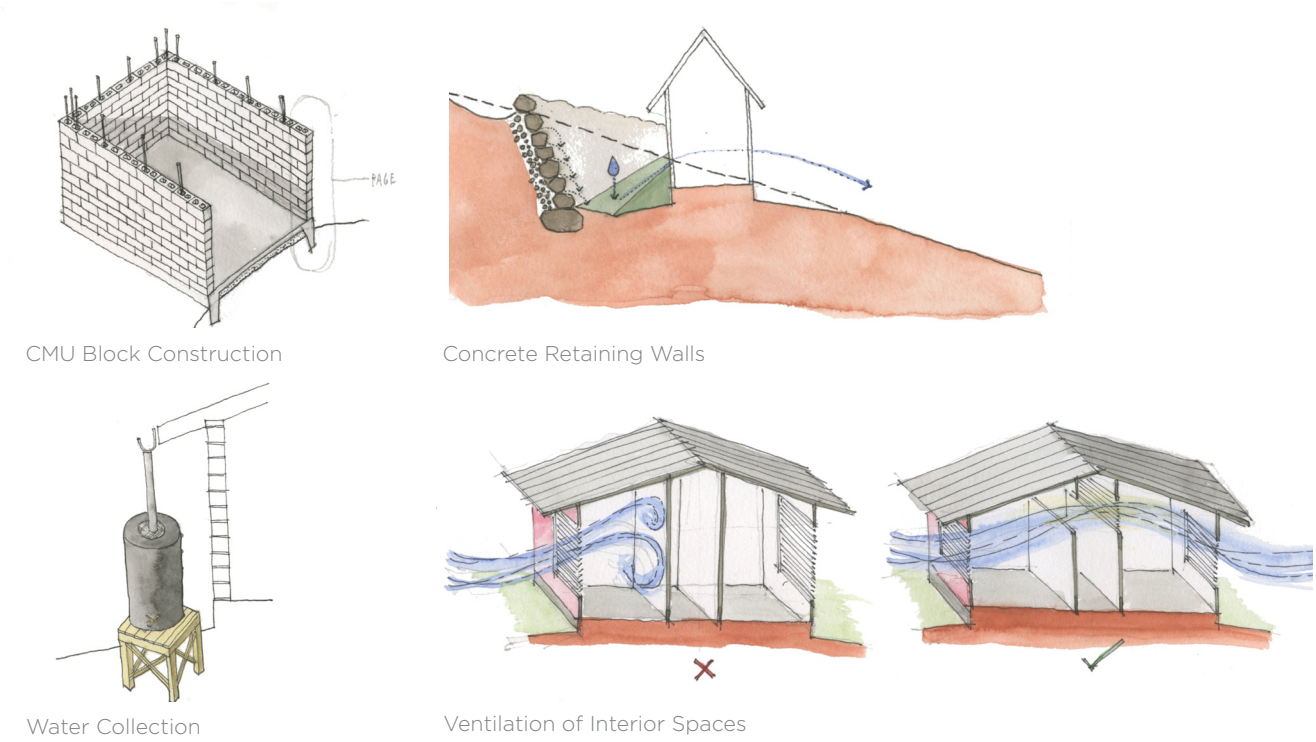


Figure 92: Section of 2nd generation home_Phase 2 (Author)

Figure 93: Exterior perspective of 2nd generation home_Phase 2 (Author)

For the construction of the additions of the second phase of the Phase 1 House, the following LIFEHouse illustrations have been selected as conducive.



CMU Block Construction

Concrete Retaining Walls

Water Collection

Ventilation of Interior Spaces

Figure 94: LIFEHouse illustrations that are applicable in Phase 6 (Tarovella and Godwin)

Phase 7: Phase 3 of House Reconstruction

In phase 3 of the house reconstruction, the wrought iron panels in the Phase 1 Houses are completely replaced with permanent building materials. In addition, some families are still infilling exterior walls to create additional rooms. Since rooms are still being added, it allows for the future integration of indoor plumbing into the Phase 1 Houses by placing all plumbing fixtures on the exterior walls that are under construction. Phase 3 also involves further personalization by each family to their individual Phase 1 House. The houses are finished with preferred materials and color is introduced into the pallet. When the Phase 1 House is completely transformed, each family has a permanent home that is structurally safe, healthy, and sustainable to future natural disasters. Figures 95-106 on the following pages show the final transformation and completion of the Phase 1 Houses on the Labady Compound. The wrought iron panels that have been replaced can be stored away until another disaster causes devastation to Fond-des-Blancs or other rural communities. Since wrought iron is very durable, the upkeep for these panels is minimal from disaster to disaster. Thus, investing in these panels initially will continue to save more and more money on disaster relief housing in the future.

1st generation Labady House_Jonas's mothers house and kitchen

2nd generation Labady House_Jonas's sisters house

2nd generation Labady House_Jonas's house and kitchen

Figure 95: Site Plan for Phase 3 of Labady Compound

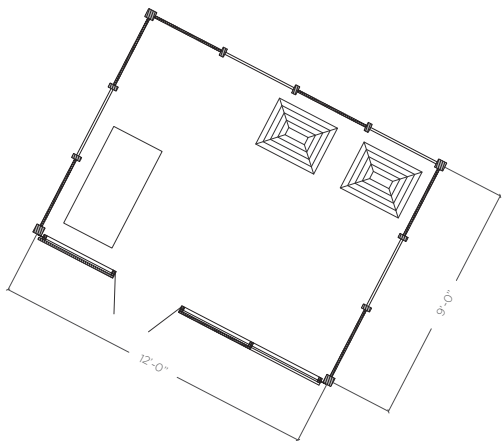


Figure 96: Plan of 1st generation kitchen_Phase 3 (Author)

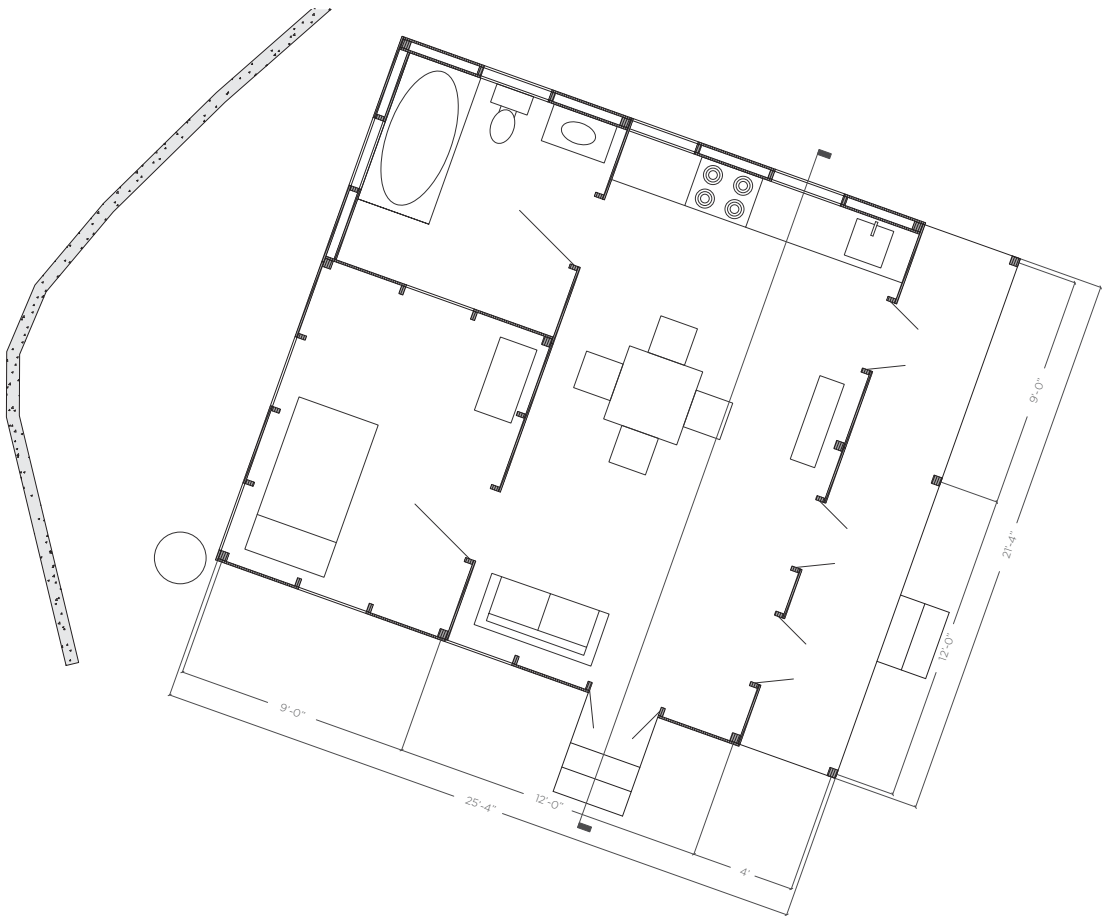


Figure 97: Plan of 1st generation home_Phase 3 (Author)

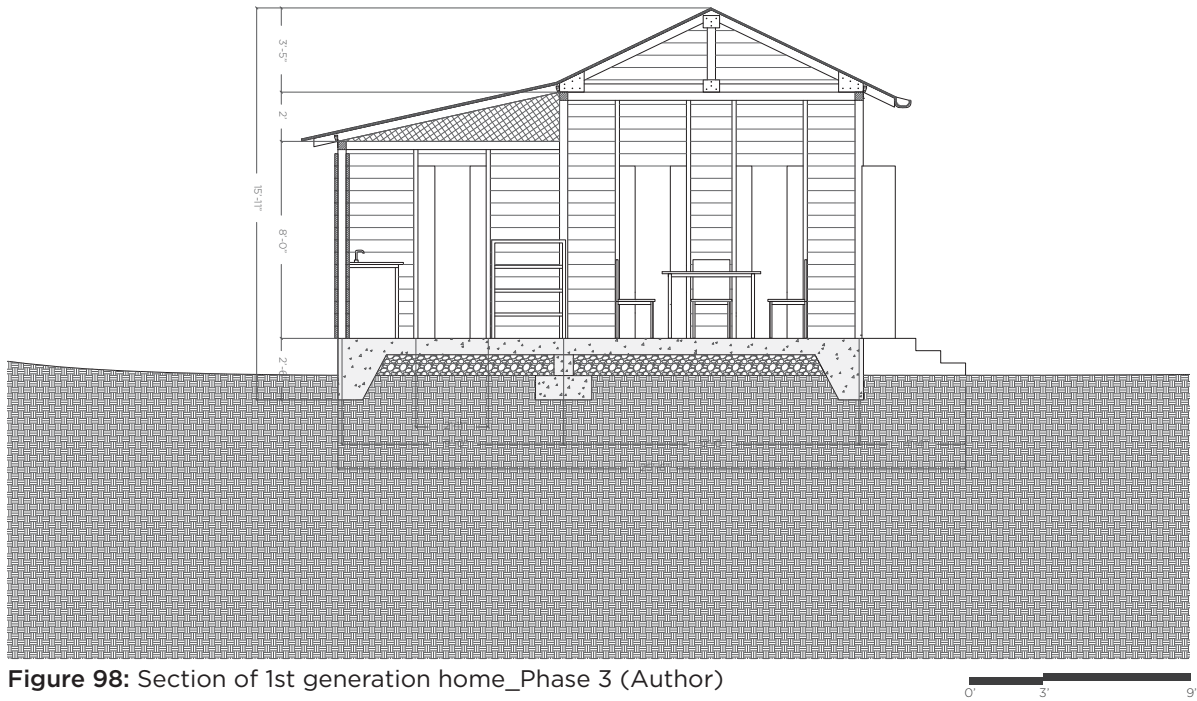


Figure 98: Section of 1st generation home_Phase 3 (Author)

Figure 99: Exterior perspective of 1st generation home_Phase 3 (Author)

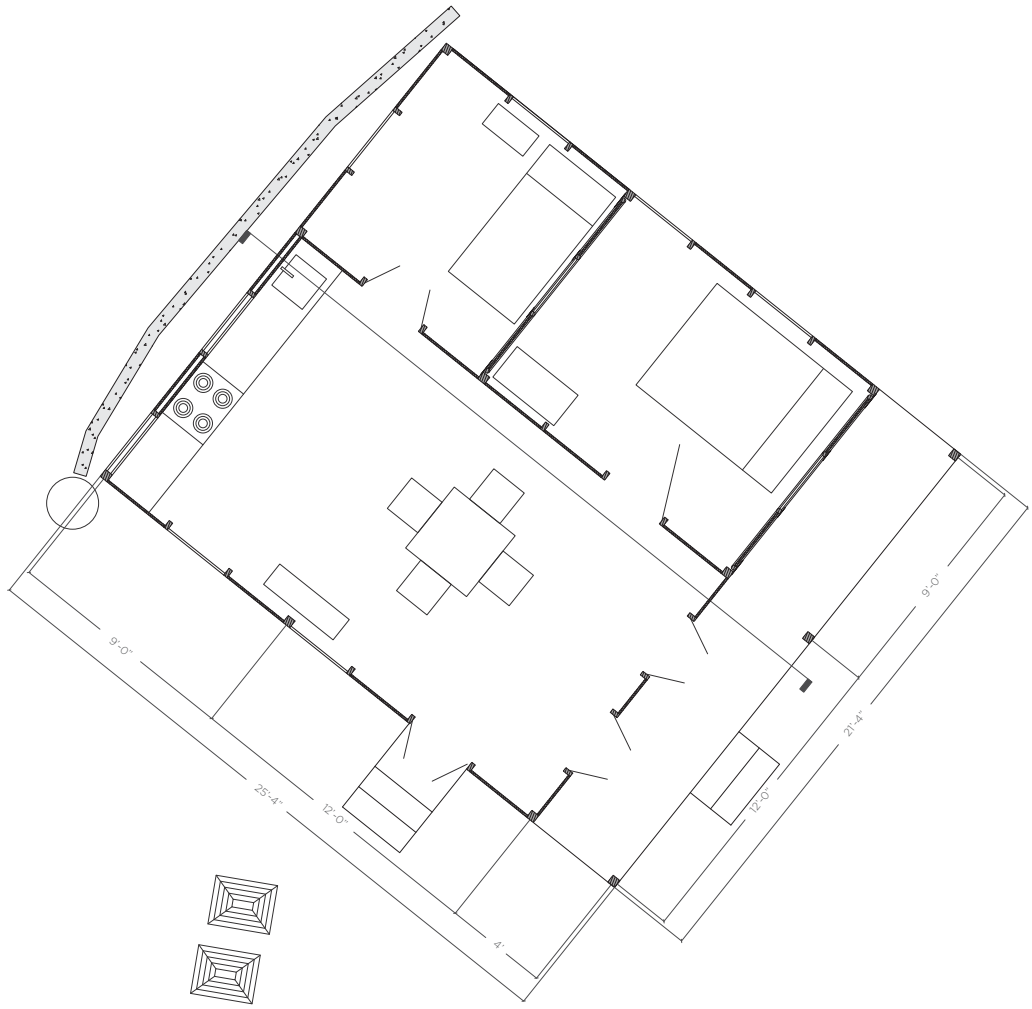


Figure 100: Plan of 2nd generation home_Phase 3 (Author)

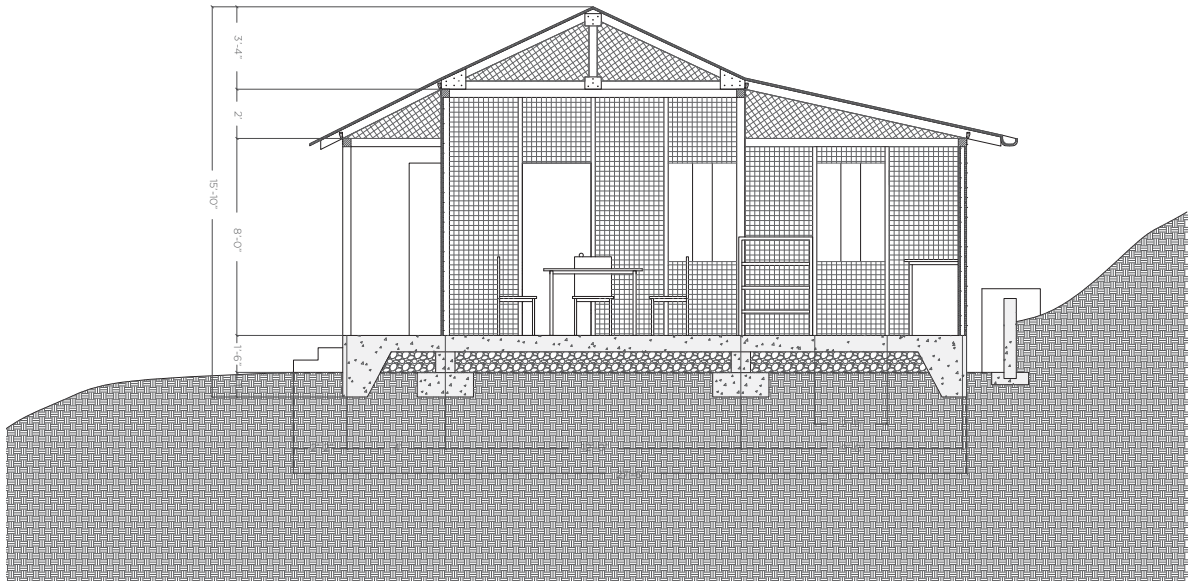


Figure 101: Section of 2nd generation home_Phase 3 (Author)

Figure 102: Exterior perspective of 2nd generation home_Phase 3 (Author)

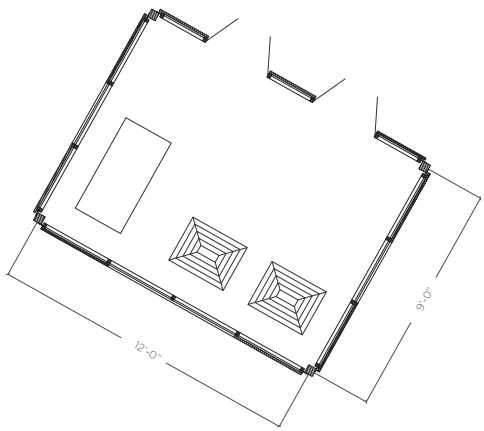


Figure 103: Plan of 2nd generation kitchen_Phase 3 (Author)

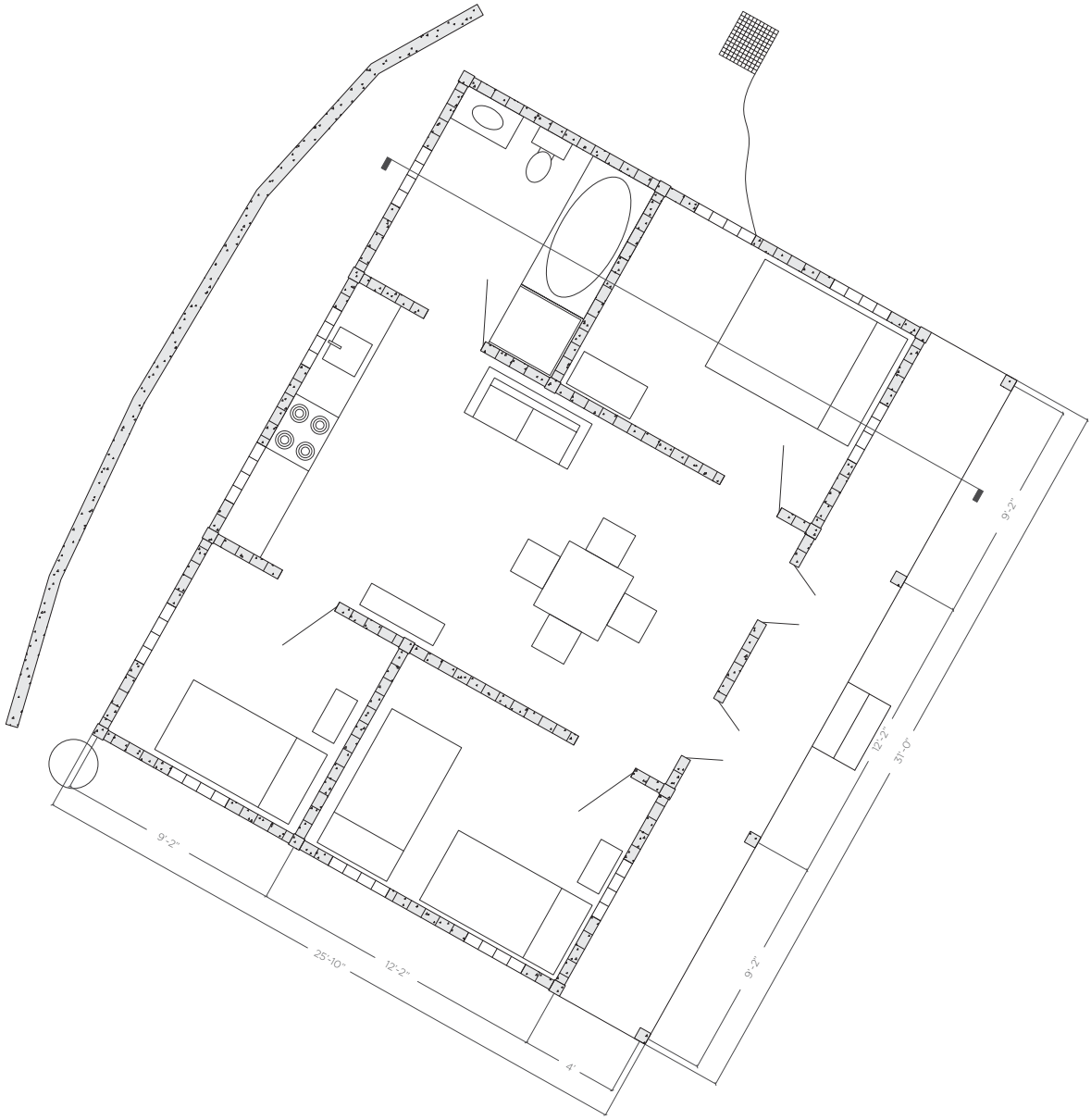


Figure 104: Plan of 2nd generation home_Phase 3 (Author)

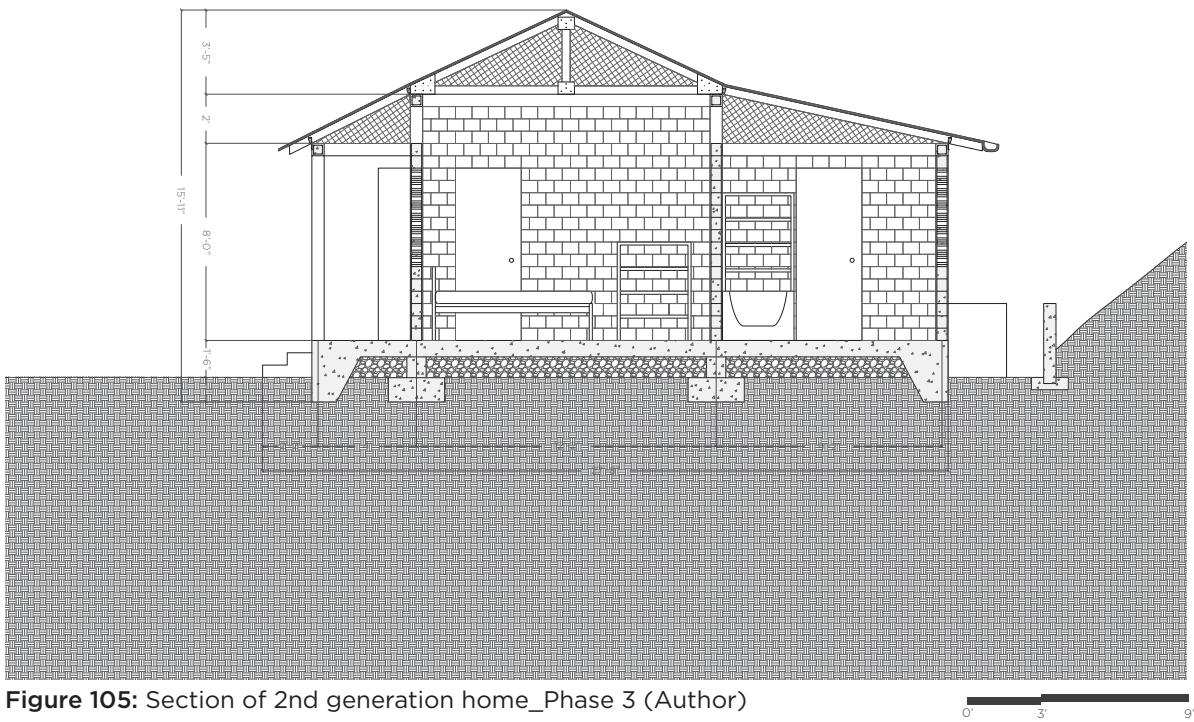


Figure 105: Section of 2nd generation home_Phase 3 (Author)

Figure 106: Exterior perspective of 2nd generation home_Phase 3 (Author)

Chapter 10
Sharing the Knowledge

The significance of the proposed natural disaster recovery process and the Phase 1 House is its transferability to other rural communities in Haiti and potentially developing countries around the world. The main principles of the proposed disaster recovery process and Phase 1 House that are major improvements from the existing process and temporary shelters are the encouragement of community involvement, the implementation of shelters that utilize local building materials and techniques, the improvement of the local economy, the reduction of costs spent on temporary shelters, the reduction of time in which internally displaced persons live in camps, the fulfillment of IDP families preferences and needs, and the sharing of knowledge in pre-disaster recovery planning. Specifically for rural Haiti, the proposed recovery process will become more and more successful and utilized as the Caleb Program continues to teach and send young leaders to communities throughout Haiti who can promote pre-disaster planning. The Phase 1 House will also improve over time as the construction process is adapted into Haitian tradition and the distribution of the LIFEHouse publication becomes a nationwide source for good building practices. The overall goal for the proposed natural disaster recovery process and Phase 1 House is to provide communities with the knowledge about the importance of building back better in order to create safe, healthy, and sustainable living conditions for themselves and their families. Since the recovery process highlights specific phases and the encouraged involvement of the community, government, and relief organizations at each phase, IDPs from around the world can adapt this process to their communities current circumstances. The hope is that one day developing countries will see the benefits of this recovery process in Haiti and will take a proactive approach in implementing this process or one similar within their own communities.

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Vita

Mallory Lyn Barga was born and raised in Versailles, Ohio. After her high school graduation from Versailles High School, she attended Ball State University in Muncie, Indiana to study Architecture. In May of 2012, she received a Bachelor in Science of Architecture. Immediately following her undergraduate education, she knew she wanted to continue her education to earn a Master of Architecture degree in order to one day become a licensed architect. She considered various accredited architecture programs before confidently deciding on the University of Tennessee College of Architecture and Design. Throughout her two years of study, she has had the opportunity to learn from many influential and exceptional professors. In October, she traveled to Fond-des-Blancs, Haiti to study the culture and do research for her thesis. Correspondingly, she received a research assistantship working for the Haiti design studios doing grant writing, brochure design, award submissions, and assisting with the LIFEHouse publication. In May of 2014 she graduated from the University of Tennessee with a Master of Architecture and concentration in Conservation and Stewardship. She is interested in working for a small architecture firm in Knoxville, TN and is in pursuit of this professional goal.