DESIGN BOOK II
Les Cayes Site Study

HAITI HOUSING RELIEF
AYITI LOJMAN  SEKOU

Western Washington University | Huxley College of the Environment | Sustainable Design Studio Spring 2011
The earthquake that occurred in Haiti on 12 January 2010 resulted in more than 100,000 tragic deaths and displaced 1 million people while leaving an even greater number of people affected by damage and destruction to both the country’s infrastructure as well as individual homes. In order to reduce the suffering and vulnerability that the Haitian people face, appropriate and equitable shelter support is required. Displaced people require protection from the impending hurricane season, and permanent shelter solutions during the course of reconstruction, which is projected to last for several decades.

Haiti’s natural disaster challenges the global community to consider new approaches for human development. The redevelopment of Haiti should avoid past mistakes and incorporate lessons learned from disasters.

Haiti Housing Relief Design Book II was prepared by Nicholas Zaferatos, Ph.D., and his students at Western Washington University. The Design Book II investigation is case study for a site located in LaCeyes. It is to be purchased by a non-profit, religious-based organization in the United States for use in providing long-term sustainable community development.

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June 2011

The Design Book II investigation is case study for a site located in LaCeyes. The project supplements Design Book I (2010) that provides conceptual development for “community self help” to build stronger self reliance among Haitian communities as they undertake their own redevelopment. In order to successfully carry out Haitian redevelopment, long term partnerships are necessary among the Haitian people, its government institutions, and local and international organizations. Community self reliance development is dependent upon partnerships that are capable of bring together vital resources in order to achieve the re-development of Haitian communities. Haitian families should play an integral role by contributing knowledge of construction techniques and by providing rural local resources. The shelter and village design provided in this Book is intended to be a comprehensive resource to provide guidance for building quality homes and to serve as an important role in providing building materials and resources while local organizations should assume leadership in providing essential community support services.

The intended beneficiaries of this investigation include Haitian families and the non government organizations that provide daily service work in Haiti. The student authors of Design Book II offer these design concepts in the spirit of contributing to an indigenous model for Haiti’s long term sustainable community development.

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The Haiti Housing Relief Design Book II is a Free Distribution Publication. It is dedicated to the people of Haiti in the hope that these housing design concepts may contribute towards a better life condition for Haitian Peoples. The shelter designs are not intended as building blue prints and the undertaking of construction of the design concepts contained in the Design Book II should only occur following an engineering structural analysis. Construction is subject to applicable building codes.

http://faculty.wwu.edu/zaferan/Haiti Design Book II.pdf

Chapter 1: Framework for Haiti’s Recovery

Chapter 1: Framework for Haiti’s Recovery

Introduction

Haiti Housing Relief Design Book II presents no single solution to Haiti’s post-disaster recovery. Rather, it offers development concepts that seek to foster self-reliant communities. The aim is to promote sustainable development, adhering to the needs and interests of the affected communities. The book follows the recommendations of experts and is designed to address the needs of Haitian culture. The class approached this project knowing that the principles many of those sustainable development concepts in post disaster areas.

Appropriate Design

The study’s scope includes a model village plan for a small land parcel located in Les Cayes in southwest Haiti. The site plan conforms to our client’s list of desired uses, which include the following elements:

- Housing to accommodate approximately 160 internally displaced persons and patients receiving medical rehabilitation treatment.
- Integrated housing for a team of doctors and researchers participating in educational programs.
- Housing for a team of doctors and researchers participating in medical rehabilitation programs through the organization Advantage Haiti.
- A clinic for Advantage Haiti, including 20 beds, a 20’ by 20’ shop space to be designed by Medical Teams International, and an area for rehabilitation therapy.
- An manufacturing area for teaching, research, and development of educational activities.
- Agricultural systems for village food production.
- Village water treatment and human waste systems.

Entwoudkyon

Chapter 2: Village Site Plan

Design Philosophy:

To develop a sustainable housing plan that would allow the residents to achieve self-reliance in food and water production, economic and environmental stability and promote Haitian heritage.

Objectives:

- Meet basic needs such as food, housing and water.
- Expand the local economy with the development of a medical center, implementation of a model village, production of construction materials and a sustainable agricultural system.

Address environmental impacts and make improvements to the local environment through reuse of materials and restoration of natural habitats.

Space Requirements:

- Total residential space for 200 persons
- 20 permanent homes for 140 full-time Haitian residents
- 20 transitional staff
- 1 medical building to house prosthetic device manufacture and agricultural space divides the two sites into manufacturing facilities, waste and water management systems.

Design Parameters:

- Three variations of site plans that would result in the most effective use of the limited land area. These designs incorporate the use of two separate plots of land: Site A (118'x300') which is expected to be purchased in fee title by the client NGO, and Site B (100'x1000') a secondary parcel of land which is expected to be purchased in fee title by the client NGO, and Site B (100'x600'), a secondary parcel of land.

- The most effective use of space to accommodate the 200 residents, the medical building, 20 transitional patients and a communal area.

- The prediction of the agricultural system is expected to be purchased in fee title by the client NGO, and Site B (100'x600'), a secondary parcel of land which is expected to be purchased in fee title by the client NGO.

Site location: 18° 13’ 05.33” N / 73° 45.37’ 77” W

- Tropical climate/average high temperature of 88°F/20°C (1.5 miles/Les Cayes, Haiti)
- Site A and Site B which are within a 50 - 100 year floodplain.
- The site is a floodplain that borders both sites and can support hydro-electric energy

Land description:

- 18° 13’ 05.33” N / 73° 45.37’ 77” W
- Tropical Climat/average temperature of 230 (W)
- 2.1 miles distance from river
- Two rainy seasons: April-June/October
- South East prevailing winds
- Site A (Community/Medical Facility) is rectangular in shape
- Site B (Agriculture/Complex) is rectangular in shape 100 feet in width and 600 feet in length.

Surface Water

- The site does not have a large threat of surface water inundation. The prediction is that the sites are both within a 50-100 year floodplain. Even so it is recommended that a minimum 20 feet buffer exists as a riparian zone in the surrounding stream. Within this riparian zone we suggest planting of native grasses and trees, which will act as a filter, multiple erosion and excessive heat from contacting the stream (see agricultural zone). With the use of rainwater catchment, irrigation water can be used to reduce erosion from heavy rains that cannot be utilized by rainwater catchment systems.

- Tropical climate with high temperature of 88°F/20°C (1.5 miles/Les Cayes, Ayiti)
- Klima Tropikal / moyen tanpar la ki moun nan (230°C F 73°F)
- November-January: April-June/October, novanm
- Water fixation systems for collection and reuse of water
- Site A (Kominote / Medikal Etablisman) se rekapte la se komsa, skropl ak 100'x600', ak moun
- Site B (Agrilet / Complex / Popwoz) se rekapte la gen 100'x600' la nan site B.
- Site C (Aspart / Medikal Etablisman) se rekapte la se komsa, skin ak 100'x600', ak moun
- Site D (Kominote / Medikal Etablisman) se rekapte la se komsa, skin ak 100'x600', ak moun

- De sit sa yo nan yon plan innon’nan (50-100 an.)
- N’ka sa se prizay la di e ki ak lòt lòt, anbute la sa la ak abite.
- Sit sa yo nan yon sa bou pou twon klas sa ka aplan an’lòt skropl ak likitrizik.

- Material constitution and agricultural space divides the two sites into a primary living village model (Site A) and an intensive agriculture and manufacturing space (Site B).

Design Parameters:

- Based on collected research, the location attributes, and the design requirements, there are 3 variations of site plans that would result in the most effective use of the limited land area. These designs incorporate the use of two separate plots of land: Site A (118’x300’), which is expected to be purchased in fee title by the client NGO, and Site B (100’x1000’), a secondary parcel of land for medium term leasing or possible purchase.

- In our preliminary research of the agricultural systems, we saw to the conclusion that the Site A would not be able to support the basic living needs of the 200 residents in addition to the necessary agricultural and manufacturing space divides the two sites into manufacturing, waste and water management systems, thus needed is the inclusion of Site B. The most effective use of space to accommodate the 200 residents, the medical building, 20 transitional patients and a communal area.

- 1 medical building
- 20 transitional patients
- 20 permanent homes
- Site B (Agriculture/Complex) is rectangular 100 feet in width and 600 feet in length.
- Site A (Community/Medical Facility) is rectangular in shape 100 feet in width and 600 feet in length.

- Site A (118’x300’) is designed to accommodate the 200 residents, the medical building, 20 transitional patients and a communal area.

- Site B (100’x1000’) a secondary parcel of land for medium term leasing or possible purchase.

- The site borders both sides of the two sites and can support hydro-electric energy.

- The site is a floodplain that borders both sites and can support hydro-electric energy.

- The prediction is that the sites are both within a 50-100 year floodplain. Even so it is recommended that a minimum 20 feet buffer exists as a riparian zone in the surrounding stream.

- Within this riparian zone we suggest planting of native grasses and trees, which will act as a filter, multiple erosion and excessive heat from contacting the stream (see agricultural zone).

- Water system consisting of rainwater catchment, filtration, potable water purification and storage.

- Waste management system for collection and compost of 200 residents.

- 1 medical building
- 20 transitional patients
- 20 permanent homes
Chapter 2
Village Site Plan

Introduction to Site A Designs 1, 2, and 3

The size and the shape of the site presented significant design challenges. The size and shape made it impossible to create the ideal traditional Village (lakuai). However, even with such limitations, 3 design options are presented for development as a semi-sustainable village. For all 3 sites, bamboo was used extensively as a buffer to the entire perimeter of the site to promote a sense of privacy and safety. Two houses were placed on Site B for each of the site designs as housing for agricultural workers and to provide for security.

Land Use Design 1
Design 1 is the preferred site layout because it most efficiently accommodates 200 persons, support facilities and agricultural activities. The medical facility is located on the west side of Site A to allow for easy access to and from the road for transportation of medical staff, patients, and supplies as well as close proximity to the stream and water tank for water needs. The transitional dorm is situated near the medical facility but not far away from the other housing to build a sense of community between the transients and the permanent residents. The primary housing has been separated into clusters that each share a communal garden and are all situated near the perimeter of the site. To mitigate contamination, all outhouses were placed into two small groups as far away from the garden as possible. Land Use Design 2
Design 2 highlights the use of pedestrian pathways around the perimeter of the site where access to the medical facility is not as efficient as in Design 1 making this design an less desirable alternative choice. The medical facility was placed centrally to serve as a community gathering place. All the houses were spaced equal distances from the medical facility with the transient dorms and medical staff housing located closest to the facility.

Site B
Entwodiksyon nan Site A Designs 1, 2, ak 3 gouvè ki af am fir nan sit sa te la yon gwo defi lè desine dispozisyon diferan ak limit pou yo te la konsayon. Nan rechèch, nou te la konsayon ki fi kapab itilize sistèm nan kaptaj dlo lapli ak espas agrikòl. Itilizasyon nan jaden lapli nou gade diminye depase dlo lapli soti nan gwo lapli ki pa kapab itilize sistèm nan kaptaj dlo lapli.

Land Use Requirement Site A: Design 1

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Square Footage</th>
<th>Land Use Requirement Site A: Design 2</th>
</tr>
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<tbody>
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<td>Medical Building</td>
<td>2925</td>
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<td>Manufacturing</td>
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<tr>
<td></td>
<td></td>
<td>Doors: Tenant</td>
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<tr>
<td>Marketing</td>
<td>Permanant: Bottle Homes: 8800</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>Outhouses</td>
<td>286</td>
</tr>
<tr>
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<td>1370</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>2490</td>
</tr>
</tbody>
</table>

Land Use Design 2
Design 2 highlights the use of pedestrian pathways around the perimeter of the site where access to the medical facility is not as efficient as in Design 1 making this design an less desirable alternative choice. The medical facility was placed centrally to serve as a community gathering place. All the houses were spaced equal distances from the medical facility with the transient dorms and medical staff housing located closest to the facility.

Design parameters
Ki baze sou kolekte rechèch, kote an ak kondisyon yo konsepsyon, gen 3 varyasyon nan plan ki ta itilize sititilize nan tout peyi ki pi efikas. Desen sa yo enkòpore itilize nan tout de konplo nan peyi, Site A (18'x300') ak Site B (100'x600'). Nan rechèch prelimè nou an sistèm yo agrikòl, nou rive konklizyon an ke yon nan Site pa te kapab itilize desizyon vivan yo te la moun bezwa. Nan Site B li te la neplisizyon yon sistèm ki moun bezwa la rezidan yo deko grand an lòt sit presan sitilizasyon an. Afièk ilizayisyon ki nan danen lapli nou gade diminye depasse dlo lapli sitilizasyon lapli la. Entwodiksyon nan Site A Designs 1, 2, ak 3 gouvè ki af am fir nan sit sa te la yon gwo defi lè desine dispozisyon diferan ak limit pou yo te la konsayon. Nan rechèch, nou te la konsayon ki fi kapab itilize sistèm nan kaptaj dlo lapli ak espas agrikòl. Itilizasyon nan jaden lapli nou gade diminye depasse dlo lapli sitilizasyon lapli la. 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Land Use Design 3

Design 3 is the alternative that best promotes the sustainable village that is proposed here. It is also the best for promoting an environment that is healthy and safe for the human population. It provides the necessary services that are required for the entire community, and at the same time, it includes all required services for the entire population.

The housing units have been placed over the other two designs. One advantage of this design is that the location of the human waste facility is centered to facilitate accessibility for the entire community.

Frontier yo etablisman fabrikasyon wout la pèmèt aksè ak nan wout la pou anplwaye ak kagezon an materyèl tankou, sa yo an plis plant sa a ki lòt plant jan li pwodui kalori ki pi pou chak liv.

In Design 3, the housing units have been placed on the small road for easy access and maintenance. The intensive agriculture sites are for mono crops such as corns and potatoes. The intensive agriculture sites are for mono crops such as corns and potatoes.
Zone 3 – (Borders, Bamboo and Nitrogen Fixers) The recommendation within this zone is to use the plants for structural support and support within Site A and B. With Site A, Bamboo, both large and small, should be planted around the entire perimeter of the land. As bamboo is fast growing and invasive it should be separated from plants devoted to food production. A separation of 4 ft. between village clumping of housing. Plants within this zone should occupy the minimum amount of space. It is suggested that goats, rabbits, tilapia, and chickens be utilized for dairy, meat, and egg production.

Livestock

These plants should not necessarily surround the site. They should be planted within Site A or B, but rather bordering the surrounding stream. If propagated along the stream these plants will help to control erosion, flood, surface runoff and water pollution into the stream.

Zone 4 – (Intensive Agriculture) This zone is designated for Site A. Plants in the site within this zone should be used in the space available in the area. Here the plants can be large, as long as they do not shade out the crops. A separation of 4 ft is recommended to site A and B. The class A vegetation space is to be reduced by 30% and the class B space by 50%. The class A zone is approximately 50 sq. ft. per person and the class B zone is approximately 100 sq. ft. per person. These zones will be used on a daily basis and require a high amount of care and irrigation. Most of the plants can be hand watered by the surrounding residents.

Zone 2 – (Perennials and Fruit Producing Trees) This zone should occupy the surrounding space of Zone 1 within a short distance of the housing. Plants within this zone require less care and labor than zone 1. Food from these plants will be of upmost importance in developing 20 year food security and proficiency to meet such a goal there must be as much space as possible devoted to agriculture.

To best utilize the agricultural space, the plants listed in the appendix have been determined to grow within the climate and soil conditions of the site. They have also been selected for their numerous uses including food, fiber, fuel, wood, build-

ment, soil restoration and economic opportuni-

ties. Furthermore, the suggestion is to grow these plants within the following zones:

Zone 1 – (High Intensity and Close Proximity to Housing) This zone should occupy the space between village clumping of housing. Plants within this zone will be used on a daily basis and require a high amount of care and irrigation. Most of the plants can be hand watered by the surrounding residents.

Zone 4

Agriculture

The size of the two plots of land is approximately 200 acres or 81.07 hectares (3.25 sq. km). Both plots are 80,000 sq. ft. This equals approximately 2.2 acres of land. Based on the Haitian climate and local existing systems, there are an extensive amount of tropical plants that would suit best the specific agronomy of the site (see appendix). From these find-

ings, as well as the United Nations basic requirement of 2100 calories per person per day, the determined land would not sustainably support the basic calorie needs of 200 residents on a yearly basis. Nevertheless, with the current social and economic position of the residents it would be appropriate to dedicate a significant portion of the area to food production to meet the basic calorie needs of 2100 calories per person per day.

As food from these plants will be of upmost importance.

This zone will act as communal garden space. With Site B, the amount of care and irrigation. Most of the plants can

In developing 20 year food security and proficiency to

Most of the plants within this zone should occupy the minimum amount of space. It is suggested that goats, rabbits, tilapia, and chickens be utilized for dairy, meat, and egg production.

Goats

4½ minimòm yon 900sq.letan la dwe apeprè 3ft fon lanmè ak

First, oil your postrale dlo dirèkteman nan kouran la kòm kanpe dlo va

The plants with these characteristics will be used for planting immediately as most develop fruits 4 years of planting.

5 lbs. Of oil you needed as a replacement for 2 lbs of kerosene.

The plants with these characteristics will be used for planting immediately as most develop fruits 4 years of planting.

25 poul ou ta bezwen 50sq. ft nan espas etab la. Yon rejan ak

The plants with these characteristics will be used for planting immediately as most develop fruits 4 years of planting.

The plants with these characteristics will be used for planting immediately as most develop fruits 4 years of planting.

Plant sa yo pa ta dwe nouri yon

These plants should not necessarily surround the site. They should be planted within Site A or B, but rather bordering the surrounding stream. If propagated along the stream these plants will help to control erosion, flood, surface runoff and water pollution into the stream.

Zone 4

Agriculture

The size of the two plots of land is approximately 200 acres or 81.07 hectares (3.25 sq. km). Both plots are 80,000 sq. ft. This equals approximately 2.2 acres of land. Based on the Haitian climate and local existing systems, there are an extensive amount of tropical plants that would suit best the specific agronomy of the site (see appendix). From these find-

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Chickens
One adult chicken needs approximately 2 sq. ft. of space in a coop and at least 3 sq. ft. of space for grazing. For 25 chickens you would need about 500sq. ft. of coop space not including storage area. Chickens can eat grains, seeds, fruits, and vegetables. Fresh drinking water should always be available. Chicken coops may be a feasible coop-grazing option for the village because they are small, maneuverable, require minimal cleaning, and are easy to build. A simple A-frame structure made out of bamboo poles and chicken wire would suffice.

Rabbits
One adult rabbit needs approximately 4 sq. ft. of hutch space plus some room to roam. For 10 rabbits you would need at least 40 sq. ft. of hutch space. Rabbits need approximately 20 lbs of food per 6 lbs of their body weight. Assuming all the rabbits weigh 6 lbs you would need to feed them 20 lbs of food per day or 7300 lbs of feed per year. Rabbits should be fed a mixture of hay, grains, leafy greens, and vegetables. Fresh water should be available as well as a salt-lick.

Tilapia
Tilapias are very hardy fish and can survive in high stress conditions. These fish reproduce easily and grow quickly making them a good choice for protein production. If maintained properly tilapia can survive off of the manure of other animals i.e. goats, chickens, and rabbits. To raise 80 tilapia a 900 sq. ft. pond (30ftx30ft) is required. The pond should be approximately 3 ft deep and pull water directly from the stream as standing water will create a hypoxic environment which is deadly for tilapia. Tilapia can also be fed grain and grain by-products.

Conclusions
The two sites combined are approximately 2.2 acres, making it extremely challenging to produce a sustainable village plan. In order to create the most self-sufficient community, land use would have to be extremely efficient with: fast growing, high calorie, condensed crops; multistory buildings to minimize surface area use; and minimal livestock to minimize land requirements (barn, grazing, food production).

The United Nations recommends a diet of 2100 calories per person per day so the land would have to supply 153,300,000 calories annually for all 200 residents. One acre of land can sustain approximately 43 million calories per year thus in order for this community to have a sustainable agricultural system it would require a minimum of 3½ acres which does not include fallow land. For preferred Option A the maximum space allocated for agriculture is less than the recommended number of acres.

Recommendations
Offsite grazing for goats would be ideal in order to limit the amount of feed and space required. To be self-sufficient with goat milk production, at least 60 goats would be required with a minimum of 10 acres of grazing land. The project managers should evaluate ways to acquire additional land to support grazing activities.

fig 2.9. Agricultural Zoning base map for Design 1
fig 2.10. Agricultural Zoning of Design 2
fig 2.11. Agricultural Zoning of Design 3

HAITI HOUSING RELIEF DESIGN BOOK II
Chapter 2
Village Site Plan

Key to agricultural zones
# Village Site Plan

## Food and Agriculture Plants

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<th>Common Name</th>
<th>Type</th>
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## Food and Agriculture Zones

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<th>Food and Agriculture Zones</th>
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<tbody>
<tr>
<td>Bamboo</td>
<td>Bamboo</td>
<td>None</td>
</tr>
<tr>
<td>Restorative</td>
<td>Restorative</td>
<td>None</td>
</tr>
</tbody>
</table>

### Bamboo

- **Latin Name**: *Bambusa*
- **Common Name**: Bamboo
- **Edible**: Yes
- **Zones**: Restorative

### Restorative

- **Latin Name**: *Ziziphus*
- **Common Name**: Guava
- **Edible**: Yes
- **Zones**: Bamboo, Restorative

## Index Reference Tables

### Food and Agriculture Plants

- **Latin Name**: *Bamboo*
- **Common Name**: Bamboo
- **Type**: Bamboo
- **Notes**: None

### Food and Agriculture Zones

- **Latin Name**: *Ziziphus*
- **Common Name**: Guava
- **Type**: None
- **Notes**: None
Introduction
Polluted water and organic wastes can be a life threatening liability. It is our hope that this design will allow Haitians to instead utilize water and waste effectively, as a cradle-to-cradle resource. This will help eliminate the reliance on imports and thus provide resilience for the community.

Water Infrastructure
Three water sources have been identified for this site: rainwater, surface water, and groundwater. Based on usage, precipitation, and roof cover estimates, rainwater catchment can account for roughly half of the village’s freshwater needs. The other half must be sourced from the nearby stream or groundwater. By the end of the cycle, waste water will be recycled and reused on site.

Rainwater catchment
Rainwater collection is a proven method that is simple to install. Rainwater is collected in tanks attached to downspouts and disposed of as needed. As an alternative, rainwater tanks can be covered with plastic corrugated sheeting or plastic downspouts can be fitted with a cover.

Sewage treatment
Sewage treatment is a proven method that is simple to install. A sewage treatment system for 45,000 people will be provided by an active natural waterway. The treatment system for the village’s wastewater needs. The other half must be sourced from the nearby stream or groundwater. By the end of the cycle, waste water will be recycled and reused on site.

Anvil jet intake location will be chosen at the end of a pipeline to the pipe. It is completely mechanized (i.e., manual or automated) and requires electricity and a shift. The treatment system for the village’s wastewater needs. The other half must be sourced from the nearby stream or groundwater. By the end of the cycle, waste water will be recycled and reused on site.

Ar Epidemiology
Derepakte dlo ak dechè óganik ki kapab yon me-nan te nan envimos ak yon tè. Li se espwa nou sa kon-sepyon ap pèmèt Ayisyen olye filiz dlo ak efikasman, ki yon rense bôse-bôse. Sa pral e so edim depends an sos entopikasyon ak men bwa se ou yo pou kompinite an.

Dlo Entoustrikiti
Twa sosy dlo yo te identifié pou ak sa a dit lòt dlo, dit altas, ak dit saouter. Ki haite soj saj, presa/lysaj, ak esistmasyon koumi twa, kaptaj dlo lajpa ka kont pou apènaj xouv an nan bezwen ak dous ti buk li. Dwe lòt mètay a ap sosite nan koumi nan anc soubyen sou dit dous saouter. San fir a ki la, la pral dlo dit dwe dwe dlo dlo sou dit a sou xout.

Rainwater kaptaj
Kapte dlo lajpa se petèt metòd ki pi senp nan koleksyon dlo. Dlo a pran nan twa ak se nwa ak efikasman ak downspouts dësann nan yon sou byen. Despréfèyèf, kik-gouy ti ki alamèt nan sosyot an plastik corrigot esp. manifastèt an plastik. Pèvèl dlo saout ka fè tsivi nan jete boule plouts. Sa ap mimiz kriyè fyo, iltiz yon pwodwo fatwa ak pè mètay tou pou antityèn lok yon ak reparasyon.

Nou amivaje chak esitr ak gén yon twa ak aper-re priye yo pran gèn pi pwèt ki la yon Gat 55. plastik lajpa barik, ceswa pi pri-affiskman, te fòt sa dit nan lokal- man souze kontèk ak Birl. Bish sa bati nan saj saj pi pa slid pariz problèm pou itilizeyon domestik tankou benyen ak ay aye lave. Sowasan, filit trijaj ki nessei pou twa dlo.

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Anvil jet intake location will be chosen at the end of a pipeline to the pipe. It is completely mechanized (i.e., manual or automated) and requires electricity and a shift. The treatment system for the village’s wastewater needs. The other half must be sourced from the nearby stream or groundwater. By the end of the cycle, waste water will be recycled and reused on site.
Rainwater Catchment

Harvesting rain water is perhaps the simplest method of water collection. Water is caught by roofs and channeled through gutters and downspouts down to a cistern. Ideally, side-gutters can be fashioned from sections of corrugated plastic manufactured on-site, while downspouts can be made from discarded plastic bottles. This will minimize costs, utilize a waste product and also allow for local maintenance and repair.

We envision each structure with a suitable roof will have its own cistern that can be a 55 gal. plastic rain barrel, or more cost-effectively, made from locally sourced concrete. Slow sand filters built into the cisterns will remove particulate matter for domestic uses such as bathing and washing dishes. However, further filtering is necessary for drinking water.

In addition to each housing unit having its own rainwater catchment system, it is envisioned that the central medical unit will also contain a rainwater catchment system. Rainwater from the central medical unit will be channeled to a 45,000 liter Ferrocement community cistern that can provide additional water for the community in times of drought. Apart from being an extremely versatile method, Ferrocement is part of the local construction vernacular and should provide a maintainable investment for the community. With approximately 50% of the materials being sourced from Haiti, we estimate the cost at about $3,000.

Surface Water

The nearby stream can provide additional water to the community in times of drought. Water can be pumped from the stream and stored in the 45,000 liter community cistern for future use. While impact to the stream is likely to be minimal, we recommend that usage of the stream be studied to ensure it is a safe and sustaining water source.

The preferred method of water delivery is the Rife River Pump. The Rife River Pump is a self-supporting system for pumping water. It is completely mechanical (requiring no human interaction) and operates without electricity or fuel, requiring very little maintenance. Power necessary to drive is provided by the stream’s natural current. The pump can lift water up to 82 vertical feet, enough to pump it into the community cisterns. Multiple Rife River Pumps can be installed in the stream to deliver the necessary water should one pump prove inadequate, with costs vary depending on pump size.
Groundwater 

The availability of water is determined by its necessity to provide water for drinking and other purposes, and by its availability to be used for agriculture and other purposes related to it. It is likely that installing a well at this location will cost between $5,000 and $6,000, plus piping and maintenance. This cost estimate is based on the average water table depth in Haiti of 20 to 30 feet, and the cost of digging a well is expected to be around $6,000.

Additionally, wells require human interaction, electricity, or fuel to lift the water out of the ground. Because of the frequency of natural disasters in Haiti, it is important to assess the availability of groundwater to ensure that it is sufficient to meet the needs of the community.

Drinking water 

Drinking water is essential for human survival, and it is essential to ensure that the water used for drinking is safe to consume. The availability of drinking water is determined by the quality of the water source, the presence of contaminants, and the presence of safe storage facilities.

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It is important to assess the availability of drinking water to ensure that it is sufficient to meet the needs of the community. It is important to assess the availability of drinking water to ensure that it is sufficient to meet the needs of the community.

Filtering 

Once the water is supplied, it is necessary to remove impurities and contaminants from the water to ensure its safety for consumption. The filtration process involves the use of physical and chemical methods to remove impurities and contaminants from the water.

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Creating a centralized Humanure collection depot will streamline the transformation of this commodity into life. Proper utilization of human waste has the ability to contribute if not replace the purchased inputs and black water. Human waste contains a vast amount of nutrients that can be applied to plants in proper proportions and distributed throughout the agricultural areas. Basic education in the community about how to use the nutrients is essential and an incentive program must be developed to reward their proper use with inherent penalties for those families who do not. It must be stressed that not following the simple guidelines provided threatens the success and health of the community on the most basic level and could be grounds for expulsion from the community.

How to create a Humanure “Pen/Paddock”
Prepare the space that will be utilized within the palmetto walls by making a “bowl” of earth with the edges to collect the excess liquid and material within. Line the bottom with a foot to foot and a half of carbon rich grassy material. Empty buckets in a center of pen and line the edges and top of pile more grassy material, making sure to not leave any manure exposed. When adding subsequent huma...

Invariably there will be excess water that must be dealt with. When rainfall catches and water catchment basins are exposed to heavy storms.

Chapter 3 Village Community Services

In Haiti harnessing this valuable resource loop is a vital necessity for the success of a sustainable community. Humanure operation in Haiti:

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Chapter 3 Village Community Services

In Haiti harnessing this valuable resource loop is a vital necessity for the success of a sustainable community.
Village community team has adapted two general design options that both the medical facility and the internet communication facility would be free and accessible to all residents of the village.

Design Bi
Objectives to suit the client’s needs to be simple and efficient, yet strict enough to ensure that the building would be “green” in terms of water use and appearance, and that it be culturally appropriate for both the Haitian population it serves as well as the international medical professionals and volunteers who would be a part of this team.

The main floor of this building would be reserved specifically as a housing and retreat area for medical professional and volunteer staff (Figure 4.1).

Design A1
45 x 65 medical and communication combined facility

The client also requests that the building be “green” in terms of water use and appearance, and that it be culturally appropriate for both the Haitian population it serves as well as the international medical professionals and volunteers who would be a part of this team.

Designs A1 and A2 recommend the construction of a two-story medical and communication combined facility (Figure 4.2). The second floor of the building will be reserved specifically as a housing and retreat area for medical professional and volunteer staff.

Karakteristik ak Benefis
- Santralizasyon konsepsyon dwe itilize. konsepsyon dwe itilize yon santral nan bilding la ak antoure li pa yon balkon la. Santral santral ak detik li dlo a nan do kay la ap moute guttered koupe nan dlo a nan do kay la pa fè zòn nan reyabilitasyon sal la ki pi santral nan bilding la. Ak sa yo fè santral nan bilding la ak dlo a nan santral nan bilding la. se objektif sa a akonpli nan nan bazi ak konsepsyon dwe itilize ak benifik nan bilding la ak detik li dlo a nan do kay la.

Designs A1 and A2 recommend the construction of a two-story medical and communication combined facility (Figure 4.2). The second floor of the building will be reserved specifically as a housing and retreat area for medical professional and volunteer staff.

Description of Designs
Design A1
45 x 65 medical and communication combined facility

The first proposed option places all aspects of these two facilities under one communal roof, with housing for international medical professional and volunteers on the second floor of the building to allow for some separation from the local population. The main floor of the structure includes the required rehabilitation area, workshop, and 20-bed ward as well as an 18 x 20 internet communication café, with a covered porch space fitting the village-facing side of the building. The second floor of this building would be reserved specifically as housing and retreat area for medical professional and volunteer staff (Figure 4.1).

Design A2
45 x 52 medial and communication combined facility

Nan vlemben konsepsyon dlo la te kapab yon layout altènatif sa yo, ak sa yo fè santral nan bilding la ki la te kapab yon layout altènatif sa yo. se objektif sa a akonpli nan nan bazi ak konsepsyon dwe itilize ak benifik nan bilding la ak detik li dlo a nan do kay la. se objektif sa a akonpli nan nan bazi ak konsepsyon dwe itilize ak benifik nan bilding la ak detik li dlo a nan do kay la. se objektif sa a akonpli nan nan bazi ak konsepsyon dwe itilize ak benifik nan bilding la ak detik li dlo a nan do kay la. se objektif sa a akonpli nan nan bazi ak konsepsyon dwe itilize ak benifik nan bilding la ak detik li dlo a nan do kay la.
The design of the main floor of the building is focused to provide an open and comprehensive living environment for the patients. This is achieved by making the building and surrounding it by an exterior porch, making the rehabilitation area the most central room spent the majority of time outside of their buildings. By being guttered of centering the building concept on maximizing roof area feel for patients who are staying and undergoing train the water runoffs to a central water collection structure.Fig 4.1 This prevents patients from the feeling of isolation and to a yon gwo kantite nan chalè solè ki te kapab trans ki, espesyalman si yon twati vèt se pa sa enkli, pouvwa jaden yon lapli oswa sistèm akwakol, ajoute atmosfè space would also have the potential of including a rain garden or aquaculture system, adding atmosphere and feres nan etablisman an etaj prensipal medikal. desen sibi yon gwo kantite nan chalè solè ki te kapab transfer yon estrikt medikal la dwe distribiye ant de estrikt yo, ki prezante yon estrikt ki pral atache a tounen nan etablisman medikal la dwe.

Features and Benefits

The design of the main floor of the building is focused to provide an open and comprehensive living environment for the patients. This is achieved by making the building and surrounding it by an exterior porch, making the rehabilitation area the most central room spent the majority of time outside of their buildings. By being guttered of centering the building concept on maximizing roof area feel for patients who are staying and undergoing train the water runoffs to a central water collection structure. Fig 4.1 This prevents patients from the feeling of isolation and to a yon gwo kantite nan chalè solè ki te kapab trans ki, espesyalman si yon twati vèt se pa sa enkli, pouvwa jaden yon lapli oswa sistèm akwakol, ajoute atmosfè space would also have the potential of including a rain garden or aquaculture system, adding atmosphere and feres nan etablisman an etaj prensipal medikal. desen sibi yon gwo kantite nan chalè solè ki te kapab transfer yon estrikt medikal la dwe distribiye ant de estrikt yo, ki prezante yon estrikt ki pral atache a tounen nan etablisman medikal la dwe.

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through the mold, leaving no void spaces. The flat rim that surrounds the gold ee will be used to slide a t o t e that contains sand and water off the mold.

**Panel Manufacturing Chamber**

Making slight modifications to the pre-existing gold ee will be the most sustainable way to produce desired plastic panels. Eddy Fowler-Lindner pitched the idea and gave me plans to elaborate on, which feature a structure that will be attached to the back of the gold ee. The added structure will most likely be made of firebrick, or some readily available heat tolerant concrete mortar. The structure will be 5 feet long, and 3 feet wide, and 2 ½ feet tall. This size seems best fit for such a case because the mold that sits within the structure will be 2 feet, by 4 feet, and will weigh around 100 lbs. Any larger of a mold would require too many people to lift, and would be an unsustainable use of space. The inner dimensions of the chamber will be 3 feet, by 5 feet, to allow air to freely move around the mold.

The size and number of holes needed is still unknown; judging exactly how warm of air will be entering the manufacturing chamber is hard to calculate, however 3 to 5 holes, approximately 8 to 12 in. will produce desired temperatures.

After speaking with Andrew, Paul, and Nicole Larsen, it became obvious that we are trying to reach temperatures between 420 degrees C and 475 degrees C. Though temperatures can get as high as 500 degrees, or as low as 350 degrees, it has been noted that too high of temperature burns the corners; too cool does not allow the plastic to bind properly.

The inside of the manufacturing chamber will contain a grated table that the mold will easily slide on and off of. The mold requires somewhere between 50 and 100 lbs. per square ft. to be placed on top of it to ensure the plastic flows properly.

**Material List**

- Fire brick or cement mortar building compound.
- One grated table that can withstand between 400 C and 600 degrees C.
- Rolling table that is approximately the same height as the lower lip of the manufacturing chamber.
- Large tote that can hold 25 gallons or more of water and sand.
- Metal cover that will be placed on top of mold to contain heat.

**How To Construct**

**Step 1.** On the back side of the gold ee, stack bricks 3 feet high and 2 ½ feet long.

**Step 2.** Attach another row of bricks that run perpendicular to the first row. This row of bricks should be 4 ½ feet long, and just slightly lower than surrounding walls.

**Step 3.** Attach the final wall to the gold ee.
**Medical Center**

**Materials**
- The outside of the structure can be made of ply-wood, plastic panels, bamboo, or any other rigid build- ing material.
- If hinges will be needed for the entry door, upper swinging roof, and swinging doors.
- 2 bamboo poles to separate the inside of the unit, and two smaller ones to support foldable roof.
- Locking device.
- 4 by 4s as well as 2 by 4s (the number needed is variable and will depend on how much reinforcement they feel the structure will need and allotted materials).

**Transportation - bike shop, storage, repair**

Because of their current economic struggles, it would be unsustainable for the Haitian's to spend money on gas. Because we are striving to create a sustainable response to their hardships, bicycles seem like the best mode of transportation. With this being said it will be very important to have a structure that can house bikes, spare parts, and tools. The structure should contain an indoor and outdoor work table. The back and side walls should be sufficient with shelves as well as hooks that will allow for bikes to be hung. Space for tools, tubes, screws, tuning supplies, oil, and like materials should also be provided.

**Design F**
- **Step 1.** Lay 4 by 8 ft. Foundation.
- **Step 2.** Attach walls to foundation and reinforce with cross support if needed.
- **Step 3.** Attach plastic panels or play wood to outside of structure.

**How To Construct**

**Step 1.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 2.**
- **Materials** (Banbou oswa Coconut)
- **Step 3.**

**Design E**

**Step 1.**
- **Materials** (Banbou oswa Coconut)
- **Step 2.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 3.**

**Design D**

**Step 1.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 2.**
- **Materials** (Banbou oswa Coconut)
- **Step 3.**

**Design C**

**Step 1.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 2.**
- **Materials** (Banbou oswa Coconut)
- **Step 3.**

**Design B**

**Step 1.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 2.**
- **Materials** (Banbou oswa Coconut)
- **Step 3.**

**Design A**

**Step 1.**
- **Materials** (plastik Opsyon nan boutèy)
- **Step 2.**
- **Materials** (Banbou oswa Coconut)
- **Step 3.**

---

**Fig. 4.7.** Design D: Sugar cane juice production. The structure will not be used for living.

**Fig. 4.8.** Design E: 10' by 8' by 8' Storage shed for panels.
Chapter 5: Family Shelter 1

Family Shelter Design 1

Goal of the Design

This step of the Haitian village development details the role of permanent housing for 160 indigenous peoples on the selected land plot. It is just as important as effectiveness in the construction of the housing complex, so the materials used and the architecture of the home must both complement Haitian culture.

An easily adaptable, affordable housing construction that satisfies Haitian cultural beliefs and maintains an ecologically sound environment is embodied in the technology of the already field-tested model of earthbag homes. The idea of stacking bags of sand (or other filler material) has been in practice since the early 1900s. Military use coupled with the ease of availability in almost every developing country in the world proves sandbags (with dimensions anywhere from 14"x24" to 18"x30") to be one of the most disaster-resistant and easy-to-use materials for architectural construction.

Research and comparison has brought about the decision that earthbag homes are the best choice for the Haitian people on the client’s land plot. Earthbag homes boast a simple building process coupled with the abundance of on-site materials to make this housing style the most suitable, cost effective and sustainable method for housing available.

Design Description

Although earthbag homes can be constructed to meet nearly any design concept, the permanent housing blueprints put forth for this project would best suited as a rectangular shape with a covered porch along the front portion of the building. The dimensions of the home are as follows: 22" long (front) by 10" wide (front face) and 12" wide (back face). With a earthbag roof descending down to 8.5’ high rear face. The foundation of the home can be one of two options, chosen by the builders: built directly on a shallow trench filled with gravel (to keep water from seeping up through the base of the home) or laid on a poured concrete plot, relative to the size of each individual home or groupings of homes.

The interior of the home can be accessed through a 8’x8” functioning door, leading into a cooking and storage area roughly measuring 8’10". Another door (this time only a space, not functioning) leads into the sleeping quarters, a room measuring 10’x11”, depending on where the “+1” sandbag wall falls in the center of the home. All of the windows – constructed from (3’x4’; upper; 3’x2’; front; 2’x2’; back) sheets of 100 percent recycled thermoplastic, melted down on site – have the ability to close and lock for security and add much-needed air circulation. If more security is needed, wood can be used in the construction of the window frame and pane. The downward sloping, shaded-structure roof is also constructed from thermoplastic.

If this cannot be metelled down in such a demanding surface area, corrugated metal sheets or thatch can be utilized for a roof.

Haitian Housing Relief Design Book II

Chapter 5

Family Shelter Design 1

Objectif Design nan

Etape sa a nan desid ayisyen desvyekman vilaj wòt nan lojman plemanm nan (160) pey endi-jen sòs trase nan pèyi. Tradisyòn se jen esprit menjen etikasite nan konstrisyon nan konpliks li nan an lòman, pou moun ayisyen yo te ilizite ak architekti pou konstru lojman nan te a kliye li ki konpli nan ayisyen li.

Yon fasap adaptasyon, konstrisyon kay ababò nan sati ayisyen kwayans kiltirèl ak konplik se yon egzisite ekzako ki sondak any nan teknologik nan modèl laks nan laks kay yo chwa ki pi bon pou pèp ayisyen.

Rechech ak konparezon te fè sou desizyon an ki konstru ak konstru la nan sòs trase nan peyi chwazi. Nan indrayè nan apil nan desizyon foupsè ki konstrusyon man apil nan desizyon, ak abond ansanm pèy kon devan bòskon man apil nan desizyon.

Design Deskripsyon

Matitekna laks kay kapab konstrui konstrusyon nan livay nan desizyon ki pi moun bon, sou mas yon bòskon de. Konstrusyon nan te fè sou ki nan bòskon nan de. Kreyòl ayisyen ki nan lòman nan de nan ki nan desizyon nan nan apil nan desizyon.

Karakteristik & Benefis

Memot konstrusyon tankou se sou konstrusyon kay ankoraye ki lojman sou sit-sit, moun ayisyen, poten nan konstrusyon kreyòl, yo. Jan nan moun nan asiti-e-peepti nan desizyon an pou itilizepad pòskon, nan moun nan fot grafik wosan lòman, konstrusyon (kreyòl an jwenn na konstru nan sit-sit), nan te moun nan apil nan desizyon an pou itilizepad pòskon.

Objektiv Design nan

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Features & Benefits

Construction methods as is on earthbag homes is cheap and easily shipped from anywhere in the world, including from a site easily active in Haiti. In addition, the earthbag home movement has since begun in Haiti, and has been rapidly and successfully expanding across the country as less of an alternative housing solution, but needing a standard in the wake of the earthquake. In countries across the globe, the method is catching on and spreading as one of the best methods – both financially and stability-wise – for temporary buildings.

Earthbags are light, compact and can be shipped by the pallet load, enabling ease of transport. The purchase and transport of the non-site materials are negligible when using earthbag materials and methods.

Building The Structure

Without a concrete foundation (A flat, earthbath is ideal. Builders must first dig a trench on earth, with several (2” – 4”) bags of loose gravel to ensure no seepage up from soggy ground. Builders will then begin laying the bottom three to six sandbag “levels” of the home. It is important to note that these first bags must be filled with gravel or loose rock to further ensure no seepage from damp ground caused by rain or wet soil. This ensures that the bag fill is effective manner and still allows the bag fill to move on every “level” must be packed down by hand.

When each bag has been laid long end to long end, any gravel or loose rock needed to fill in the gaps between bags can be done with a hoe or stamper tool with which a builder will deliver several strong hits to the top of each filled bag from above. This ensures that the bag fill is compacted as tightly and expensively as possible. Not applying the stamping on each and every bag on every “level” can result in a structurally unsound earthbag home in the future.

Earthbag se build to provide an inexpensive, quick, and adaptable solution as a highly scalable solution, as large numbers of shelter units could be shipped on little or no advanced notice, since sandbags are typically stockpiled for disaster relief. Earthbag homes are a highly scalable solution, as large numbers of shelter units could be shipped on little or no advanced notice, since sandbags are typically stockpiled for disaster relief. Earthbags are a highly scalable solution, as large numbers of shelter units could be shipped on little or no advanced notice, since sandbags are typically stockpiled for disaster relief.

Earthbag homes as well as is so easy to construct, strong weather resistance and limited possibility for user customization, either in terms of graphic shape or building coloring (through the use of natural dyes or paints). Cost, upkeep and durability are negligible when using earthbag materials and methods.

The purchase and transport of the non-site materials (i.e., shovel, bags, barbed wire, (optional) packing tools) is cheap and easily shipped from anywhere in the world, including from a site easily active in Haiti. In addition, the earthbag home movement has since begun in Haiti, and has been rapidly and successfully expanding across the country as less of an alternative housing solution, but needing a standard in the wake of the earthquake. In countries across the globe, the method is catching on and spreading as one of the best methods – both financially and stability-wise – for temporary buildings.

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It is also imperative to note that after each individual family shelter design layer, all along each and every bag on the latest “level.” This wire serves as the structural equivalent of an adhesive or fastener being used to run through the top five sandbag layers as a structural strengthening method. Each end, will run through the top five sandbag layers as a structural strengthening method.

The bent end of the 6’ diameter bamboo poles support a thermoplastic sheet roof. A porch roof serves a simple protection from rainfall or heat. An awning on the front side of each individual home, four 6” diameter bamboo poles support a thermoplastic sheet roof which can be used as an anchored lashing point for at least 2” thicker than a foot wide, making any wall 14” thick. Natural clay mixed with sand and water can also suffice. Natural lime plaster (depreferans) kouvèti plastik nan twati. Sèvi ak lè ekivalan a estrikti ak rezon la kòm yon pwen reprimand pou ancrage atache ak tèt la. Senki yo ak ata ant sak. Natirèl ajil kouvrir nan yon lòt teksti respekte lè yo aplike.

The thermoplastic roof shingles are made to be only a free resource for home building, but also also help in clearing up Haiti of its abundant plastic offcuts and litter. The roof serves a simple protection from rainfall or heat. The roof porch roof serves a simple protection from rainfall or baking sunlight, and provides a place to relax and chat with their neighbors in the development.

After the foundation and walls have been successfully erected, a number of choices are available for builders to apply to the home for further structure and aesthetic reasons. Many earthbag homeowners use plaster (or lime plaster) in several layers to fill in the grooves and recesses between bags. Natural clay mixed with sand and water can also suffice. Natural lime plaster) in several layers to fill in the grooves and recesses between bags. Natural clay mixed with sand and water can also suffice.

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Materials & Cost Estimate

The majority of the mass required for home construction can be extracted for free from on-site sources. Costs for the materials needed to purchase will vary depending on local accessibility.

Shared walls will reduce housing space and total construction cost. As seen through the pricing, building houses in clusters of five (with shared walls) drastically reduces construction costs in comparison to individual houses in clusters of five (with shared walls). Shared walls will reduce housing space and total pri

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Bamboo (post planks-4’x4’). Costs ($18.95/pole)

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Rebar #4 in 4’ cost. Cost $3.55

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The traditional Haitian home is quaint with 2 rooms, a large porch and it often brightly colored. Our concept, the primary concept behind this model Haitian home is to provide a replicable and cost effective home for a nonprofit organization to build a sustainable village in Haiti. After receiving the location of the proposed Haitian village the design team looked into the abundance of onsite waste in the homes. The main focus of the particular housing design is to utilize the abundance of onsite waste in the form of PET bottles. Using this material not only helps to desalinate water but also increases flood resistance.

The concept proposes the use of bright green color and a small two large porch and it often brightly colored. Our concept, the primary concept behind this model Haitian home is to provide a replicable and cost effective home for a nonprofit organization to build a sustainable village in Haiti. After receiving the location of the proposed Haitian village the design team looked into the abundance of onsite waste in the homes. The main focus of the particular housing design is to utilize the abundance of onsite waste in the form of PET bottles. Using this material not only helps to desalinate water but also increases flood resistance.

The end result is a quaint home that is sustainable and culturally relevant Haitian home, at minimal cost but with maximum functionality and hazard resiliency. This utilization of bottles can further reduce the need for traditional clay bricks, used in many traditional Haitian homes. COB is a traditional building material for decades. COB, which translates to mud, is made locally and has immediate post-earthquake characteristics. This is because it can be made locally and has been a traditional building material for decades. COB has proven in England to stand the test of time for earthquake and weather resistance. This utilization of COB combined with a concrete base and lime containing weather and disaster reduction strategies in the form of earthquake and weather resistance, also increases flood resistance.
Building the Structure

Step 1: Foundations. In order to allow for the founda-

tion piece of the house, it is key to begin by digging

2 deep trenches around the perimeter of the home.

The base of the structure is 2 feet of concrete under

the home in Haiti but a little smaller area.

The design of the home follows that of a traditional

family shelters, with the addition of a concrete founda-

tion to give it stability and durability. The floors are

made of concrete for durability and ease of cleaning.

The next stage requires the creation of the con-

crete foundation, which will be used as a base for

the walls and the roof.

The walls are 1' thick and are constructed of con-

crete blocks. The blocks are stacked on top of each

other to form a solid wall, and the concrete is allowed
to cure for 24 hours before the next row of blocks is

added.

Step 2: Frame. Once the foundation is complete, the

walls are then erected. The walls are made of con-

crete blocks, and the foundations are then con-

structed. The walls are then covered with a layer of

concrete to provide additional support and to pre-

vent moisture from entering the walls.

The roof is then constructed, using concrete blocks

for support and a thatch roof for insulation and

weather protection.

The roof is supported by concrete blocks, which

are placed on top of the foundation. The blocks are

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The roof is then covered with a thatch roof for in-

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the cob mixture. Start with a layer of cob that is around 3 inches thick or so. First, during the framing stage of the construction it is important to know before-hand where the inhabitants would like their windows to be. This can be completed by filling with sand or dirt. From there begin to place your recycled plastic PET bottles that’s been impregnated with tar to make it waterproof, while making sure to span them the width of your window openings, while preventing the collapse of the outer wall. This wall may be constructed wherever the inhabitants will be created just of cob and will create two rooms. The following instructions are adapted; some text by EHOW.com. Please see the website for more details.

Step 4 Windows: In order to construct the windows with cob while wet. This can be completed by filling with sand or dirt. From there begin to place your recycled plastic PET bottles that’s been impregnated with tar to make it waterproof, while making sure to span them the width of your window openings, while preventing the collapse of the outer wall. This wall may be constructed wherever the inhabitants will be created just of cob and will create two rooms. The following instructions are adapted; some text by EHOW.com. Please see the website for more details.

Step 5 Roof: In order to build the thatch roof it was necessary to complete some some online research. The design team had never built a thatch roof before, so this document will be relying on the directions given by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHOW.com. Please see the website for more details. The following instructions are adapted; some text by EHW
eight pieces and cut the ends to a point with a knife. Soak the wood in water for several hours to soften them. These will be used for "spar" to help fasten the bundles of straw to each other.

Lay the first bundle along the right side of the roof at the eaves. Tie it to the battens, which run horizontally between the rafters, or pin it down with a pole about 1 inch in diameter, nailed to the rafters on either side. Lay enough bundles beside it to cover a section of roof about 3 feet wide. Wet the bundles and again combine them with a rake to pull out any loose straw. Beat them flat with the back of the rake. Trim the bottom of the bundles off square to the eaves. Lay the next bundles above the first one, working up to the peak. Repeat the process until one side of the roof is covered, then start at the eaves on the other side and continue the same way. When you come to the peak, bend the last bundle from the first side and fasten it down on the side of the roof. Lay the last bundle on this side with some of it sticking up. Bend it over so you can fasten it down on the first side. (Thompson, 2010)

Chapter 6

Step 6 Door: For this two long bamboo poles are needed at the height of the intended door and two shorter ones a length equal to the width of the door. The bamboo must be lashed together at the corners creating a rectangular frame. (See earlier lashing image) Over the front of the frame there will use an interwoven bamboo mat as the cover. This can be attached to the lashing material. The door will be attached to the house using two imported hinges, and the locking mechanism will be placed on the inside as a simple sliding lock attached to the wall of the home and the center of the pole closest to the wall. (Thompson, 2010)

<table>
<thead>
<tr>
<th>Materials List</th>
<th>Cost</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo (30 canes)</td>
<td>$44.60 for 10 canes</td>
<td>Naturally recovered</td>
</tr>
<tr>
<td>Cob</td>
<td>$0</td>
<td>Salvaged</td>
</tr>
<tr>
<td>Plastic bottles (~2200)</td>
<td>$8.50 per 47 lb. bag</td>
<td>Available online; spoil of 2008 teine</td>
</tr>
<tr>
<td>Concrete</td>
<td>$37.00 per 47 lb. bag</td>
<td><a href="http://www.directdoorhardware.com/Hinges.htm">http://www.directdoorhardware.com/Hinges.htm</a></td>
</tr>
<tr>
<td>Lime plaster</td>
<td>$3.00 per tub</td>
<td><a href="http://www.makewoodprojectswithoutusingnailsp.htm">http://www.makewoodprojectswithoutusingnailsp.htm</a></td>
</tr>
<tr>
<td>Thatch for roof</td>
<td>$0</td>
<td><a href="http://www.makewoodprojectswithoutusingnailsp.htm">http://www.makewoodprojectswithoutusingnailsp.htm</a></td>
</tr>
<tr>
<td>Lashing material</td>
<td>$12/whipping</td>
<td>Available online; spoil of 2008 teine</td>
</tr>
<tr>
<td>Door Hinges</td>
<td>$6 each</td>
<td><a href="http://www.directdoorhardware.com/Hinges.htm">http://www.directdoorhardware.com/Hinges.htm</a></td>
</tr>
<tr>
<td>Soft wood for thatch roof</td>
<td>$0</td>
<td>Can be salvaged from pre-existing site</td>
</tr>
<tr>
<td>Simple wooden door lock</td>
<td>$5 for (doweling)</td>
<td><a href="http://www.makewoodprojectswithoutusingnailsp.htm">http://www.makewoodprojectswithoutusingnailsp.htm</a></td>
</tr>
</tbody>
</table>

References:
Introduction
Portable housing was included to allow the residents the option of taking the home that is provided to new locations. This will simultaneously give the residents of Les Cayes secure housing and an option in future locations.

The consideration of bamboo as a material was solidified when the practicality of the material and its proficiency in sustainability were learned. Bamboo is a material that is particularly easy to produce in tropical climates, is quickly renewable and has been proven to be an excellent building material.

Sustainability
The use of bamboo in construction and as an economic resource has many practical and sustainable implications for Haiti, the foremost being that bamboo growth is fast, providing a usable building product within three years. The use of bamboo has another vital quality to Haiti, its propagation and use can replace the need for lumber and firewood from the badly depleted native forests of the country; this can have profoundly positive effects on such a badly overused ecosystem. Bamboo's ability to grow in depleted soils and to prevent erosion increases its practicality and usefulness. Beyond the immediate needs of Haiti as a culture, bamboo has other sustainable qualities that contribute to its effectiveness and sensibleness. The incorporation of plastic panels currently in research development by WWU's engineering technology department supports the recycling of HDPE plastics for building materials while also allowing owners of the home to place windows and ventilation where they see fit.

Structure
The structure was given an octagonal footprint primarily to give the house greater flexibility. The octagonal footprint permits individual units to efficiently be assembled into tight clusters while avoiding common walls. Also, the front of the octagon serves as a porch and houses that are constructed in clusters provide a communal, lakou type of space for the residents. The intent was to maintain a degree of privacy while maximizing space in the small community. A major intent has been to develop a structure that leaves a large degree of individualization up to those that will be residing in the units. This serves to encourage a feeling of personal ownership. The structure is an 18' by 18' octagonal concrete floor. The walls and supports are composed of a structured bamboo system that can be taken apart and moved with relative ease. The roof and siding are designed here with bamboo but this is an option based on the availability of materials. At this point the incorporation of plastic panels currently in research development by WWU's engineering technology department supports the recycling of HDPE plastics for building materials while also allowing owners of the home to place windows and ventilation where they see fit.

The structure is an 18' by 18' octagonal concrete floor. The walls and supports are composed of a structured bamboo system that can be taken apart and moved with relative ease. The roof and siding are designed here with bamboo but this is an option based on the availability of materials. A thatched roof would also be appropriate and other siding materials are also a consideration.

Entwodiksyon
La te Portable lojman enkli pèmèt rezidan yo chwa pou pran kay la ki bay pozisyon nouvo. Sa ap bay rezidan yo ansanm nan Les Cayes lojman an sekti ak yon asayis yo konfite ak li nan tamarin. Les Cayes nan ban bou kòm yo mounyl ta konpris li yo le konmide ak li nan mounyl la ak konpris li nan durable akpranm. Ban- tou se mounyl la ki se paktiklyman faal pwodui nan klima twopikal, sa byen dlo renovelise la te pouwo yo dwe genyen mounyl konstritsyon eksisan.

fig. 7.0. Perspective of Portable Bamboo Family Shelter

Chapter 7: Family Shelters 3
A Portable Housing Alternative
David Conrad, William Wrede
How to Build

Excavation
Step 1. Remove top layer of soil and all organic material down to hard ground surface (clay). So that the slab settles as little as possible, remove all decompositional material down to hard ground surface (clay). So that the top of the highest point the adjacent landscape should be 6" above the grade of the excavated area with gravel or sand to allow the slab to sit 6" above the grade of the top of the highest point the adjacent landscape.

Step 2. Level excavated area with gravel or sand to against light flooding and rain.

Step 3. Layout bamboo reinforcement strips at 18" on center each way (see description of using bamboo in reinforcement).

Fig 7.7. A simple method for connecting rebar with a threaded coupler. The male on the right will be epoxied into the 5" post. The male on the left will be epoxied into the 5" rebar coupler (figure 7.7) should be epoxied in place in the 5" posts. The rebar needs 10" embedment into epoxy. See figure 7.6 for female anchor placement (figure 7.4).

Step 4. Layout post anchors per vertical 5" post and fix in place for pour (figure 7.4/7.5)

b. Female anchor placement (figure 7.4 / 7.5)

Tools
1. Shovels
2. Wheel Barrow
3. Drill and ½" bit
4. Handsaws (large and small)
5. 12"-16" dull knife or machete
6. ½" drill and bit
7. Epoxy dispenser

Durable
Flat plates make banbou natural construction a kòm yon kominite piti. Aplansan la te fèt kapasite pou retansyon kabòn nan banbou. Banbou kwit konveniyen ak kas promone kabòn pi vit ki pye, apkoze nan pou ki kontribye nan efikasite li ak sensibleness. Yon pote depo zot la se yon mol pawi nan yon moun ki te enpoze prejije pèsonèl nou. Itilize a kòm yon materyo konstriksyon eksepsyonèl ak sou anfòm avèk efikasite nan grap sere pandan y ap.

Additional Materials
1. Concrete. 5.5 Yards. $330 @ $60 per yard
2. Sand or gravel fill (T&D). 85 cubic yards. $330 @ $60 per yard
3. 60" of 2"x6" forming material for slab (reusable). $15
4. 11 lbs of heavy duty epoxy. $10 each
5. 11 rebar couplers (½"). $12 each
6. Waterproofing for bamboo (paint, varnish, tar). $20
7. Total cost approximation. $1,500

Fig 7.6. How to fix in place for pour (figure 7.4/7.5)

Additional Materials
- 1 rebar couplers (¾”). $12 each
- ½" rebar couplers (¾”). $12 each
- 12" heavy file
- 12”-16” dull knife or machete
- Sand or gravel fill (TBD)
- ½" drill and bit
- Epoxy dispenser
- $1,500

Materials and Cost

Bamboo Pieces

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Length (ft)</th>
<th>Diameter (inches)</th>
<th>USD (each)</th>
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<tbody>
<tr>
<td>Foundation</td>
<td>3</td>
<td>18</td>
<td>114</td>
</tr>
<tr>
<td>Corner/ Interior Posts</td>
<td>4</td>
<td>6</td>
<td>4-6</td>
</tr>
<tr>
<td>Horizontal Wall Posts</td>
<td>7</td>
<td>7.5</td>
<td>4-6</td>
</tr>
<tr>
<td>Roof Frame</td>
<td>8</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Bamboo Roof Tiles</td>
<td>4</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Total Cost</td>
<td></td>
<td></td>
<td>$1,258</td>
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</table>
Frame
Step 5. Set 6" corner posts in couplers the day after slab is poured.
Step 2. Connect horizontal bamboo to 5" vertical posts (figure 7.3) with epoxied anchor bolts.
Step 3. Connect Vertical bamboo stabs (detail 7.1).
Step 4. Connect diagonal supports between each 5" post to insure against racking (figure 7.2).

Fig. 7.4. The layout of the 5" upright posts and the adjoining roof lateral layout from figure 7.7.

KOU MAN PO Bati
Etap 1. Mete 5" posts kwen nan akoupleman jou aprè fason te.
Etap 2. Konekte banbou horizontal 5" "mostor" vètikal (fig 7.2). Anba ranje yo ap 6' fòk chak ranje, li sa a sòpze a konkrè mouye, sa pral lakòz yo fann .
Etap 3. Résolucion konekte planch Bambou (delay 7.1) . Konekte aple dyagonale an chak post 5" ak astre li, bay rebar yo yon baryè kont inondasyon limi aprè.
Etap 4. Lankt post Layout chak vètikal 5" post yo anplò an plas pou (fig. 8.7) tèn 1" anzage anmah akoupleman lam. (fig. 7.7) 7"7" pemèt anplò lam ao plas la fòk ak fann.
Etap 5. Banbou nan ranfòsman Layout bambou a 18 " achat bambou, anplò rebar (ak dekrayiskin saiv ak bambou nan ranfòsman).
Etap 6. Banbou yo pa dwe pi pre 1 1 / 2 " nan sifas fini.
Etap 7. Banbou yo ta dwe mare nan entèval regilye konkrè (anba, anwo oswa kwen).

Travo site
Bambou Costa Rica, konstraksyon, Polonè Banbou ak mèb.

"Bambou reinforced Concrete KONSTRUCTIONY". Richisch Cement Concrete Woman nan Merve Davol. 20 Me 2011.
"Green Building Home. Bambou konstraksyon, Polonè Banbou ak mèb.

fig. 7.3 Illustrates how the top rung of the structure will be secured. The uprights will be cut into a U-shaped cup that is approximate to the size of the culm that will sit within it. The posted upright is drilled with a ½ inch drill bit 3 inches below the highest point of the upright. Green bamboo lashings will be used to lash the connection together.

fig. 7.6. The final product of a bamboo tiled roof. The culms are cut in half lengthwise and placed alongside each other to allow for a spillway. The other half of the culms is turned over and placed on top of the first row to route the water into the upright culms creating an attractive and practical roofing system.

fig. 7.8. Plastic shingle siding should be drilled with ¼" drill bit to allow for lashing. Begin at lowest rung of horizontal 1" bamboo and work up. Bottom shingle should overlap slab to allow for runoff. Shingles can be cut to fit for row endings.

Using Bamboo in concrete reinforcement
Step 1. The right bamboo is necessary to insure strength and durability. Choose Bamboo of large diameter and at least three years of age. Young or green bamboo is not fit for use.
Step 2. To split bamboo into ¾" strips, use a dull blade to run down the length of the culm. This will split the culm straight with the fiber of the bamboo.
Step 3. Proper treatment of bamboo is necessary, dry or soak bamboo for three to four weeks then apply a water proofing (paint, varnish or tar) in a thin layer to insure the bamboo will not expand when exposed to wet concrete, this will result in cracking.
Step 4. Lay bamboo reinforcement out as if it were rebar reinforcement or wire mesh.
Step 5. Tie crossing intervals together with wire or bamboo strips.
Step 6. Bamboo should be no closer to 1 1/2" from finish concrete surface (bottom, top or edge).
Step 7. Bamboo should be tied down at regular intervals so that it does not float during pour.
Step 8. Reinforcing bamboo should be overlapped 2" and run continuously throughout slab.

Works Cited:
Description of Design

The Dormitory for Transitional Residents will house up to 32 displaced Haitian residents. It is composed of two one-story structures with a common area in between each structure resulting in a 36’x52’ total building area. Parts of the structures have four rooms, each of which house four people. The main function of these buildings is to provide a sleeping area and a space to store valuables.

The building will also collect of lateral forces. Gen

These often conflicting considerations were reconciled first of all through the consideration of design of the roof, which was brought down to the middle of each room which separates the sleeping area of each half of the room by over three feet, providing adequate ventilation to the structure. All of the dormitories will incorporate predominately local materials such as cob, bamboo, and HDPE roofing panels made from bottles collected from the area.

Features and Benefits

Economical use of materials and human comfort are two main goals when designing a 32-person dormitory for Les Cayes residents. These often conflicting considerations were reconciled first of all through the consideration of design of the roof, which was brought down to the middle of each room which separates the sleeping area of each half of the room by over three feet, providing adequate ventilation to the structure. All of the dormitories will incorporate predominately local materials such as cob, bamboo, and HDPE roofing panels made from bottles collected from the area.

Deskripsi Design

Dormitory for Transitional Residents that total 32 residents. It consists of two one-story buildings with a common area in between each structure resulting in a 36’x52’ total building area. Parts of the structures have four rooms, each of which house four people. The main function of these buildings is to provide a sleeping area and a space to store valuables. The building will also collect of lateral forces. Gen

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How to Build

Step 1: Dig out the soil to a depth of 19" for each 12'x50' building footprint.

Step 2: Fill 4" with coarse aggregate (preferably crushed rock, but rubble would also be an option).

Step 3: Fill another 2" with fine aggregate and 2" more with sand. Compact the fine aggregate and sand as much as possible either mechanically or by hand tamping.

Step 4: Make forms for the concrete. Drive in stakes around the perimeter of the building and attach boards to these with wire. Run a string line across the width and length of the framework and ensure the tops are level.

Step 5: Put in expansion joints. Use salvaged plywood 3" wide and divide each footprint into 16 squares with the expansion joints. Avoid placing expansion joints beneath where walls will go.

Step 6: Tie 6"x6" wire mesh 1.5" from the bottom of the forms so that it will be embedded in the concrete slab.

Step 7: Assemble the bamboo frame for the cob walls. Lash the pieces together with wire or rope. Use a pencil tied to a string and anchored to one corner of the framework to draw the 12' radius onto the frame work, then cut the ends appropriately. Insert anchors into the bottom 3" of the frame.

Step 8: Erect the bamboo frames. Set the frames about 2" inside of the forms. Use temporary cross bracing staked down outside of the foundation to keep the walls plumb until the concrete is poured.

Step 9: Mix konkre (1:3 siman nan sab) ak pour fondasyon an nan yon pwofondè nan 3", tès depité konkre la se konkre a meteyman apre vidè.

Step 10: Slide 2 eye sou chak 12 " pan. Chalè jwen nan kreyon mo sop plastik yon seksyon 12 ' ak tanzantan nan rebò yo nan seksyon 12 a ak kout fwèt pan yo.

Step 11: Depi anba nan do kay la epi travay leve, tache pan ki genyen ant chak nan miray yo, de pref anba among plastik ak fil metal lòt nan chak nan pan an.


Step 13: Tache fil poul fondasyon an banbou pou miray yo epi savi ak baling oswa lòt fil metal.

Step 14: Mare Banbou Mare Frame la Banbou arwo pafl la.

Step 15: Meksit la (50%-85% sab, 10%-40% ajil, 10%-40% pay ak dlo). Melanje nan vlo prepa, rake moute koye a pande melans energye malòn yon. Aplike epik ankanman an pa men.

Step 16: Coat miray ak kouvrir lacho.
Step 9: Mix the concrete (1:3 cement to sand) and pour the foundation to a depth of 3”, screening the surface of the concrete immediately after pouring.

Step 10: Slide 2 eyelets over each 12” purlin. Heat weld the 2’ x 3’ plastic panels into 12’ sections. Drill holes through the corners of each 12” assembled plastic panel and bolt a row of panels to each purlin. Also drill holes intermittently through the edges of the 12’ sections and lash to the purlins with wire.

Step 11: Starting from the bottom of the roof and working up, attach the purlins between each of the walls, preferably using double couplers or other metal connectors at each end of the purlin.

Step 12: Bolt the free end of each row of panels to the purlin underneath. Take necessary safety measures as this will involve getting on the roof. When the roof is assembled trim the edges so they are flush.

Step 13: Attach chicken wire to the bamboo framework for the cob walls using bailing or other metal wire.

Step 14: Tie bamboo weave to the bamboo frame above the door.

Step 15: Mix the cob (50%-85% sand, 10%-40% clay, 10%-40% straw and water). Mix on a tarp, pulling up the corners while mixing to integrate the materials. Apply cob to the frame by hand.

Step 16: Coat walls with lime plaster.

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**Chapter 8  Transitional resident dormitory**

---

**Materials and Cost**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Aggregate (salvaged)</td>
<td>Fine Aggregate (400/yd³ x 67yd³)</td>
<td>$ 2,680</td>
</tr>
<tr>
<td></td>
<td>Sand (300/yd³ x 67yd³)</td>
<td>$ 2,010</td>
</tr>
<tr>
<td></td>
<td>Concrete ($100/yd³ x 100yd³)</td>
<td>$10,000</td>
</tr>
<tr>
<td></td>
<td>Plywood Expansion Joints (salvaged)</td>
<td>$  0</td>
</tr>
<tr>
<td></td>
<td>Woven Bamboo Mats (native materials)</td>
<td>$  0</td>
</tr>
<tr>
<td></td>
<td>Eyebolts ($0.30 x 90)</td>
<td>$  27</td>
</tr>
<tr>
<td></td>
<td>Washers ($0.30 x 90)</td>
<td>$  27</td>
</tr>
<tr>
<td></td>
<td>Nuts ($0.30 x 90)</td>
<td>$  27</td>
</tr>
<tr>
<td>Double Couplers ($2.50 x 154)</td>
<td></td>
<td>$  386</td>
</tr>
<tr>
<td></td>
<td>HDPE Panels: native materials</td>
<td>$  0</td>
</tr>
<tr>
<td>50 gal drum ($100 each x 12)</td>
<td></td>
<td>$  1,200</td>
</tr>
<tr>
<td>Cob (native materials)</td>
<td></td>
<td>$  0</td>
</tr>
<tr>
<td>Slaked Lime ($10 per ton x 0.5 ton)</td>
<td></td>
<td>$  50</td>
</tr>
<tr>
<td>Bailing wire (55 per roll x 4 rolls)</td>
<td></td>
<td>$  20</td>
</tr>
<tr>
<td>12 Bamboo Poles ($5 each x 280)</td>
<td></td>
<td>$ 1,320</td>
</tr>
<tr>
<td>Chicken Wire ($200 / 2 x 150’ roll x 12)</td>
<td></td>
<td>$  240</td>
</tr>
<tr>
<td>6’ x 6’ Mesh ($40 per 3’ x 100’ roll x 4)</td>
<td></td>
<td>$ 160</td>
</tr>
</tbody>
</table>

**Total Cost:** USD $18,254
Chapter 8

Transitional resident dormitory
Chapter 8: Transitional resident dormitory
Design Goal
The goal of team research was to provide a more permanent form of housing for medical professionals, educators, staff, and visitors located in the area. This research seeks to be useful, fulfilling its promise to create a private housing area within the larger facility. This area will also provide more privacy to the users, allowing for a separate housing cluster of smaller buildings, can work as a whole, while still allowing extensive privacy on the site and keeps the doctors very close to their patients. Option A, B, C and D will also ideally contain a 10' by 20' common living space and kitchen. Each home is based on the Haitian lakou concept, which is native to Haiti and also allows for a sense of community feel amongst those living there. This lakou concept has been built with a compact, living-only idea in mind.

Materials and Cost
Options A and A2, to ensure strong structural support, should be built in the traditional Haitian style using concrete blocks and steel. Locals in Les Cayes have the knowledge of constructing Insulated Concrete Forms or ICF blocks to replace building with concrete alone. ICF blocks can be found everywhere as scrap in Haiti. By blending the Styrofoam pellets and concrete mix, blocks are stronger and more durable than wood built structures, sustainable, ICF' blocks also provide the benefit of being heavy load of a roof garden, bears less weight onto the floor, and keeps the doctors very close to their patients.

Design Bi / Rekomandasyon
Objeksif neswè ekpye ko li bai yan film pi pikisik nan kòm bouyon pou profesyonel medikal, sidikal, antipleye ak, yo atipy ap zevil sa li nan Les Cayes. Demo yon krayi ki vle Medikal Ekip Version viv re, ki gen lew li yon lakou lakou ayisyen, yon 40 piripel, 10 pylò, ak 10 math. MTT, tomiko yo kote ki jeann jwenn nan travay la ak diak. (Fig 5.1) Akove sa a nan, olo opis, mitylo yo li te planifie pou loujman, yon moun yo dezye jel sou Medikal klinik ki a ti lòt kòm yon grapp moun pep blok medikal rekomandasyon ak an se Opisyon, dezye elen nan le kote, gen lew li yon lakou lakou ayisyen, 3 designs have been created to accommodate 2, 4, or 6 people, depending on the type of person inhabiting the home. Each home is based off of a 10' by 10' space for every 2 people, making the 4-person home 10' by 20' and the 6-person home 15' by 30'. These homes will be clustered in a Haitian lakou fashion, which is native to Haiti and allows for a sense of community feel amongst those living there. This lakou concept has been built with a compact, living-only idea in mind.

Design Description

Option A

Option A is divided into 2 parts, A1 and A2. These correlate to the presentation in Chapter 4 of alternative solutions for the medical facility. Option A1 features a 40' by 60' building, with stairs on the back corner of the building, leading up to the second floor. This floor includes a 5' wide open-air porch that extends around the entire structure. There are 6 rooms for housing the doctors and visitors, including 2 double rooms, 1-6 person room, 1-5 person room, and 2-3 person rooms. The client wishes to adjust this room style because the wall layout can adjust this room style because the wall layout can be used if chosen by the client, but as a whole works as a permanent form of housing that can work as a whole, while still allowing extensive privacy on the site and keeps the doctors very close to their patients. Each home has a pitch roof, concrete paving as well as an aesthetically pleasing green space for every 2 people, making the 4-person home 10' by 20' and the 6-person home 15' by 30'. These homes will be clustered in a Haitian lakou fashion, which is native to Haiti and allows for a sense of community feel amongst those living there. This lakou concept has been built with a compact, living-only idea in mind.

Option A1 characteristiks yon 40 'pa 60' bati, ak eskay sekele yo kreye yon desen pi plis anviwonnman dirab, nou te planifye pou lojman, yon dezyèm etaj sou la ak kenbe doktè yo. Oplisyon A1 karakteristik yon 40 'pa 60' bati, ak eskay sekele yo kreye yon desen pi plis anviwonnman dirab, nou te planifye pou lojman, yon dezyèm etaj sou la ak kenbe doktè yo.}

Opisyon A

Se Opisyon A divize an pa at AK, a A2. Fò sa a ti mou ki tout te correspond prezantasyon Chapter 3 an de desen nan faïble medikal. A1 karakteristik yon 40 'pa 60' bati, ak eskay sekele yo kreye yon desen pi plis anviwonnman dirab, nou te planifye pou lojman, yon dezyèm etaj sou la ak kenbe doktè yo. Oplisyon A1 karakteristik yon 40 'pa 60' bati, ak eskay sekele yo kreye yon desen pi plis anviwonnman dirab, nou te planifye pou lojman, yon dezyèm etaj sou la ak kenbe doktè yo.
especially to wind and earthquakes. (Fig 9.5)

**Option B**

How to Build

**Step 1: The Foundation**

The concrete foundation should be six inches thick, and it should rest on a wider surface. The wall shall be the center of the wall six inches thick, with all six inches exposed above the concrete. Note: These are exact measurements. Any deviation may cause serious structural damage.

**Step 2: Bamboo Column Preparation**

For the support columns, 4" diameter prepared bamboo shall be cut to lengths of seven feet. The first film (diaphragm membrane) is punched out in what is to be the lower end. This is to be filled with a section of steel bar held in mortar. The bar shall protrude six to eight inches from the end of the bamboo. These columns shall be placed plumb and centered into the bamboo anchor bolt with 1-1/2 inches of the threaded end exposed. The protruding bar shall connect bar at all contact points. The bar shall protrude one foot above the surrounding ground. The boards will lie flat and be manufactured to meet the code specifications. These columns shall be placed six to eight inches exposed above the concrete. Note: These are exact measurements. Any deviation may cause serious structural damage.

**Step 3: Top Plate**

A top plate of 2"x6" lumber will be attached to the columns for a top plate. The boards will lie flat and it should rise one foot above the surrounding ground.

**Step 4: Bandaj**

For the support columns, 4" diameter prepared bamboo shall be cut to lengths of seven feet. The first film (diaphragm membrane) is punched out in what is to be the lower end. This is to be filled with a section of steel bar held in mortar. The bar shall protrude six to eight inches from the end of the bamboo. These columns shall be placed plumb and centered into the bamboo anchor bolt with 1-1/2 inches of the threaded end exposed. The protruding bar shall connect bar at all contact points. The bar shall protrude one foot above the surrounding ground. The boards will lie flat and be manufactured to meet the code specifications. These columns shall be placed six to eight inches exposed above the concrete. Note: These are exact measurements. Any deviation may cause serious structural damage.
be centered over the bamboo columns. Holes will be
drilled to accommodate the threaded anchor bolts of
the bamboo. The top 1/2" shall be countersunk to ac-
commodate the washer and nut connectors. Between
the columns, centered vertical holes will be drilled
every six inches for steel bar sections to be inserted,
with four inches exposed below and where needed
above to support panel grid. These pins must line up
vertically with the pins exposed in the foundation.

Step 4: Wall Panels
The wall panels will be built upon a grid of split 1-1/2
inch bamboo poles. After being split lengthwise using a
machete, these poles are attached to the steel bar
pins vertically and horizontally in a grid pattern. All
connections with the steel bar and at intersections
shall be bound with steel wire. Door and window holes
may be framed with lumber and placed where desired.
This grid is then covered with chicken wire on both
sides, attached by steel wire at numerous contact
points. The exterior of these panels can be covered
with stucco and painted (or left raw).

Step 5: Trusses
The structures are designed with a simple shed style
roof, for ease of construction, great ventilation, and
ample shade. The trusses are simple triangles of 4
inch bamboo poles built at a 3/12 pitch. All
joists will use steel bolts, washers, nuts, and plywood
gussets. These shall be centered over the bamboo
columns. They will be attached using steel L-brackets
which can be bolted through the gusset plates and
truss system. Lag bolts will attach the bottom of the
L-brackets to the top plate. The same bamboo grid-

chicken wire-stucco panels will cover the two outer
trusses and the front (taller side) of the structure.
Bamboo purlins shall be bolted through the gusset plates and
the front (taller side) of the structure. Chicken wire-stucco panels will cover the two outer
trusses ... " nut w/ rubber washer  224 320 
L-bracket 3"x3"  8 12 
Lag bolts  16 24 

Step 6: Roofing
The roofing could be any variety of available com-
gated roofing products such as plastic, fiberglass, or
metal. Thatched roofing would also be appropriate.
Corrugated products would employs a threaded J-bolt
which would house the bamboo purlins and be attached
to the roofing by a rubber washer and nut.

Chapter 9
Staff and visitor housing

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Quantity 2 person</th>
<th>Quantity 4 person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo 4&quot; dia.</td>
<td>128 75'</td>
<td>308 5'</td>
</tr>
<tr>
<td>Bamboo 1.5&quot; dia.</td>
<td>84</td>
<td>84</td>
</tr>
<tr>
<td>Rack &quot;</td>
<td>Quantity</td>
<td>Quantity</td>
</tr>
<tr>
<td>Door 1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wire 1 set</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bolt 6&quot;X3/X3 96</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>3/8&quot; washer 188</td>
<td>280</td>
<td></td>
</tr>
<tr>
<td>3/8&quot; nut 108</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Chicken wire 32.5 sq. ft.</td>
<td>411 sq. ft.</td>
<td></td>
</tr>
<tr>
<td>2&quot;X3&quot; lumber 42</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>3/8&quot;X6&quot; threaded anchor bolt 12</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2&quot;X4&quot; lumber 39</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>5/8&quot; plywood Two sheet s</td>
<td>Two sheet s</td>
<td></td>
</tr>
<tr>
<td>Roofing J bolt 34-3&quot; 254</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>3/4&quot;x1/4&quot; nut washer 254</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>L-bracket 3&quot;X1/2 8</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Lag bolts 16</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

fig. 9.10

fig. 9.11

HAITI HOUSING RELIEF DESIGN BOOK II

Page 75
HAITI HOUSING RELIEF
AYITI LOJMAN SEKOU

DESIGN BOOK II
Les Cayes Site Study

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