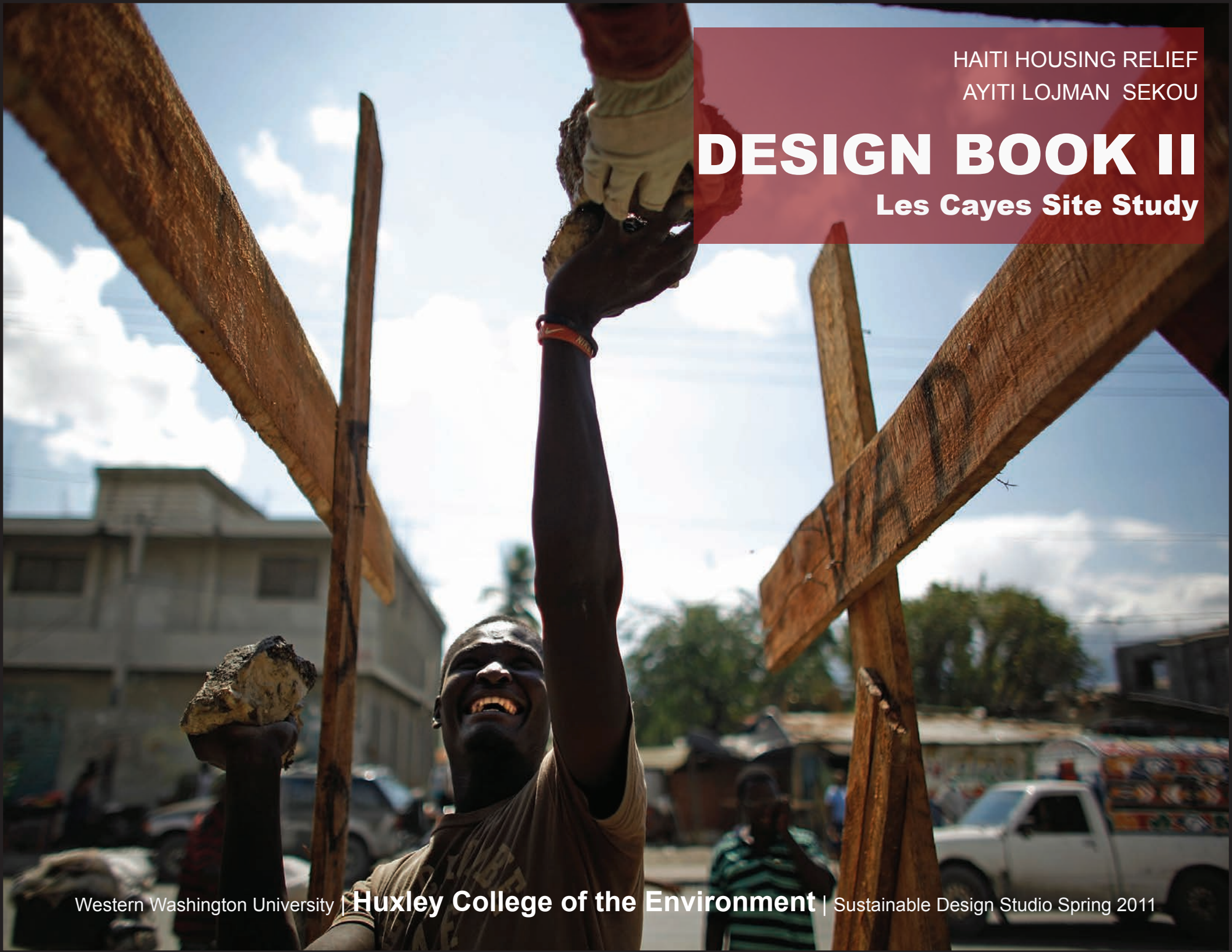

HAITI HOUSING RELIEF

AYITI LOJMAN SEKOU

DESIGN BOOK II

Les Cayes Site Study

Western Washington University | **Huxley College of the Environment** | Sustainable Design Studio Spring 2011

PREFACE

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 more 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 building practices that have proven to be unsustainable and must anticipate the likelihood of future natural disasters.

Haiti Housing Relief Design Book II was prepared by Western Washington University's (WWU) 2011 Sustainable Design Studio to provide guidance for building alternative and sustainable housing and village communities that reflect concern for Haitian cultural, economic, and social priorities. It is a case study examination of a particular site located in southwest Haiti in the community of LaCeyes. The project supplements Design Book I (2010) that provides conceptual development guide for "community self help" to build greater 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 reliant development is dependent upon partnerships that are capable of bringing together vital resources in order to achieve the redevelopment of Haitian communities. Haitian families should play an integral role by contributing knowledge of construction techniques and by providing manual labor. International relief organizations should play an important role in providing building materials and resources while local organizations should assume leadership in providing essential community support services.

It is important to note that the shelter and village infrastructure designs presented in this Design Book II are offered as conceptual ideas. Any building design should be subject to careful engineering analysis to ensure that structural integrity is maintained under specific climatic conditions and under the event of natural disaster. Students examined basic concepts in applying appropriate technology to shelter design, and placed emphasis in considering culturally appropriate forms of shelter and community development.

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 to provide for basic housing relief, temporary housing relief for transient individuals, a medical facility for prosthetic devises, housing for medical staff and community voluneers. In order to provide for a resident village community of approximately 200 individuals, village infrastructure and site planning was also considered in this study.

The primary means for disseminating the Design Book II is through electronic distribution and the report is downloadable at WWU Huxley College of Environment's website at: http://faculty.wwu.edu/zaferan.

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.

Nicholas Zaferatos , Ph.D., AICP
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June 2011

PREFACE

Tranbleman tè a ki te fèt an Ayiti sou 12 janvye 2010 abouti nan plis pase 100,000 lanmò trajik e deplase 1 milyon moun pandan y ap kite yon nimewo menm pi gran moun ki afekte pa dega ak destriksyon a tou de enfrastrikti peyi a menm jan tou kay endividyèl.

Nan lòd diminye soufrans lan ak vulnerable ki moun ayisyen figi a, se apwopriye ak sipò pou lojman ekitab obligatwa. moun ki pèdi kay mande pou pwoteksyon kont sezon siklòn nan pwochen, ak plis pèmanan solisyon lojman pandan rekonstriksyon an, ki se dènye prevwa pou dè dekad plizyè.

Dezas natirèl Ayiti a defi kominote global la yo konsidere nouvo apwòch pou devlopman imen. Redevlopman an Ayiti dwe evite pratik bilding sot pase ki gen pwouve yo dwe durabl epi yo dwe antisipe chans nan dezas nan lavni natirèl.

Ayiti Lojman Relief Design Book Mondyal la se te prepare pa (WWU) Western Washington University an 2011 Dirab Design Studio bay konsèy pou bati lojman altènatif ak dirab ak kominote ti bouk ki reflete enkyetid pou priyorite ayisyen kiltirèl, ekonomik ak sosyal. Li se yon egzamen etid ka nan yon sit patikilye ki sitye nan sidwès Ayiti nan kominote a LaCeyes. Pwojè a sipleman Design Book mwen (2010) ki ofri gid filozofik devlopman pou "ede kominote tèt" nan bati pi plis depandans tèt li nan mitan kominote ayisyen jan yo antreprann Redevlopman yo. Nan lòd avèk siksè egzekite ayisyen Redevlopman, long patenarya tèm ki nesesè nan mitan pèp ayisyen yo, enstitisyon gouvènman li yo, ak òganizasyon lokal ak entènasyonal. Devlopman Kominotè tèt depandan an depann sou patenarya ke yo ki kapab pote yo ansanm resous vital nan lòd rive Redevlopman nan kominote ayisyen. fanmi ayisyen yo ta dwe jwe yon wòl entegral nan kontribye konesans sou teknik konstriksyon ak nan ofri travay manyèl. òganizasyon entènasyonal sekou yo ta dwe jwe yon wòl enpòtan nan bay materyèl bilding ak resous pandan òganizasyon lokal yo ta dwe pran lidèchip nan bay sèvis esansyèl sipò kominote.

Li enpòtan pou sonje ke desen enfrastrikti nan abri ak vilaj prezante nan liv sa a Design II yo ofri kòm ide konsepsyon. Nenpòt konsepsyon bilding yo ta dwe sijè a analiz jeni atansyon Pou asire ke entegrite estriktirèl se konsève kondisyon espesifik klimatik ak anba evènman an dezas natirèl. Elèv yo egzamine konsèp debaz nan aplike ki apwopriye teknoloji desen refij, epi yo mete aksan an konsidere kilti fòm apwopriye pou abri ak devlopman kominote yo.

Design Book II envestigasyon an se etid ka pou yon sit ki sitye nan LaCeyes. Li se yo dwe achte nan yon pwofi ki pa, relijyon òganizasyon ki baze nan peyi Etazini bay pou soulajman lojman debaz yo, lojman tanporè sekou pou moun pasajè, yon etablisman medikal pou protez konswa, lojman pou anplwaye medikal ak voluneers kominote. Nan lòd bay pou yon kominote nan vilaj rezidan nan apeprè 200 moun, enfrastrikti vilaj ak planifikasyon sou sit te tou konsidere nan etid sa.

Vle di nan prensipal pou pibliye enfòmasyon sou Design Book II a se nan elektwonik ak distribisyon rapò a se Downloadable nan WWU College Huxley nan sit wèb Anviwònman a nan: http://faculty.wwu.edu/zaferan.

Benefisyè yo gen entansyon nan envestigasyon sa yo enkli fanmi ayisyen ak òganizasyon sa yo ki pa gouvènman ki bay chak jou sèvis travay an Ayiti. Otè yo elèv la Design Book II ofri sa yo konsèp desen nan lespri a kontribiye nan yon modèl endijèn pou lontan devlopman Ayiti a tèm nan kominote dirab.

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Translations to Haitian Creole relied entirely on the free access service provided by Google Translate software (http://translate.google.com/). We apologize in advance for any errors in translation from the original English text.

Photo credits: Above: University of Indianapolis - www.uindy.edu; MSNBC, www.msnbc.com. Left: Huffington Post Haiti Relief blog.

MATYE

CONTENTS

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: A Framework for Haiti's Recovery:

Case Study Ley Cayes

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 reconstruction by addressing the needs of family shelters, supporting neighborhood infrastructure, community facilities, and life support systems by providing a framework of self-sufficient village development. The design concepts in this publication attempts to achieve a form of development that is respectful of Haitian cultural values.

Our class approached this project knowing that successful solutions for Haiti first require a thoughtful understanding of Haitian culture and lifestyle. As American students, we recognized that none of our preconceptions about housing and community design could easily translate into direct solutions for Haitian people. The resulting design concepts attempt to address both the conditions of daily life and the aspirations voiced by those involved in the recovery effort. We suggest solutions that Haitian families might be able to further adapt as their own.

Appropriate Design
The building designs in this book incorporate a number of responsive to Haitian life. We understood that some of our most basic assumptions about housing required complete revision in order to function properly within Haitian culture. For example, open windows are incompatible with safety concerns as well as with some spiritual considerations of Haitians, and so our designs sought to incorporate established styles for well ventilated walls and secured shutters. We took into account that the vast majority of Haitian life occurs outside the home and community interaction is the center of daily life. The designs do not attempt to reinvent the Haitian home, but promote a more sustainable interpretation of Haiti's unique housing composition.

The 2011 WWU Sustainable Design course examined sustainable design solutions for poor peoples settlements in post disaster areas. This project follows an earlier Haiti housing investigation in 2010, and applies the principles many of those sustainable development principles to a particular site location in Les Cayes. The design recommendations are intended to be also reproducible in locations throughout Haiti.

The clientele for this project is represented by Rev. Eddy Fowler-Lindner, Director of Response Ability Builders, a religious-affiliated NGO that is working in Haiti, as well as representatives from the local Les Cayes community.

Reuse of Discarded Plastics as Building Material
The WWU Engineering Technology Department is undertaking research for Response Ability Builders to determine if a 100 percent recycled thermoplastic construction panel can be manufactured with the limited resources and equipment available in Haiti. The use of discarded plastic waste as a construction material is expected to be used as a moisture barrier, insulation, roofing systems, and non-structural siding material. Determining whether the PET or HDPE form of plastics are easily recycled was the focus of the study. The WWU research has shown that with the limited technology and infrastructure, HDPE plastic bottles can be remolded into useful construction materials. The jobs that could be created by the gathering, cleaning, cutting, and molding of HDPE bottles could help play a role in stimulating the country's economic development while reducing discarded waste. As a result, our students where asked to consider the incorporation of remanufactured plastics as a building material in their sustainable designs.

Sustainable Village Design Elements
The study's scope includes on 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 staff and research teams participating in educational programs;
- Housing for a team of doctors offering services 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 production of plastic-based building materials;
- Agicultural systems for village food production;
- Village water treatment and human waste systems.

Entwodiksyon
Ayiti Lojman Relief Design Book II prezante pa gen solisyon sèl rekiperasyon post-dezas an Ayiti. Okontrè, li ofri devlopman konsèp ki ap chache adoptif kominote oto-depandan. Objektif la se ankouraje dirab rekonstriksyon pa konsidere bezwen yo nan abri fanmi an, sipòte enfrastrikti katye, enstalasyon nan kominote a, ak sistèm sipò lavi nan ofri yon fondasyon devlopman oto-ase bouk. konsèp konsepsyon yo nan piblikasyon sa a eseye reyalize yon fòm devlopman ki se respè valè ayisyen kiltirèl.

Klas nou apwoche pwojè sa a konnen ke solisyon siksè pou Ayiti premye mande pou yon konpreyansyon reflechi nan kilti ayisyen ak vi. Kòm elèv Ameriken, nou rekonèt okenn nan prejije nou yo sou kay ak desen kominote kapab fasil tradui nan solisyon dirèk pou pèp ayisyen. konsèp yo konsepsyon kifè eseye adrès toude kondisyon yo nan lavi chak jou ak aspirasyon yo eksprime nan sa yo patisipe nan efò a gerizon. Nou sijere solisyon pou fanmi ayisyen ta dwe kapab adapte plis tankou yo.

Apwopriye Design
Desen yo te bati nan liv sa a enkòpore yon kantite reyaji nan lavi ayisyen. Nou konprann ke kèk nan sipozisyon ki pi debaz nou yo sou kay oblije ranpli revizyon yo nan lòd fonksyon byen nan kilti ayisyen. Pou egzanp, ouvri fenèt yo se mache ak enkyetid sou sekirite menm jan tou ak kèk konsiderasyon espirityèl la Ayisyen, ak desen konsa nou t'ap chache enkòpore etabli estil pou byen aere miray ak shutters sekirite. Nou te pran an kont ki pi fò moun ki lavi ayisyen rive deyò entèraksyon nan kay ak nan kominote se sant lan nan lavi chak jou. desen yo pa eseye renouvle kay la ayisyen, men ankouraje yon entèpretasyon plis dirab nan konpozisyon inik lojman an Ayiti.

2011 WWU Dirab Design kou a egzamine solisyon dirab pou konsepsyon koloni pèp pòv nan zòn dezas post. Pwojè sa a swiv yon ankèt pi bonè lojman Ayiti nan 2010, epi aplike prensip yo anpil nan sa yo prensip devlopman dirab nan yon kote sou sit patikilye nan Les Cayes. rekòmandasyon yo konsepsyon fèt yo dwe tou repwodwi nan pozisyon nan tout Ayiti.

Se kliyantèl la pou pwojè sa a reprezante pa Rev Eddy Fowler Lindner-, Direktè a Repons Builders Ability, yon ONG relijye-afilye ki ap travay an Ayiti, menm jan tou reprezantan ki soti lokal kominote a Les Cayes.

Reuse Ki Okipe plastik Kom Bilding Material
WWU Jeni Teknoloji Depatman an se antreprann rechèch pou Repons Builders Ability Pou detèmine si ka yon pousan 100 resikle panèl plastik konstriksyon ap fabrike ak resous ki limite ak ekipman disponib an Ayiti. Itilizasyon jete fatra an plastik tankou yon materyèl konstriksyon atann yo dwe sèvi kòm yon baryè imidite, izolasyon, sistèm ROOFING, ak non-estriktirèl materyèl Siding. Detèminen si yo se fòm nan PET oswa HDPE an plastik fasil resikle te konsantre nan etid la. gen rechèch la WWU montre ke ak teknoloji a limite ak enfrastrikti, HDPE boutèy plastik ka remolded nan materyèl konstriksyon itil. travay yo ki te kapab kreye pa rasanbleman an, netwaye, koupe, ak bòdi an boutèy HDPE kapab ede jwe yon wòl nan estimile devlopman ekonomik peyi a pandan y ap diminye jete fatra. Kòm rezilta, elèv nou yo kote yo mande yo konsidere enkòporasyon an plastik reusine kòm yon materyo konstriksyon dirab nan desen yo.

Dirab Village: Eleman Design
Grandè etid la gen ladan sou yon plan vilaj modèl pou yon pasèl tè ti sitiye nan Les Cayes nan sidwès Ayiti. plan an sou sit koresponn nan lis kliyan nou an an vle itilize, ki enkli ladan eleman sa yo:

- Lojman akomode apeprè 160 extérieur deplase moun ak pasyan k ap resevwa tretman medikal reyabilitasyon
- entegre lojman pou anplwaye ak rechèch ekip k ap patisipe nan pwogram edikasyon
- Lojman pou yon ekip doktè ofri sèvis atravè òganizasyon Advantage Ayiti an.
- Yon klinik pou Advantage Ayiti, ki gen ladan 20 kabann, yon 20 'a 20' espas boutik yo dwe fèt nan Ekip Medikal Version, ak yon zòn pou terapi reyabilitasyon
- Yon zòn fabrikasyon pou rechèch ansèyman, ak pwodiksyon materyèl plastik ki baze sou bilding
- Agicultural sistèm sipòte pwodiksyon manje vilaj
- Village dlo tretman ak sistèm fatra imen

Chapter 2: Village Site Plan

A siteplan for a cohesive village system.
Lester Johnstone, Naomi Shucard and Raena Parsons

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
- 1 medical building to house prosthetics device manufacturing facilities, 20 transitional staff, 20 transitional patients and a communal area
- Transitional dormitory housing to house 20 - 30 transitional residents
- Manufacturing space for sugar cane production and plastic-reuse manufacturing (1728 sq. ft)
- Water system consisting of rainwater catchment, filtration, portable water purification and storage
- Waste management system for collection and compost of 200 residents
- Communal space
- Agricultural and food production

Land description
- Site location: 18° 13' 05.33" N / 73° 45.37' 77" W (1.5 miles/Les Cayes, Haiti)
- Tropical Climate/average low temperature of (230 C) 73o F/High of (31o C) 88o F
- Two rainy seasons: April-June/October, November
- South East prevailing winds
- Site A (Community/Medical Facility) is rectangular shaped118 feet in width and 300 feet in length.
- Site B (Agriculture/Compost/Production) is rectangular shaped 100 feet in width and 600 feet in length.
- The two sites are in a flood plain (50-100 yr.)
- The soil is presumed to be alluvial deposition on the surface and clay underneath.
- The site is near a stream that borders both sites and can support hydro-electric energy

Surface Water
According to the contact in Haiti there is not a large threat of surface water inundation. The prediction is that the sites are both within a 50-100 year flood plain. Even so it is recommended that a minimum 20 foot buffer acts 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 a, mitigate erosion and excessive heat from contacting the stream (see agricultural zone 5). With the use of rain gardens we look to reduce excess rainwater from heavy rains that cannot be utilized by rainwater catchment systems.

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'x600'), a secondary parcel available for medium term leasing or possible purchase. In our preliminary research of the agricultural systems, we came 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 waste management systems, thus needed is the inclusion of Site B. The most effective use of space to accommodate the 200 residents, the medical and manufacturing facilities, waste and water management 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 Filozofi
Pou devlope yon plan pou lojman dirab ki ta pèmèt rezidan yo rive jwenn oto-depandans nan pwodiksyon manje ak dlo, estabilite ekonomik ak anviwonman an epi ankouraje ayisyen eritaj.

Objektif
1. Satisfè bezwen debaz yo tankou lojman manje, ak dlo.
2. Ogmante ekonomi lokal la ak devlopman nan yon sant medikal, egzekisyon yon vilaj modèl, pwodiksyon materyèl konstriksyon ak yon sistèm agrikilti dirab.
3. enpak Adrès anviwonman an, epi fè amelyorasyon nan anviwònman lokal la atravè REUSE an materyèl ak restorasyon nan abita natirèl.

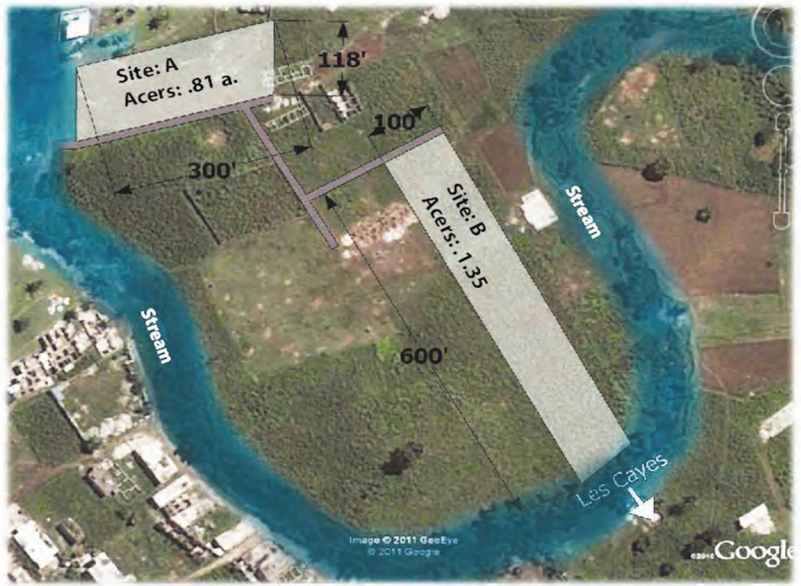


fig 2.0 - Base Map

Espas Kondisyon
• Total espas rezidansyèl pou 200 moun
• 20 kay pèmanan pou 140 rezidan yo a plen tan ayisyen
• 1 medikal bilding nan kay protez etablisman fabrikasyon aparèy, 20 anplwaye tranzisyon, 20 patients tranzisyon ak yon zòn kominal
• lojman dòtwa Tranzisyonèl nan kay 20 - 30 rezidan tranzisyon
• Faktori espas pou pwodiksyon kann ak fabrikasyon an plastik-REUSE (1728 pye sq nan espas)
• Dlo sistèm ki gen kaptaj dlo lapli, filtraj, pòtab pou pirifye dlo ak depo.
• Waste jesyon sistèm pou koleksyon ak compost nan 200 rezidan
• kominal espas
• Agrikilti ak pwodiksyon manje (tankou bèt) espas

Peyi deskripsyon
• Site Location: 18 ° 13 '05,33 "N / 73 ° 45,37' 77" W (1.5 mil / Les Cayes, Ayiti)
• Klima Twopikal / mwayèn tanperati ki ba nan (230 C) F 73o / Segondè nan (31o C) 88o F
• De sezon lapli: April-June/October, novanm
• South East van dominan
• Site A (Kominote / Medikal Etablisman) se rektangilè shaped118 pye nan lajè ak 300 pye nan longè.
• Site B (Agrikilti / Compost / Pwodiksyon) se rektangilè ki gen fòm 100 pye nan lajè ak 600 pye nan longè.
• De sit sa yo nan yon plenn inondasyon (50-100 ane.)
• tè a se prezime yo dwe alluvions depozisyon sou sifas la ak ajil anba.
• sit la se yon kouran ki tou pre fwontyè ni plas ak ka sipòte enèji idwolik-elektrik

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 community center. The outhouses have been placed into two small groups as far away from the garden as possible to mitigate contamination.

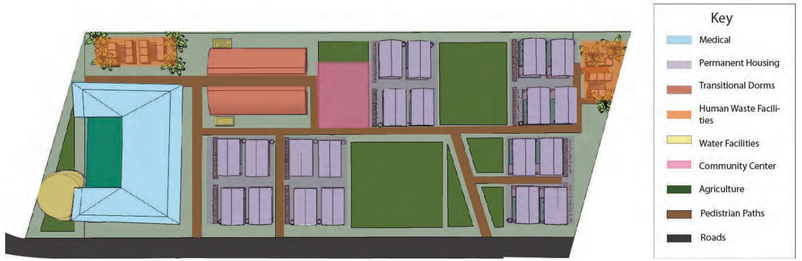


fig. 2.1. Site Design 1

Land Use Requirement Site A: Design 1

		Square Footage
Facilities	Medical, Dorm, Transporation, & Communication Building	2925
	Manufacturing Storage	40
Housing	Dorms: Transient	1764
	Permanent: Bottle Homes	8000
Infastructure	Water Tank	156
	Outhouses	288
Agriculture	Food Plants	12307
	Total	25480

Land Use Requirement Site A: Design 2

		Square Footage
Facilities	Medical Building Only	2925
Housing	Dorms: Medical Staff and Visitors	946
	Dorms: Transient	1764
	Permanent: Earth Bags	10032
Infastructure	Water Tank	156
	Outhouses	288
Agriculture	Food Plants	10836
	Total	26947

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 desired alternative choice. The medical facility was placed centrally to serve as a community gather 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.

Sifas Dlo
Dapre kontakte la an Ayiti pa gen yon menas gwo inondasyon dlo sou sifas. prediksyon a se ke kote yo tou de se nan yon plenn inondasyon ane 50-100. Menm si sa li rekòmande pou yon minimòm 20 tanpon pye aji kòm yon zòn rivren nan kouran nan vwazinaj la. Nan zòn sa a rivren Nou sijere plante nan zèb natif natal ak pye bwa, ki pral aji tankou yon filtè a, redwir ewozyon ak twòp chalè nan kontakte kouran an (wè agrikòl nan zòn 5). Avèk itilizasyon nan jaden lapli nou gade diminye depase dlo lapli soti nan gwo lapli ki pa kapab itilize sistèm nan kaptaj dlo lapli.

Design parameters
Ki baze sou kolekte rechèch, kote an ak kondisyon yo konsepsyon, gen 3 varyasyon nan plan ki ta itilize sit itilize nan tout peyi ki pi efikas. Desen sa yo enkòpore itilize nan tou de konplo nan peyi, Site A (118'x300 ') ak Site B (100'x600'). Nan rechèch preliminè nou an sistèm yo agrikòl, nou rive konklizyon an ke yon nan Site pa ta kapab sipòte bezwen vivan yo debaz sou 200 rezidan yo plus sistèm ki nesesè yo jesyon agrikòl ak fatra, kidonk nou bezwen enklizyon nan Site B. itilize ki pi efikas nan espas akomode rezidan yo 200, fasilite medikal yo ak fabrikasyon, jesyon fatra ak dlo ak espas agrikòl divize de kote yo antre nan yon modèl ti bouk ki rete prensipal (Site A) ak yon agrikilti entansif ak espas fabrikasyon (Site B) .

Entwodiksyon nan Site A Designs 1, 2, ak 3
gwosè a ak fòm nan sou sit la te yon gwo defi lè desine dispozisyon diferan ak limit posiblite yo te fè konsepsyon. gwosè ak fòm lan te fè li enposib yo kreye lakuai nan ideyal. Sepandan, menm ak limitasyon 3 opsyon konsepsyon pwoche kòm ide posib pou yon ti bouk semi-dirab. Pou yo te tout Banbou 3 sit itilize kòm yon tanpon alantou perimèt la nan sit la redwir prive, sekirite, ak vòl. De kay yo te mete sou sit B pou tout desen pou rezon sekirite.

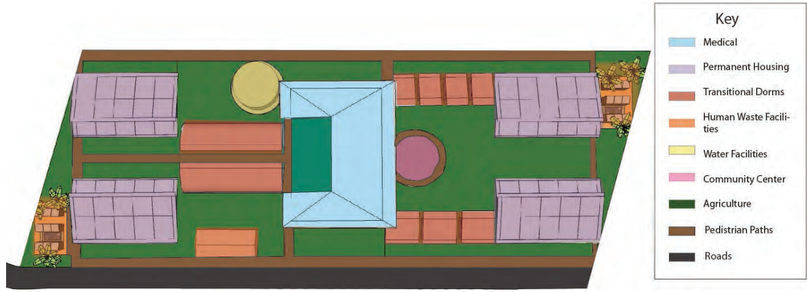


fig. 2.3. Site Design 2

Land Use Design 3

Design 3 is the final alternative supporting the sustainable village plan. Design 3 emphasizes pedestrian walkways and access but does not utilize a through way axis point through the center of the site. The medical facility is centered to facilitate accessibility for the entire community. The housing units have been placed in clusters. This Design uses the most space for housing over the other two designs. One advantage of this design alternative is that the location of the human waste disposal facility is placed on the trail closest to the main road for easy access and maintenance.

Land Use Requirement Site A: Design 3

		Square Footage
Facilities	Medical, Dorm, Transporation, & Communication Building	3600
Housing	Dorms: Transient	1764
	Portable: Bamboo	11800
Infastructure	Water Tank	156
	Outhouses	288
Agriculture	Food Plants	9041
	Total	**26649**

Land Use Site B

Site B's layout remains the same for Design 1, 2, and 3. The village's central human waste facility is located on this site placed in close proximity to the road and surrounded by trees and perennials to mitigate contamination. The manufacturing facility borders the road to facilitate access for staff and the shipment of materials such as plastics and sugarcane. There are two houses on this site located near the manufacturing facility to provide security, as well as the barn. The tilapia pond is on the south end of the site, closest to the stream to draw fresh water for the fish. The agriculture is set up along small rows of nitrogen fixers to help replenish lost nutrients from crops around large intensive agriculture sites. The intensive agriculture sites are for mono crops such as corns and potatoes.

Land Use Requirement Site B: Designs 1, 2, and 3

Agriculture	Food	47602
	Tilapia	3000
	Livestock	2212
Facilities	Human Waste	3300
	Manufactoring Facility and Storage	1775
Housing	Removable	544
	Total	**58433**

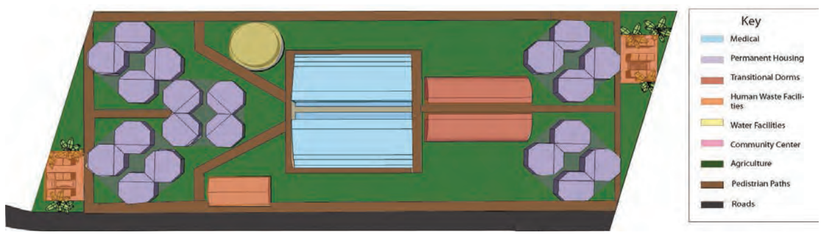


fig. 2.4. Site Design 3

Peyi Sèvi ak Design 1

Design 1 se layout sou sit pi pito, paske li te detèmine yo dwe itilize nan pi efikas nan espas nan tèm akòmode 200 moun, enstalasyon ak espas agrikòl. se etablisman medikal la ki chita sou bò solèy kouche nan sit A pèmèt pou gen aksè fasil ak nan wout la pou transpò nan estaf medikal, pasyan yo, ak materyèl menm jan tou pre pwoksimite tank la kouran ak dlo pou bezwen dlo. se dorm la tranzisyon sitiye tou pre etablisman medikal la, men se pa lwen nan lòt lojman bati yon sans nan kominote ant Tranzitwa yo ak rezidan yo pèmanan. gen lojman an prensipal yo te separe an gwoup ke chak pataje se yon jaden yon dejene ansanm ak tout sitiye tou pre sant lan kominote. depandans yo te mete an de ti gwoup tankou lwen jaden an posib redwir kontaminasyon.

Peyi Sèvi ak Design 2

Design 2 endike itilize nan wout pyeton alantou aksè a yo tout ak nan etablisman medikal la pa efikas tankou tankou nan peyi Design 1 Sèvi ak desen sa a fè yon chwa dezyèm fwa. te etablisman medikal la yo mete santralman yo aji kòm yon kominote ranmase kote. Tout kay yo te repati egal distans soti nan etablisman medikal la ak dortwar yo pasajè ak medikal lojman anplwaye pi pre an.

Peyi Sèvi ak Design 3

Konsepsyon 3 se altènatif final la pou plan an vilaj dirab an Ayiti. Konsepsyon 3 fwa ankò konsantre sou pasaj pyeton pyeton ak aksè, men san yon fason desann nan sant la nan sit la. se etablisman medikal la santre ankò nan pèmèt pou aksè pou tout kominote a. inite yo lojman yo te mete yo nan ama o aza tankou desen an pa itilize pou lojman ki pi bon nan sèvi ak espas. Sa a Design itilize espas ki la pou lojman ki pi plis pase lòt de desen yo fè li pi ba sou lis la. Youn plis sa-a se konsepsyon ki se etablisman an fatra imen mete sou Trail la pi pre wout prensipal la pou gen aksè fasil ak antretyen.

Sèvi ak peyi Site B

layout Site B a rete menm la pou 1, Design 2, ak 3. kapab prensipal etablisman imen an fatra kapab jwenn sou sit sa a plase nan pwoksimite pre wout la ak antoure pa pye bwa ak vivas redwir kontaminasyon. Frontier yo etablisman fabrikasyon wout la pèmèt aksè fasil pou anplwaye ak kagezon an materyèl tankou, plastik ak pwodiksyon kan. Gen de kay sou sit sa a ki sitiye tou pre lopital la manifakti menm jan tou etab la redwir vòl. letan an tilapya se sou fen nan sid nan sit la, pi pre kouran an fè desen an dlo fre pou pwason an kòm yon anviwònman ipoksik pral touye yo. se agrikilti nan mete kanpe style ale ak ranje ti kantite fixers nitwojèn ede ogmante pèdi eleman nitritif nan rekòt alantou sit gwo agrikilti entansif. kote yo agrikilti entansif yo se pou rekòt mono tankou gren pòmdetè,, elatriye

Agrikilti

Gwosè nan de konplo ki nan peyi se apeprè 95.400 sq ft Site A se 35.400 ft sq ak Site B se 60,000 sq ft sa a egal a apeprè 2.2 kawo tè nan peyi. Ki baze sou klima ayisyen an ak lokal ki deja egziste pratik agrikilti, gen yon kantite extensive plant yo twopikal ki ta pi bon kostim espesifik agrikòl-ekoloji a nan sit la (Al gade nan Apendis). Soti nan konstatasyon sa yo, menm jan tou Etazini egzijans nan Nasyon debaz sou 2100 kalori pou chak moun chak jou, peyi a detèmine pa ta durable sipò bezwen yo kalori debaz sou 200 rezidan yo sou yon baz chak ane. Men, avèk pozisyon aktyèl la an Ayiti sosyal ak ekonomik, objektif la dwe vin endepandan, espesyalman nan regards pwodiksyon manje. Pou satisfè tankou yon objektif dwe gen kòm espas otank posib sistèm konsakre agrikòl.

Pi byen itilize espas ki la agrikòl, lis plant yo nan apendis la te detèmine yo grandi byen fasil nan mikroklima sou sit la menm jan tou bay itilize anpil tankou manje, fib, bwa gaz, bilding materyèl, restorasyon tè ak opòtinite ekonomik. Anplis, suggestion a se grandi plant sa yo nan zòn sila yo:

Zòn 1 - (High entansite ak Fèmen proksimite Lojman) zòn sa a ap aji kòm espas jaden kominal ant vilaj agregasyon nan lojman. Plant nan zòn sa a pral itilize sou yon baz chak jou epi mande pou yon kantite lajan ki wo swen ak irigasyon. Pifò nan plant yo kapab wouze nan men rezidan nan vwazinaj la.

Zòn 2 - (vivas ak fwi prodiksyon Pyebwa) zòn sa a ta dwe okipe espas la antoure nan Zòn 1 nan yon ti distans de lojman an. Plant nan zòn sa a mande pou swen ak mwens dlo pase nan zòn 1. Manje nan plant sa yo pral pli ekstrèm ki gen enpòtans nan devlopman 20 sekirite alimantè ane ak konpetans feed rezidan yo 200. Plant sa yo ak pye bwa yo ta dwe plante imedyatman kòm pi devlope fwi nan lespas 4 ane nan plante.

Zòn 3 - (Borders, banbou ak Nitrogen Fixers) rekòmandasyon an ak sa ki nan zòn yo sèvi ak plant yo kòm yon fwontyè aji oswa kloti pou perimèt la toude lokal. Avèk Site A, banbou, ni gwo ak piti, yo ta dwe plante alantou perimèt la nan peyi an. Tankou banbou se jèn grandi epi anvayisan li ta dwe separe nan plant konsakre pwodiksyon manje. Yon separasyon banbou an gwo ak banbou ti tou rekòmande pou itilizasyon deziyen materyèl bilding ak deziyen bwa gaz. Site avèk B, azòt nan ranje plant yo makonnen ak plant ki aji kòm nouri bèt yo ta dwe smi nan sa yo rele "agrikilti ale." Kraze agrikilti Alley moute pi gwo espas ki la agrikòl nan ranje nan fixers yo nitwojèn fontyè. Sa yo fixers nitwojèn ap ede ogmante tè a ak eleman nitritif ki nesesè ki te pwouve nan syans ka an Ayiti ap ogmante pwodiksyon mayi ak lanmidon.

Zòn 4 - (entansif Agrikilti) sa a se zòn ki deziyen sou sit B sèlman. plant yo nan zòn sa a ta dwe okipe espas la nan fwontyè agrikilti ale. Men plant yo pral lajman mono-taye nan ranje ak / oswa espès epi ou ta dwe plante anpil espas maksimòm yo. rekòmandasyon a se plant plis Manihot èskulanta pase lòt plant jan li pwodui kalori ki pi pou chak liv.

Agriculture
The size of the two plots of land is approximately 95,400 sq. ft. Site A is 35,400 sq. ft. and Site B is 60,000 sq. ft. This equals approximately 2.2 acres of land. Based on the Haitian climate and local existing agricultural practices, there are an extensive amount of tropical plants that would best suit the specific agro-ecology of the site (see appendix). From these findings, 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 Haiti, the goal should be self-sufficiency, especially in regards to food production. To meet such a goal there must be as much space as possible devoted to agricultural systems.

To best utilize the agricultural space, the plant lists within the appendix have been determined to grow easily within the site's microclimate as well as provide numerous uses including food, fiber, fuel wood, building materials, soil restoration and economic opportunities. Furthermore, the suggestion is to grow these plants within the following zones:

Zone 1 – (High Intensity and Close Proximity to Housing) This zone will act as communal garden 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 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 water than zone 1. Food from these plants will be of upmost importance in developing 20 year food security and proficiency to feed the 200 residents. These plants and trees should be planting immediately as most develop fruits within 4 years of planting.

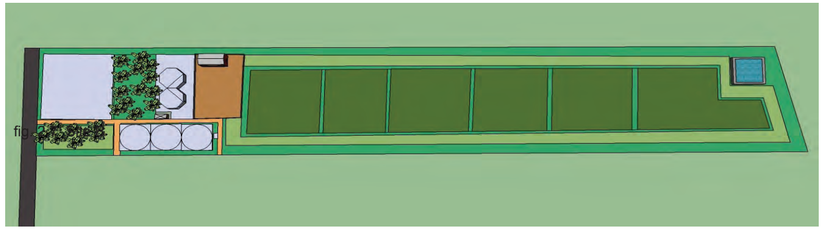


fig. 2.5 Site B, agricultural parcel

Zone 3 – (Borders, Bamboos and Nitrogen Fixers) The recommendation within this zone is to use the plants as a border or fence for the perimeter of both sites. With Site A, bamboos, 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 the large bamboo and small bamboo is also recommended for utilization of designated building materials and designated fuel wood. With Site B, the nitrogen fixing plants coupled with plants that act as animal feed should be seeded in what is called "alley farming." Alley farming breaks up the larger agricultural space into rows by the bordering nitrogen fixers. These nitrogen fixers will help replenish the soil with necessary nutrients that has been proven by case studies in Haiti to increase production of corn and starches.

Zone 4 – (Intensive Agriculture) This zone is designated to Site B. The plants within this zone should occupy the space within alley farming borders. Here the plants will be largely mono-cropped by rows and/or species and should be planted extensively to their maximum space. The recommendation is to plant more Manihot esculenta than other plants as it produces the most calories per pound.

Zone 5 – (Restoration) This zone features native plants and trees that will serve to restore the land back to a natural state. These plants should not necessarily be planted within Site A or B, but rather bordering the surrounding stream. If propagated along the stream bed, these plants will help to control erosion, flooding, surface runoff water and mitigate pollution into the stream.

Livestock
Livestock have been selected by size, diet, and the minimum space they require. It is suggested that goats, rabbits, tilapia, and chickens be utilized for dairy, meat, and egg production.

Goats
¼ acre (10,750sq. ft.) can accommodate 3-4 goats with additional feed. Each goat will need to be fed approximately 2lbs of grain and alfalfa (or equivalent) twice daily. So for 4 goats you would need 16lb of food per day or 5840lb of feed per year. Goats can be fed grains, alfalfa, leafy greens, and vegetables. Goats also need fresh drinking water and a salt-lick. 15sq. ft. of barn space is required for each goat, so a minimum of 60sq. ft. of barn space is needed to accommodate 4 goats, not including storage for feed, tools, etc.

Zòn 5 - (Restoration) karakteristik zòn sa a ayisyen natif natal plant ak pye bwa ki pral sèvi renmèt peyi a retounen nan yon eta natirèl. Plant sa yo pa ta dwe nesesèman ap plante nan Site A oswa B, men pito fontyè kouran nan vwazinaj la. Si pwopaje sou kabann lan kouran, plant sa yo pral ede kontwole ewozyon, inondasyon, dlo risèlman sifas ak redwir polisyon nan kouran an.

Bèt
Bèt yo te chwazi pa gwosè, rejim alimantè, ak espas la minimòm yo egzije. Li sigjere ke kabrit, lapen, tilapya, epi poul ka sèvi pou letye, vyann, ak pwodiksyon ze.

Kabrit
¼ ¼ acre (10,750 ft sq) kapab akomode 3-4 bouk kabrit ak manje anplis. Chak bouk kabrit yo ap bezwen apeprè manje 2lbs nan rekòt ble ak luzèrn (oswa ekivalan) de fwa chak jou. Se konsa, pou 4 kabrit ou ta bezwen 16lb nan manje chak jou oswa 5840lb a nouri chak ane. Kabrit yo ka manje grenn, luzèrn, fèy vèt, ak legim. Kabrit bezwen tou fre dlo potab ak yon sèl niche-. 15sq. se ft nan espas etab egzije pou chak bouk kabrit, pou yon minimòm de 60sq. se ft nan espas etab bezwen akomode 4 bouk kabrit, yo pa enkli depo pou nouri zouti,, elatriye

Poul
Yon poul granmoun bezwen apeprè 2 ft sq nan espas nan yon poulaye ak omwen 3 sq ft nan espas pou parkour. Pou 25 poul ou ta bezwen 50sq. ft nan espas poulaye pa enkli depo zòn nan. Chak poul bezwen apeprè 1/3lb nan manje chak jou. 25 Se konsa poul ta mande sou 9lbs nan manje chak jou oswa 3285lbs a nouri chak ane. Poul ka manje grenn, grenn, fwi, ak legim. Fre dlo potab dwe toujou disponib. traktè Chicken pouvwa gen yon poulaye posib / opsyon parkour pou vilaj la yo paske yo te piti, manyabl, egzije minimòm netwayaj, epi yo fasil bati. Yon senp A-ankadreman estrikti te fè soti nan poto banbou ak fil poul ta sifi.

Lapen
Yon lapen granmoun bezwen apeprè 4sq. ft nan espas bwat plus kèk chanm Roaming. Pou 10 lapen ou ta bezwen omwen 40sq. ft nan espas bwat. Lapen bezwen apeprè 2lbs pou manje pou chak 6lbs nan pwa kò yo. Konsideran tout lapen yo peze 6lbs ou ta bezwen ba yo manje 20lbs nan manje chak jou oswa 7300lbs pou manje chak ane. Lapen yo ta dwe nouri yon melanj nan zèb, grenn, fèy vèt, ak legim. Fre dlo yo ta dwe disponib kòm osi byen yon niche sèl-.

Tilapya
Tilapya yo trè Hardy pwason ak ka siviv nan kondisyon estrès segondè. Pwason sa yo repwodui fasil ak grandi byen vit fè yo yon chwa bon pou pwodiksyon pwoteyin. Si konsève byen tilapya ka siviv koupe nan fimye nan lòt bèt kabrit sètadi, poul, ak lapen. Ogmante 80 tilapya yon 900sq.letan la dwe apeprè 3ft fon lanmè ak rale dlo direkteman nan kouran la kòm kanpe dlo va kreye yon anviwònman ipoksik ki se mòtèl pou tilapya. Tilapya kapab tou manje grenn jaden ak ble pa-pwodwi yo.

Yon minimòm 11.854 sq se ft nan espas nesesè pou bèt. 10.750 sq ft a obligatwa pou parkour ak vagabondaj nan bouk kabrit yo, epi poul, 900sq. ft se nesesè pou letan an tilapya, 144sq. ft se nesesè pou etab la kabrit ak lapen, e se 60 sq ft ki obligatwa pou yon poulaye poul zwazo 25. Youn nan sijesyon konfòme l avèk espas la se bèt ki nesesè sèvi ak peyi a adjasan Site ant A ak B Site pou bèt parkour.

Konklizyon
kote yo konbine de yo se apeprè 2.2 kawo tè, fè li trè difisil yo pwodwi yon plan vilaj dirab. Yo nan lòd yo kreye kominote a ki pi endepandan, itilize peyi ta dwe fè anpil efikas avèk: vit grandi, segondè kalori, rekòt kondanse; bilding multistory pou misyon pou minimize zòn sou sifas itilize; ansanm ak tout bèt minimòm pou misyon pou minimize kondisyon pou peyi (etab, parkour, pwodiksyon manje.)
rekòmandasyon ki annapre yo pouvwa ede reyalize ranpli endepandan:

Nasyonzini yo rekòmande pou yon rejim alimantè a 2100 kalori pa moun pa jou konsa peyi a ta gen rezèv 153.300.000 kalori chak ane pou 200 tout rezidan. Youn acre nan peyi kapab soutni apeprè 43 milyon dola kalori chak ane kidonk yo nan lòd pou kominote sa gen yon sistèm agrikilti dirab li ta mande pou yon minimòm 3 ½ kawo tè ki pa tankou frich tè. Pou Opsyon pito yon espas maksimòm lajan pou agrikilti gen mwens pase numbe a recommnded an kawo.

Rekòmandasyon
Ofsit parkour ta ideyal pou kabrit yo limite kantite required.To feed dwe endepandan ak pwodiksyon lèt bouk kabrit, omwen 60 kabrit ta dwe obligatwa ak yon minimòm 10 kawo tè nan peyi parkour. manadjè pwojè yo ta dwe evalye fason yo genyen plis peyi sipòte aktivite parkour.

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 50sq. ft. of coop space not including storage area. Each chicken needs approximately 1/3lb of feed per day. Thus 25 chickens would require about 9lbs of feed per day or 3285lbs of feed per year. Chickens can eat grains, seeds, fruits, and vegetables. Fresh drinking water should always be available. Chicken tractors 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 4sq. ft. of hutch space plus some room to roam. For 10 rabbits you would need at least 40sq. ft. of hutch space. Rabbits need approximately 2lbs of food per 6lbs of their body weight. Assuming all the rabbits weigh 6lbs you would need to feed them 20lbs of food per day or 7300lbs of food 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 900sq. ft. pond (30ftx30ft) is required. The pond should be approximately 3ft 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.

A minimum of 11,854sq. ft. of space is required for livestock. 10,750sq. ft. is required for grazing and roaming by the goats and chickens, 900sq. ft. is needed for the tilapia pond, 144sq. ft. is needed for the goat and rabbit barn, and 60 sq. ft. is required for a 25 bird chicken coop. One suggestion to comply with the necessary livestock space is to use the adjacent land between Site A and Site B for grazing animals.

Conclusion
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 including 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.

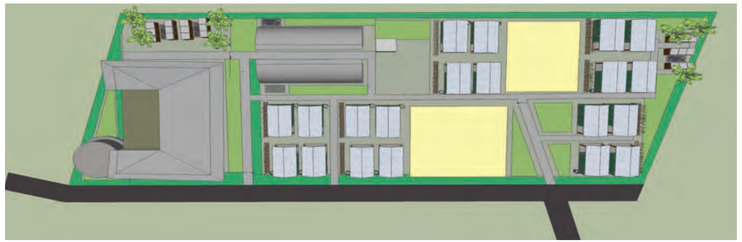


fig. 2.9. Agricultural Zoning base map for Design 1

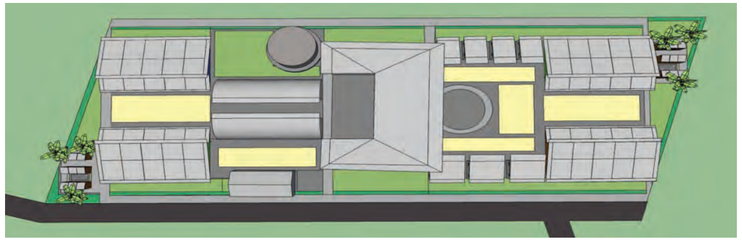


fig 2.10. Agricultural Zoning of Design 2

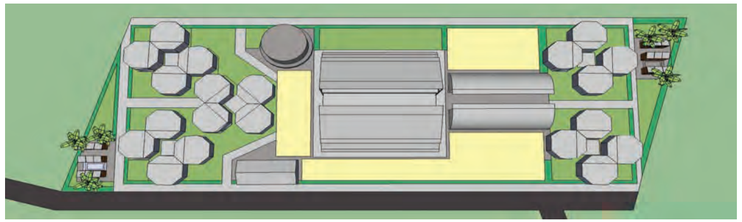
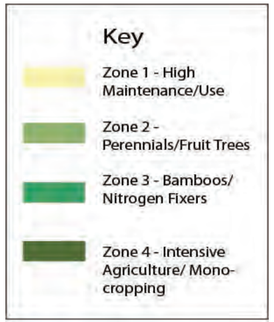


fig 2.11. Agricultural Zoning of Design 3



Key to agricultural zones

Index Reference Tables

Food and Agriculture Plants

FRUIT

Latin Name	Common Name	Uses
Ananas comosus	Pineapple	
Averrhoa carabbola	Star Fruit	
Carica papaya	Papaya/PawPaw	
Artocarpus hetrophyllus	Jackfruit	
Chrysophyllum cainito	Star Apple	
Citrullus lanatus	Watermelon	
Citrus x limon	Lemon	
Citrus maxima	Pummelo	
Citrus spp.	Orange	
Citrus spp.	Grapefruit	
Citrus spp.	Lime	
Cocos nucifera	Coconut Palm	Water purification. Full of electrolytes
Cucumis melo	Cantalope	
Eugenia uniflora	Surinam Cherry	
Grossulariaiceae	Red Currant	
Musa spp.	Bananas	Wastewater treatment
Musa balbisian	Plantains	Wastewater treatment
Mangifera spp.	Mango	
Passiflora spp.	Passion Fruit	
Persea americana	Avocado – Chequette or Lula	
Prunoideae	European Plum	
Psidium spp.	Guava	
Punica granatum	Pomegranate	
Solanum cajanumense	Casana	

VEGETABLES

Latin Name	Common Name	Uses
Abelmoschus exculentus	Okra	
Allium ampeloprasum	Leek	
Allium cepa	Onion	
Allium sativum	Garlic	
Capsicum annuum	Pepper	
Cajanus cajan	Pigeon Peas	
Cucurbita spp.	Squash	
Cynaras scolymus	Artichoke	
Daucus carota	Carrot	
Dioscorea spp.	Yams	
Fabaceae spp.	Beans	
Ipomoea batatas	Sweet Potatoes	
Manihot esculenta	Cassava/Manioc	
Solanum melongena	Eggplant	
Spinacia aleracea	Spinach	
Zea Mays	Corn	

MEDICINALS

Latin Name	Common Name	Uses	Notes
Aloe vera		Cuts, Burns	
Aloysia triphylla	Verbena	Pain reliever, used during childbirth	
Aralia nudicaulis	Sarsaparilla	Purifies/Cleans: blood, liver, kidneys, spleen and bowels	
Cae salpinioideae	Senna	Expels worms, relieves indigestion, laxative	
Chenopedium	Wormseed	Cures roundworm	
Nepeta cataria	Catnip	Blood purifier, mild sedative, tea for infants	
Salvia miltiorrhiza	Red Sage	Emmenagogue (promotes menstrual flow)	
Simarouba excelsa	Quassia/Bitterwood	Tonic, febrifuge (expels intestinal worms)	

SPICES

Latin Name	Common Name	Uses	Notes
Agave americana	Agave	sweetener	
Capsicum baccatum	Peruvian Pepper		
Myristica spp.	Nutmeg	Antibacterial properties	
Eryngium foetidum	Coriander		
Lamiaceae spp.	Mint	A decongestant, diuretic, antipruritic	
Rosmarmus officinalis	Rosemary	Anticancer agent, anti-inflammatory	
Zingiber officianale	Ginger	Analgesic (pain reliever), sedative, antipyretic (fever reducer) and has antibacterial properties	

NUTS

Latin Name	Common Name	Uses	Notes
Anacardium occidentale	Cashews		
Arachis hypogeae	Peanuts		
Jatropha curcau	Physic Nut		
Macademia spp.	Macademia	Nuts and oil are edible	
Prunus dulcis	Almond		

OILS

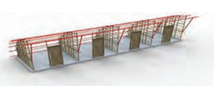
Latin Name	Common Name	Uses	Notes
Attalea speciosa	Babassu Palm	Oil is edible, fruits can be ground into a flour, thatches, lumber for building, possibility for use a biofuel	
Brassica napus	Canola	Oil is edible	
Cocos nucifera	Coconut Palm	Edible endosperms, thatches, young fruits full of electrolytes	
Macademia spp.	Macademia	Nuts and oil are edible	
Vitellaria paradoxa	Shea Tree	Antioxidant properties, contains 5 essential fatty acids	

SOIL ENHANCEMENT

Common Name	Latin Name	Uses	Notes
Chrysopogon zizanioides	Lemon Grass/Vetiver	Erosion control, weed control, refined oil is chief ingredients in perfumes, medicinal uses	Non-invasive but quick growing
Moringa oleifera	Benzolive	Soil rehabilitation, Leaves can be fed to humans and cattle/goats; increases milk production by 43-65% in animals and assists in weight gain, Leaves contain Vitamins A, Vitamin B, Vitamin C and minerals, defatted meal can be used to purify water.	Will grow in poor soil conditions, grows quickly, works well as as hedges or for alley farming.
Ricinus communis	Castor Beans	Soil rehabilitation, oil has multiple medicinal uses	*Seeds are highly toxic if ingested raw
Trifolium repens	White Clover	Green manure, crop cover. (Nitrogen Fixing)	

THATCHES

Latin Name	Common Name	Uses	Notes
Acromia aculeata	Gru Gru Palm		
Attalea maripa	Maripa Palm		
Cocus nucifera	Coconut Palm		
Pseudophoenix vinifera	White Palm		



Bamboo

GIANT BAMBOO

Latin Name	Common Name	Uses	Notes
Bambusa lako	Bamboo	Building materials	**70' tall, 4" diameter**
Bambusa oldhamii	Giant Timber Bamboo	Building materials	**65' tall, 4" diameter**
Bambusa vulgaris	Bamboo	Building materials, edible shoots	**50' tall, 4" diameter** Should not be used for construction as termites lavish on it for up to 3 months after cutting. Must be very well treated.
Dendrocalamus asper	Bamboo	Building materials	**60' tall, 5" diameter**
Dendrocalamus latiflorus		Building materials	**80' tall, 4" diameter**
Guada angustifolia	Guada	Building materials	**60-90' tall, 4" diameter** Harvest after 4 years for building use
Phyllostachys moso	Bamboo		**60' tall, 6" diameter**
Phyllostachys nigra	Black Bamboo	Building materials, erosion control, charcoal production	**30' tall, 2" diameter** Invasive and fast growing, ideal for quick use and harvest
Phyllostachys vivax	Vivax	Building materials	**45' tall, 5" diameter**

SMALL BAMBOO

Common Name	Latin Name	Uses	Notes
	Otatea acuminata	Fuel Wood	
	Nastus elatus	Edible Shoots	
	Thyrsostachys siamensis	Fuel Wood	

Restorative

NATIVE TREES

Latin Name	Common Name	Uses	Notes
Catalpa longissima	Haitian Catalpa		Well-drained soils
Clusia major		Fruits are edible	
Crescentia cujete		Fruit concoction treats diarrhea, stomachaches, colds, bronchitis, asthma and urethritis	
Bucida buceras	Black Olive	Fruits are edible	
Diphotis salicifolia		Produces wood	
Prunus myrtifolia	West Indian Cherry	Fruits are edible	
Pseudophoenix lediniana			Endangered species
Pseudophoenix sargentii			Popular ornamental plant in Haiti
Rosystonea borinquena	Puerto Rican Royal Palm	Thatch, fruits can be fed to livestock	
Simarouba glauca	Paradise Tree	Assists in wasteland reclamation, oil is edible, controls erosion	
Swietenia mahagoni	Indian Mahogany		Endangered species

WATER PLANTS

Latin Name	Common Name	Uses	Notes
Rorippa nasturtium	Water Cress	Edible Plant	*Must be harvested far from human/animal waste due to persistent parasitic breeding
Vallisneria americana	Water Celery	Tilapia food	

Food and Agriculture Zones

FOOD AND AGRICULTURE ZONES

Zone 1 High Intensity and Proximity to Homes	Zone 2 Perennials, Fruit Producing Trees	Zone 3 Borders, Bamboo, Fuel Wood, Nitrogen Fixers	Zone 4 Intensive Agriculture, Mono-Cropping	Zone 5 Restoration
Abelmoschus exculentus	*Ananas comosus*	*Acromia aculeata*	*Dioscorea spp.*	*Catalpa longissima*
Agave Americana	*Averrhoa carabbola*	*Attalea maripa*	*Fabaceae spp.*	*Clusia major*
Allium ampeloprasum	*Anacardium occidentale*	*Bambusa lako*	*Ipomoea batatas*	*Crescentia cujete*
Allium cepa	*Artocarpus hetrophyllus*	*Bambusa oldhamii*	*Manihot esculenta*	*Bucida buceras*
Allium sativum	*Arachis hypogeae*	*Bambusa vulgaris*	*Zea Maya*	*Diphotis salicifolia*
Aloe vera	*Attalea speciosa*	*Chrysopogon zizanioides*		*Prunus myrtifolia*
Aloysia triphylla	*Brassica napus*	*Dendrocalamus asper*		*Pseudophoenix lediniana*
Arachis hypogeae	*Carica papaya*	*Dendrocalamus latiflorus*		*Pseudophoenix sargentii*
Aralia nudicaulis	*Capsicum baccatum*	*Guada angustifolia*		*Rosystonea borinquena*
Capsicum annuum	*Chrysophyllum cainito*	*Moringa oleifera*		*Simarouba glauca*
Cajanus cajan	*Cocos nucifera*	*Nastus elatus*		*Swietenia mahagoni*
Cae salpinioideae	*Citrus x limon*	*Otatea acuminata*		
Chenopedium	*Citrus maxima*	*Phyllostachys moso*		
Citrullus lanatus	*Citrus spp.*	*Phyllostachys nigra*		
Cucumis melo	*Eugenia uniflora*	*Pseudophoenix vinifera*		
Cucurbita spp.	*Grossulariaiceae*	*Phyllostachys vivax*		
Cynaras scolymus	*Jatropha curcau*	*Thyrsostachys siamensis*		
Daucus carota	*Mangifera spp.*			
Eryngium foetidum	*Macademia spp.*			
Fabaceae spp.	*Myristica spp.*			
Lamiaceae spp.	*Musa spp.*			
Nepeta cataria	*Passiflora spp.*			
Rosmarmus officinalis	*Persea Americana*			
Salvia miltiorrhiza	*Prunoideae*			
Simarouba excels	*Prunus dulcis*			
Solanum melongena	*Psidium spp.*			
Spinacia aleracea	*Punica granatum*			
Zingiber officianale	*Solanum cajanumense*			
	Vitellaria paradoxa			

Chapter 3: Village Community Services

A facility design supporting the health needs of a Haitian village

Gregory Jilek, Galen Van Horn, Riley Market

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, rain water 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.

Entwodiksyon

Derespekte dlo ak dechè òganik ki kapab yon menase lavi responsablite. Li se espwa nou sa konsepsyon ap pèmèt Ayisyen olye itilize dlo ak fatra efikasman, kòm yon resous bèso-a-bèso. Sa pral ede elimine depandans a sou enpòtasyon ak men bay detèminasyon pou kominote an.

Dlo Enfrakstrikti

Twa sous dlo yo te idantifye pou sit sa a: dlo lapli, dlo sifas, ak dlo souteren. Ki baze sou izaj, presipitasyon, ak estimasyon kouvri twati, kaptaj dlo lapli ka kont pou apeprè mwatye nan bezwen dlo dous ti bouk la. dwe lòt mwatye a ap souse nan kouran an oubyen tou pre dlo souteren. Nan fen sik la, yo pral dlo dechè dwe resikle ak reyitilize sou sit.

Rainwater kaptaj

Rekòlte dlo lapli se petèt metòd ki pi senp nan koleksyon dlo. Dlo a pran nan twati ak goutyè a afèkte ak downspouts desann nan yon sitèn. Depreferans, kòt-goutyè ka alamòd nan seksyon an plastik corrugated manifaktire sou plas, pandan downspouts ka fè soti nan jete boutèy plastik. Sa ap minimize frè yo, itilize yon pwodwi fatra ak pèmèt tou pou antretyen lokal yo ak reparasyon.

Nou anvizaje chak estrikti ki gen yon twati ki apwopriye yo pral gen pi pwòp ki ka yon Gal 55. plastik lapli barik, oswa pi plis pri-efikasman, te fè soti nan lokalman souse konkrè. filtè Slow sab bati nan sitèn yo pral retire particule matyè pou itilizasyon domestik tankou benyen ak asyèt lave. Sepandan, plis filtraj ki nesesè pou bwè dlo.

Anplis chak inite lojman ki gen pwòp sistèm dlo lapli li rekritman, se anvizaje ki santral inite medikal la ap gen ladan yon sistèm kaptaj dlo lapli. Dlo lapli soti nan santral inite medikal la pral afèkte nan yon 45,000 kominote ferosim lit sitèn ki ka bay lòt dlo pou kominote a nan tan sechrès. Apa yo te soti nan yon metòd trè versatile, ferosim se yon pati nan konstriksyon lokal la jargon epi yo dwe bay yon envestisman soutnabl pou kominote an.

Sifas Dlo

kouran an ki tou pre ka bay plis dlo nan kominote a nan tan sechrès. dlo a ap dwe ponpe soti nan kouran an ak estoke nan 45,000 kominote a lit sitèn pou itilize nan lavni. Pandan ke enpak kouran an gen chans yo dwe minimòm, nou rekòmande yon etid konplè ki efikasite sa a kouran tankou yon sous dlo pasyèl.

metòd la pi pito nan livrezon dlo se abondan River ponp la. Abondan River ponp lan se yon sistèm oto-sipòte pou ponpe dlo. Li se konplètman mekanik (ki mande pa gen entèraksyon imen) ak opere san elektrisite oswa gaz, antretyen ki egzije anpil ti kras. Pouvwa nesesè kondwi se provided by aktyèl natirèl kouran an. ponp lan ka leve dlo jiska 82 pye vètikal, ase ponp l 'nan kominote a sitèn. Miltip abondan River ponp ka enstale nan kouran a delivre dlo a nesesè yo ta dwe yon ponp pwouve mank, ak depans yo varye tou depan de gwosè ponp.

Dlo souteren

Yo ta dwe kouran an pwouve yon sous dlo insuportabl nou rekòmande pou fouye nan yon kominote byen.

Ankò, ta yon etid detaye nan tablo dlo a ak nenpòt ki tou pre pwi ki deja egziste ap avize. Mwayèn depans ki asosye avèk fouye ak enstale byen an Ayiti varye depann sou byen gwosè, pwofondè, ak konpozisyon tè. Li posib ke enstale yon byen nan nivo sa a kote yo pral koute ant $ 5,000 ak $ 6,000, plis kanalizasyon ak

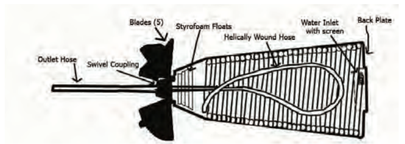
Rainwater Catchment
Harvesting rain water is perhaps the simplest method of water collection. Water is caught by roofs and channeled through gutters and downspouts down to a cistern. Ideally, side-gutters can be fashioned from sections of corrugated plastic manufactured on-site, while downspouts can 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 cistern. 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.



Rife River Pump

Groundwater
Should the stream prove an untenable water source we recommend the drilling a community well. Again, a comprehensive study of the water table and any nearby existing wells would be advised. Average costs associated with drilling and installing well in Haiti varies depending on well size, depth, and soil composition. 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 costs provided by nonprofits that specialize in well drilling in Haiti.

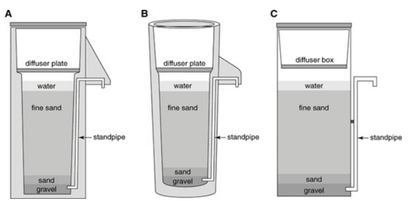
Additionally, wells require human interaction, electricity, or fuel to suction the water out of the ground. Because of the sporadic electricity supply in Haiti and the volatile price of fuel, human power would likely be method of pumping water from the ground—something not required by the other two methods of freshwater generation. The groundwater can be stored in the 45,000 liter community cistern after being pumped from the ground.

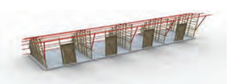
Filtration
Once the water supply is decided on, it is imperative that all water be stored in sealed containers, and purified before use. Uncovered standing water presents a breeding ground for malaria carrying mosquitoes, among other disease causing insects.

For redundancy's sake, there should be a supply of water purification tablets available. This will ensure sanitary drinking water remains available even in the event of a natural disaster. Slow sand filters act as a good first line of defense against particulate matter and some pathogens.

For drinking water, Filter Pure Filters has been identified as a simple, low-technology solution for the community. They can be locally sourced from Haiti and typically last over five years with regular maintenance (maintenance is similar to washing dirty dishes).

Filter Pure Filters are round-bottom ceramic pots composed of a mixture of clay, a combustible material (sawdust, rice husks, or sugar cane husks), and colloidal silver. The mixture is shaped into a filter and kiln fired. During the firing process, about ½ inch of charcoal is produced within the filter to improve taste and color. The filter, which is designed with a rim, is placed on a five gallon plastic storage bucket with a spigot at the bottom for dispensing drinking water. When used, water is poured through the ceramic pot and filtered into the receptacle bucket while a lid can be placed on the filter to prevent contamination. The flow rate of the filter varies from 20 to 30 liters per day depending upon how often the filter is refilled.





antretyen. sa a se estimasyon pri ki baze sou depans sa yo an mwayèn provided by nonprofits ki espesyalize nan byen fouye an Ayiti.

Anplis, pwi mande pou moun entèraksyon, elektrisite, oswa gaz aspirants dlo a soti nan tè. Paske yo pwovizyon an elektrisite detanzantan an Ayiti ak pri nan enstabilite nan gaz, imen pouvwa ta kapab metòd pou ponpe dlo nan yon bagay a tè-pa obligatwa pa de metòd yo lòt kote nan jenerasyon dlo dous. kapab dlo souteren la dwe estoke nan 45,000 kominote a lit sitèn apre yo te ponpe sou tè an.

Filtraj
Yon fwa yo rezèv dlo a deside sou yo, li nesesè pou yo tout dlo ki estoke nan kontenè ki fèmen, ak fè sèvis pou mete anvan yo itilize. Kouvri dlo kanpe prezante yon tè elvaj pou malarya moustik pote, pami lòt ensèk maladi ki lakòz.
Poutèt èkse a, ta dwe gen yon tablèt klorin rezèv ki disponib. Sa a ap asire sanitè dlo potab rete menm nan evènman ki disponib nan yon dezas natirèl.
filtè Slow sab aji tankou yon bon premye nan liy defans kont particule matyè ak kèk ajan patojèn.

Pou dlo pou bwè, Filter Bon Filtè yo te idantifye kòm yon senp, solisyon ki ba anpil-teknoloji pou kominote an. Yo ka lokalman souse nan Ayiti ak tipikman dènye pandan senk ane ak antretyen regilye (antretyen se menm jan ak lave asyèt sal.)

Filter Filtè Bon yo wonn-anba po seramik konpoze de yon melanj nan ajil, yon materyèl Konbistib (syur, kok diri, oubyen kok kann), ak an ajan koloidal. se melanj lan ki gen fòm nan yon sechwa revoke filtre ak. Pandan pwosesis la tire, se sou ½ pous nan chabon ki pwodui nan filtre nan amelyore gou ak koulè. filtre a, ki fèt avèk yon Rim, se mete sou yon bokit senk galon depo an plastik ki gen yon wobinè nan pati anba a pou Dispensing dlo pou bwè. Lè yo itilize, dlo a vide nan po a seramik ak filtre nan bokit nan resipyan pandan y ap ka yon kouvèti ka mete sou filtre a anpeche kontaminasyon. to la koule nan filtre a varye de 20 a 30 lit chak jou selon konbyen fwa filtre la se ranpli.

Grey Dlo
Pandan ke yo pa sanitè pou bwè, sab unfiltered ak ralanti dlo filtre yo apwopriye pou itilize nan manje ak netwayaj. parter Benyen ka bati pwochen nan pi a nan chak kay, ki ta ka demonte pandan tanpèt lou. Fason sa a, kouri-off soti nan douch la sitèn epi yo ka aji ak nan omojèn.

Toujour pral gen depase dlo ki dwe aji avèk yo.
Pandan kaptaj dlo lapli, epi itilize yo ta dwe pwouve diminye enpak yo nan evènman lapli, li enpòtan pou yo konsidere posib sou-koule soti nan sitèn rekritman, ak jeneral dlo-koule kouri-off. Lapli-jaden yo se yon solisyon ba anpil-Tech ak pwoblèm inondasyon. zòn nan over-flow/flood se fouye soti nan yon pwofondè nan apeprè 2 'epi li se tè a retire amande ak plis tero porositë. (Kreye yon efè eponj) plantasyon kapab kounye a ap fè nan jaden an lapli-. Nou rekòmande Banbou ak vetivè bay konstriksyon rèspèktif yo ak pwopriyete anti-mikwòb.

Nwa Dlo
Bon itilizasyon fatra moun genyen kapasite nan siplemantè si li pa ranplase facteur yo achte ak kondisyon angrè nan popilasyon an ak bezwen agrikòl yo. Nitwojèn se blòk bilding lan ki pi enpòtan obligatwa nan yon lavi plant ak fatra Imèn gen apeprè 3 a 4 fwa montan an ki la yo te jwenn nan fimye gade bèt. Konsidere ekstrèm sitiyasyon ekonomik la an Ayiti Mobilizasyon sa a bouk resous enpòtan se yon nesesite vital pou siksè nan yon kominote dirab.

Kreye yon Humanure santralize depo koleksyon ap senplifye transfòmasyon sa a komodite an fini pathogens li ak fòm maladi gratis epi minimize kantite bezwen espas pou operasyon li yo. Sipèvizyon apwopriye nan pwosesis la ak edikasyon adekwa epi konpansasyon pou akonpaye enfrastrikti a se entegral. Antretyen gen ladan koleksyon an ak netwayaj nan bokit yo, epi nan depandans yo tèt yo. dwe sifizan tè moute materyèl kabòn akonpaye bokit yo tou ap bay tèt bokit yo apre chak itilize. Sa pral asire mouch ak odè pa proliferasyon.
Okòmansman materyèl la kabòn byen tè ki kapab soti nan bwa, amaranthe, long oswa yon varyete de lòt materyèl yo pral achte nan volim gwo. Li ta dwe yon objektif imedya yo kreye materyèl sa a soti nan fatra agrikilti vèt ke nan pa te itilize kòm kouvri tè oswa paye.

Yon wòl chèf / manadjè pral asire ke pil yo ap antèt koupe avèk materyèl Grassy nan tout fwa ak yon prela pandan sezon lapli a. chak ta dwe pil dwe rete nan tanperati apwopriye yo anwo a 100 degre, epi yo pèmèt yo rete trankil pou omwen 6 mwa.

Se pil nan pi ansyen an patikilye ki itilize premye ak pil apre yo itilize yo nan lòd kwonolojik yo kenbe efikas Sterilizasyon. pozisyon a ap travay tou avèk manadjè nan jaden yo asire fimye a se aplike nan plant nan pwopòsyon apwopriye, epi distribye toupatou nan zòn yo agrikòl. Edikasyon debaz nan kominote a sou kouman yo sèvi ak bokit yo se esansyèl epi yo dwe yon

Grey Water
While not sanitary for drinking, unfiltered and slow sand filtered water are suitable for uses in cooking and cleaning. Shower stalls can be erected next to the cistern of each house, which would be dismantled during heavy storms. This way, run-off from the cistern and shower can be dealt with in unison.

Invariably there will be excess water that must be dealt with. While rainwater catchment and use should prove to lessen the impacts of rain events, it is important to consider possible over-flow from catchment cisterns, and general water-shed run-off. Rain-gardens are an extremely low-tech solution to flooding problem. The over-flow/flood area is dug out to a depth of approximately 2' and the removed soil is amended with more porous humus. (creating a sponge effect) Plantings can now be made in the rain-garden. We recommend Bamboo and Vetiver given their respective construction and anti-microbial properties.

Black Water
Proper utilization of human waste has the ability to supplement if not replace the purchased inputs and fertilizer requirements of the population and their agricultural needs. Nitrogen is the most important building block required in a plants life and Human waste contains roughly 3 to 4 times the amount that's found in cattle manure. Considering the dire economic situation in Haiti harnessing this valuable resource loop is a vital necessity for the success of a sustainable community.

Creating a centralized Humanure collection depot will streamline the transformation of this commodity into its finished pathogen and disease free form and minimize the amount of space needed for its operation. Proper oversight of the process and adequate education and compensation to accompany the infrastructure is integral. Maintenance includes the collection and cleaning of the buckets and of the outhouses themselves. Sufficient ground up carbon material to accompany the buckets must also be provided to top of the buckets after each use. This will insure flies and odors to not proliferate.

Initially the finely ground carbon material which can come from wood, amaranth, coconuts or a variety of other materials will be purchase in large volumes. It should be an immediate goal to create this material out of agriculture green waste that in not being used as ground cover or mulch.

An overseer/manager role will insure that the piles are topped off with grassy material at all times and with a tarp during the rainy season. Each pile should be kept at proper temperature of above 100 degrees, and allowed to remain undisturbed for at least 6 months.

The oldest pile in particular is used first with subsequent piles used in chronological order to maintain effective sterilization. The position will also work with the manager of the gardens to insure the manure is applied to plants in proper proportions and distributed throughout the agricultural areas. Basic education in the community about how to use the buckets 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 enclosed within the pallet walls by making a "bowl" of earth with the edges raised roughly a foot 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 into the 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 humanure pull back older cover material with a rake and dump the buckets contents into the exposed spot then recover with old grassy material and new cover material. As the pile grows in this fashion fill the enclosed pallet area till it is a few feet above the pallet walls and leave it alone for another six months. Take temperature reading and cover the pile during the rainiest months. A three foot wide perimeter poly-crop of vetiver, bamboo and bananas should be planted around the outer fence to absorb and filter any excessive runoff.

Online resources

Water Catchment:
http://www.cleanwaterforhaiti.org/_what_biosand.html
http://www.unhcr.org/49d089a62.html

River Pump:
http://www.riferam.com/river/index.htm

Filtration:
http://www.filterpurefilters.org/
http://humanurehandbook.com/

Humanure operation in Haiti:

The Humanure Handbook - A Guide to Composting Human Manure, 3rd edition
ISBN 978-0-9644258-3-5

pwogram ankourajman dwe devlope rekonpans itilize apwopriye yo ak sanksyon nannan pou moun fanmi ki pa fè sa. Li dwe ensiste ki pa swiv direktiv ki senp bay menase siksè a ak sante nan kominote a sou nivo ki pi fondamantal e li kapab rezon pou ekspilsyon nan kominote-a.

Kouman pou yo kreye yon Humanure "Pen / park"

Prepare espas la ki pral fèmen nan miray yo pale a fè yon "bòl" ki sou latè ak arebò yo leve soti vivan apeprè yon pye kolekte likid ki anplis yo ak materyèl nan. Liy anba la avèk yon pye nan pye ak yon mwatye nan materyèl kabòn rich Grassy. Vide bokit antre nan sant la nan plim ak liy rebò yo, anwo nan pil materyèl plis Grassy, asire pa kite okenn fimye ekspoze. Lè ajoute apre humanure rale tounen plis materyèl kouvri ak yon rato la epi devèse tout sa ki nan bokit tach la ekspoze Lè sa a, refè avèk materyèl fin vye granmoun Grassy ak nouvo materyèl ki kouvri. Tankou pil la grandi nan sa a mòd ranpli zòn la pale fèmen jouk lè li se yon pye kèk anwo miray yo pale epi kite li pou kont li pou yon lòt sis mwa. Pran tanperati lekti ak kouvri pil la pandan mwa yo rainiest. yo ta dwe Yon twa pye lajè perimèt poly-rekòt nan banbou vetivè, epi fig yo te plante alantou kloti a deyò yo absòbe epi filtre nenpòt ekoulman twòp.

Online resources

Water Catchment:
http://www.cleanwaterforhaiti.org/_what_biosand.html
http://www.unhcr.org/49d089a62.html

River Pump:
http://www.riferam.com/river/index.htm

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Liv la Humanure - A Guide to konposte Imèn lizye, 3yèm edisyon. ISBN 978-0-9644258-3-5

Chapter 4: Medical Facility Center

A multipurpose center for village medical and communications
Brianna Fowler-Lindner, Matthew Lang

Design Goal
The objective for this aspect of the community was to design a larger, more permanent structure to house both a medical prosthetics facility for our clients at Medical Teams International as well as a community internet communication facility that would be free and accessible to all residents of the village. The clients at Medical Teams International proposed a number of specifications that they required for the facility, including a 400 sq. ft. (20'x20') workshop space for prosthetics manufacturing and fitting, a 400 sq. ft. (20'x20') rehabilitation space for amputee patients, and a ward with sufficient space for 20 beds where amputee patients would sleep for the duration of their (approximately 2 month) stay. 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 volunteers, all of whom would be, for the most part, transitional residents. With these requests in mind, the team has adapted two general design based on client requests and adapted for compatibility with the larger village community.

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 as to create some separation from the local population. The main floor of the structure includes the requested rehabilitation area, workshop, and 20-bed ward as well as an 8' x 20' internet communication café, with a covered porch space lining 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).

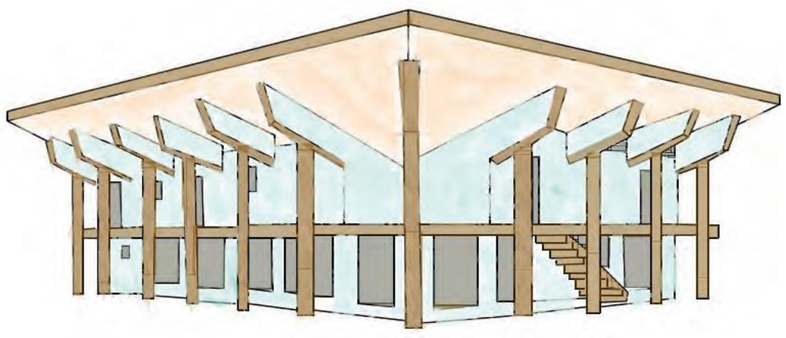
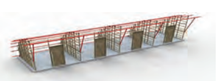


fig 4.1



Design Bi
Objektif la pou sa aspè nan kominote a te fè desen yon pi gwo, pi plis estrikti pèmanan nan kay tou de yon etablisman medikal protez pou kliyan nou an nan Ekip Medikal Version kòm osi byen yon entènèt etablisman kominikasyon nan kominote ki ta ka lib e aksesib a tout rezidan ki abite nan bouk. kliyan yo nan Ekip Medikal Version pwopoze yon kantite espesifikasyon yo ke yo egzije pou etablisman an, tankou yon 400 ft sq (20'x20') espas atelye pou fabrikasyon protez e sere, yon sq ft 400 (20'x20') espas reyabilitasyon pou pasyan anpute, ak yon Ward ak espas sifizan pou 20 kabann kote pasyan anpute ta dòmi pou tout dire a (yo apeprè mwa 2) rete. kliyan la tou demann ki bilding lan kapab "vèt" nan tèm itilize dlo ak aparans, e ke li dwe kilti ki apwopriye pou toude popilasyon ayisyen an li sèvi kòm byen kòm volontè entènasyonal yo, nan tout moun ta dwe, pou pati ki plis, rezidan tranzisyon. Ak sa yo mande nan tèt, gen ekip la adapte de jeneral desen ki baze sou demann kliyan ak adapte pou konpatibl ak kominote a vilaj pi gwo.

Deskripsyon Designs

Design A1
45 'x 65' medikal ak kominikasyon konbine etablisman

opsyon Premye pwopoze kote tout aspè nan sa yo de enstalasyon anba yon twati kominal, ak lojman pou pwofesyonèl entènasyonal medikal ak volontè sou dezyèm etaj la nan bilding lan kòm kreye kèk separasyon nan popilasyon lokal la. etaj la prensipal estrikti ki gen ladan zòn nan reyabilitasyon mande, atelye, ak 20 kabann-Ward menm jan tou yon 8 'x 20' internet kafe kominikasyon, avèk yon espas galeri ki kouvri pawa bò vilaj-ap fè fas nan bilding lan. ta dezyèm etaj la nan bilding sa a ap rezève espesyalman kòm lojman ak zòn bak pou pwofesyonèl medikal ak anplwaye volontè (figi 4.1).

Karakteristik ak Benefis
se konsepsyon nan etaj la prensipal bilding lan konsantre sitou sou ofri yon ouvè, santi w nan kominote-entegre pou pasyan ki rete ak sibi fòmasyon nan etablisman an medikal. se objektif sa a akonpli nan Santralizasyon konsèp la bati sou zòn twati maksimize pou rezon yo nan kaptaj dlo lapli, pandan ansanm bay fonse deyò espas nan devan estrikti an. ta ekoulman dlo a nan do kay la ap moute guttered koupe nan yon estrikti koleksyon dlo santral. gwo, vlope-toutotou nwasi espas galeri a an annakò avèk kilti lokal la, kòm moun ki tipikman pase majorite a nan tan deyò nan bilding yo. Pa fè zòn nan reyabilitasyon sal la ki pi santral nan bilding lan ak antoure li pa yon balkon eksteryè, sa anpeche pasyan nan santi nan izolasyon ak detachman ki ta anjeneral akonpaye fèk adapte yo andikape vi. kafe yo entènèt ta gen tou eksteryè espas balkon yo epi yo dwe fè fas kominote a pou aksè ouvè (figi 4.2).

Design A2
45 'x 52' etablisman medikal

Nan evènman an olye ke nou ta separe etablisman medikal la soti nan entènèt la kafe olye konbine de a anba yon sèl kay, te kapab yon layout altènatif sa yo konsepsyon dwe itilize. konsepsyon nan etablisman medikal la ta gen esansyèlman tout konsèp yo menm ak benefis menm jan ak estrikti ki konbine, men bilding lan ta pwodui yon anprint pi piti.

Features and Benefits
The design of the main floor of the building is focused primarily on providing an open, community-integrated feel for patients who are staying and undergoing training in the medical facility. This goal is accomplished by centering the building concept on maximizing roof area for the purposes of rainwater catchment, while simultaneously providing shaded outdoor space in front of the structure. The water runoff from the pitched roof would be guttered off to a central water collection structure. The large, wrap-around shaded porch space is in accordance with the local culture, as people typically spend the majority of time outside of their buildings. By making the rehabilitation area the most central room in the building and surrounding it by an exterior porch, this prevents patients from the feeling of isolation and

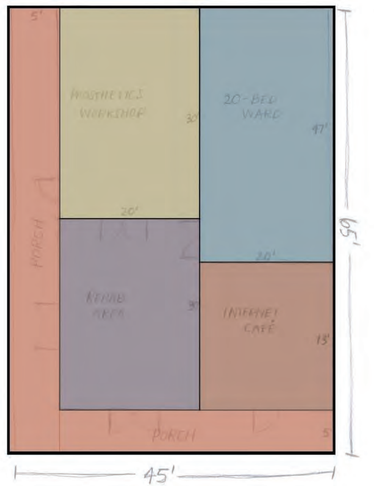


fig. 4.2

alienation that would usually accompany their newly adapted handicapped lifestyle. The internet café would also have exterior porch space and be facing the community for open accessibility (figure 4.2).

Design A2
45' x 52' medical facility

In the event that we would instead separate the medical facility from the internet café rather than combining the two under a single roof, an alternative layout of this design could be used. The design of the medical facility would have essentially all the same concepts and benefits as with the combined structure, but the building would produce a smaller footprint (figure 4.3).

Features and Benefits
The structural design incorporates all the same benefits as the larger structure; large pitched roof, shaded porch space, etc. The benefit of removing the communication facility from the MTI facility would be to make the internet café more open and available to all members of the general village community, without these community members feeling as though they are "intruding" on the medical center. Although this would likely decrease the human traffic around the rehabilitation area and isolate them from community activity, it may alternatively provide some desired separation and serenity.

Design B
2 20' x 60' side-by-side structures for medical and communication facilities

The second proposed option holds to the idea of keeping both medical and communication facilities in a single building concept, and continues to provide housing for medical professionals and volunteers on the second floor. In this design, two 20' wide by 60' long buildings stand side by side, facing one another. The second floor of both buildings create an overhang porch area on the first floor, and the buildings also include a large pitched roof that angle toward one another so as to create a shaded "lakou" area in between (figure 4.4).

Features and Benefits
The benefit for using this dual-building design over the original single building design is to eliminate the large, flat-roofed porch space on the second floor of design A1, which, especially if a green roof is not included, may undergo a large amount of solar heat that could be transferred to the main floor medical facility. The pitched roof design remains in this design which, again, provides great opportunity for a rain water collection system. However, the two pitched roofs in this design are dual-acting, creating shade from two angles and therefore increasing the amount of cool community space between the two structures. This outdoor space would also have the potential of including a rain garden or aquaculture system, adding atmosphere and environmental practicality. The outdoor space would be

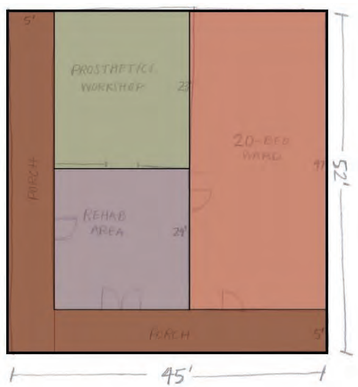
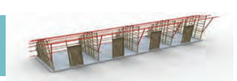


fig 4.3



Karakteristik ak Benefis
desen an estriktirèl enkòpore tout benefis menm jan ak estrikti ki pi gwo a; gwo twati moute, nwasi espas balkon, elatriye benefis la retire etablisman an kominikasyon soti nan prizon an MTI ta dwe fè entènèt la kafe plis ouvè ak disponib a tout manm nan jeneral ti bouk nan kominote a, san yo pa manm nan kominote sa yo santi tankou si yo se "anpyete" nan sant lan medikal. Malgre sa ta diminye chans trafik imen an ozalantou zòn nan reyabilitasyon ak izole yo nan aktivite kominote a, li pouvwa Altènativman bay kèk separasyon vle ak trankilite.

Design B
2 20 'x 60' bò kote-a-kòt estrikti kay ni fasilite medikal ak kominikasyon

opsyon Dezyèm pwopoze kenbe lide a pou kenbe ni fasilite medikal ak kominikasyon nan yon konsèp bilding selibatè, epi li kontinye bay lojman pou pwofesyonèl medikal ak volontè sou dezyèm etaj la. Desen sa a, de 20 'lajè pa 60' bilding long kanpe kòt a kòt, ap fè fas youn ak lòt. dezyèm etaj la de bilding kreye yon zòn balkon fo nan premye etaj la, ak bilding yo enkli tou yon gwo kay ki ang moute nan direksyon youn lòt jan pou yo kreye yon fonse "Lakou" zòn nan ant.

Karakteristik ak Benefis
benefis la pou itilize modèl sa a doub-bati sou desen orijinal la bilding sèl se elimine gwo, espas ki la platkouvèrt sou balkon dezyèm etaj la nan konsepsyon A1, ki, espesyalman si yon twati vèt se pa sa enkli, pouvwa sibi yon gwo kantite nan chalè solè ki te kapab transfere nan etablisman an etaj prensipal medikal. desen an twati moute rete nan desen sa a ki, ankò, bay gwo opòtinite pou yon sistèm koleksyon dlo lapli. Sepandan, de twati yo moute kan sa a yo se konsepsyon doub-ap aji, kreye lonbraj soti nan de ang se poutèt sa ogmante kantite espas kominote fre ant de estrikti yo. Espas sa a deyò ta tou gen potansyèl la tankou yon jaden yon lapli oswa sistèm akwakol, ajoute atmosfè ak komodite anviwonman. ta espas ki la deyò ap itilize enkòpore yo ak nan anviwònman an reyabilitasyon, jan yo ta etablisman medikal la dwe distribiye ant de bilding yo. pi gwo pye a andedan kay la kare pèmèt tou pou yon atelye reparasyon transpò kòm byen ke yon klas milti-objektif yo dwe enkòpore nan adisyon kafe nan Entènèt.

Design C
Chamber Faktori Panel

Fè modifikasyon ti goldeev nan pre-egziste pral fason ki pi dirab yo pwodwi vle panno plastik. Eddy Fowler-Lindner moute kan an ak lide ban m 'plan elabore sou yo, ki prezante yon estrikti ki pral atache a tounen nan goldeev la. pral estrikti a te ajoute plis chans dwe fèt nan firebrick, oswa kèk chalè fasilman disponib mòtye toleran konkrè. estrikti a pral 5 pye longè, ak 3 pye lajè, ak 2 ½ wotè. Gwosè sa a sanble pi byen adapte pou ka sa a, paske mwazi an ki chita nan estrikti a pral 2 pye, pa 4 pye, epi li pral peze alantou 100 lbs. Nenpòt ki pi gwo nan yon mwazi ta mande twòp moun yo leve, yo ta ka itilize yon un-dirab nan tan. dimansyon yo enteryè nan chanm lan pral 3 pye, pa 5 pye, nan pèmèt lè feely deplase nan mwazi an. anba a estrikti sa a pral gen chemine ki pral pèmèt syèl la pi cho nan goldeev a leve nan chanm lan faktori. gwosè a ak kantite twou bezwen se toujou unknown; jije egzakteman kouman cho nan syèl la pral rantre ladan chanm a se difisil kalkile, sepandan 3 a 5 twou, apeprè 8 a 12 pous ap pwodui vle tanperati. Apre pale ak Andre, Pòl, ak Nicole Larsen, li te vin klè ke nou ap eseye atenn ant tanperati 420 degre C ak 475 degre C. Menm si tanperati a kapab jwenn kòm yon wo degre 500, oswa osi ba ke 350 degre, li te gen te note ke twò wo nan tanperati boule kwen yo; twò fre pa pèmèt plastik a mare byen. anndan nan chanm lan faktori ap genyen yon tab griye ki mwazi an ap fasil glise sou yo ak koupe nan. mwazi an egzije yon kote ant 50 ak 100 lbs. ft pou chak kare yo dwe mete sou tèt li asire plastik la koule byen atravè mwazi an, kite pa gen espas vid. Rim nan plat ki antoure yo ap goldeev a ap sèvi ak glise yon transpowtè ki gen grenn sab ak dlo sou mwazi an.

Lis materyèl
• Ponpye brik oswa konpoze siman bilding mòtye.
• Yon griye tablo ki ka reziste ant 400 C ak 600 degreC
• Rolling tablo ki se apeprè wotè a menm jan ak bouch ki pi ba la chanm lan faktori.
• Gwo transpowtè ki ka kenbe 25 galon oswa plis nan dlo ak sab.
• Metal kouvri ke yo pral mete sou tèt mwazi gen chalè.

Kijan Pou Konstwi
Etap 1. Sou bò la tounen nan goldeev a, Stack brik 3 pye wotè ak 2 ½ pye nan longè.
Etap 2. Ajoute yon lòt ranje an brik ki kouri pèpandikilè ak ranje a an premye. Sa a ranje an brik yo ta dwe 4 ½ pye longè, ak jis yon ti kras pi ba pase wonn miray ranpa.
Etap 3. Tache miray la final goldeev la.

Design D
Fos nan Sugar Cane Press Goldeev

Pwodiksyon an wonm, atravè pwosesis la kann ki aktyèlman bagay la sèlman pèp ayisyen pwodui. Ak sa yo te di: nou te mande yo bati yon mwayen pou trape bourade ji nan kan soti nan laprès nan goldeev la. Hopper an dwe wo sou yon etajè jis pi wo pase goldeev la. Seksyon nan banbou yo ta dwe koupe nan mwatye li mete sou tè a jouk longè a vle a rive. Si Banbou se disponib, yon altènatif ta ka koupe yon pye kokoye a mwatye, oswa menm pi bon toujou nou te ka itilize boutèy plastik.

KOUMAN POU Konstwi
Etap 1. Koupe ni anwo ak anba sou boutèy la.
Etap 2. Si materyèl yo limite koupe chak seksyon nan mwatye.
Etap 3. Si boutèy plastik yo anpil, mete yon fen a yon lòt. Sa a ki kalite depresyon pwal gen plis strukturèl son, sepandan yo pral mande pou 2 fwa materyèl la.

utilized and incorporated into the rehabilitation environment, as the medical facility would be distributed between the two buildings. The larger indoor square footage also allows for a transportation repair workshop as well as a multi-purpose classroom to be incorporated in addition to the internet café.

Design C
Panel Manufacturing Chamber

Making slight modifications to the pre-existing goldeev 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 goldeev. 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 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 un-sustainable use of time. The inner dimensions of the chamber will be 3 feet, by 5 feet, to allow air to feely move around the mold. The bottom of this structure will have vents that will allow the warmer air from the goldeev to rise up through the manufacturing chamber. The size and number of holes needed is still unknown; judging exactly how warm of air will be entering the 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 through the mold, leaving no void spaces. The flat rim that surrounds the goldeev will be used to slide a tote that contains sand and water off the mold.

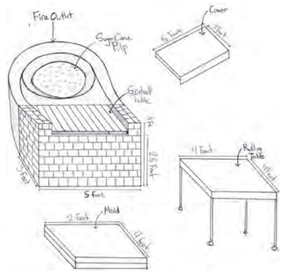


fig. 4.6 Design C: 3ft. by 5ft. Manufacturing Chamber

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 goldeev, 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 goldeev.

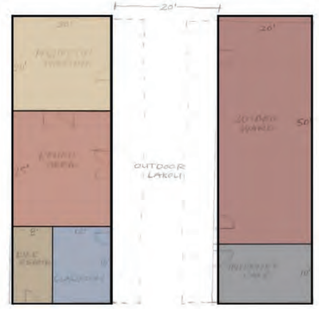


fig. 4.4

Design D
Trough from Sugar Cane Press to Goldeev

The production of rum, through the processing of sugar cane is currently the only thing Haitian people produce. With this being said we were asked to build a means of getting the pressed sugarcane juice from the press to the goldeev. The hopper should be elevated on a stand just higher than the goldeev. Sections of bamboo should be cut in half and laid on the ground until the desired length is reached. If bamboo is unavailable, an alternative would be a coconut tree cut in half, or even better yet we could use plastic bottles.

How to Construct
Step 1. Cut both the top and bottom off the bottle.
Step 2. If materials are limited cut each section in half.
Step 3. If plastic bottles are numerous, attach one end to another. This type of trough will be more structurally sound, however will require 2 times the material.

fig. 4.5 Elevation schematic for two-structure medical, resident, and communications facility

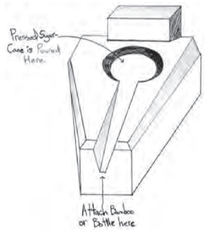


fig. 4.7. Design D: Sugar cane trough made of bottles

Bamboo or Coconut Trough Option

Step 1. First cut bamboo, or coconut trunk in half with hand saw.
Step 2. Arrange trunks or bamboo in desired location
Step 3. Tie together with rope or palm reeds if avail able.

Plastic Bottle Option

Step 1. Remove top section of the bottle just above the point where the bottle becomes narrower and eventually goes to the lid.
Step 2. Cut bottom section as low as possible.
Step 3. Connect each bottle, or if materials are limited.
Step 4. Cut each bottle in half so you are left with half cylindrical sections, that can be attached with glue.

Design E

Storage for manufacturing tools/panels

This structure will be placed close to the goldeev and manufacturing chamber, and will be 8 feet long, 4 feet wide, and 8 feet tall. The far right section of the storage unit will house cured panels. The middle section will have 2 to 5 slots where molds can be stored. The far left side of the unit will be reserved for tools and bins. This structure doesn't need to be heavily reinforced due to its size, and the fact that it will not be used for living.

Materials

• The outside of the structure can be made of ply-wood, plastic panels, bamboo, or any other rigid build-ing material.
• 8 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 devise.
• 4 by 4's as well as 2 by 4's (the number needed is variable and will depend on how much reinforcement they feel the structure will need and allotted materials).

How To Construct

Step 1. Lay 4ft. by 8ft. 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.

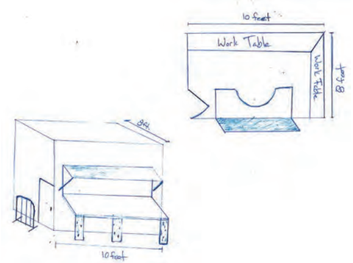


fig. 4.8 Design E: 10' by 8' by 8' Storage shed for panels

Design F

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 outfitted with shelves as well as j hooks that will allow for bikes to be hung. Space for rims, tubes, screws, tuning supplies, oil, and like materials should also be provided.

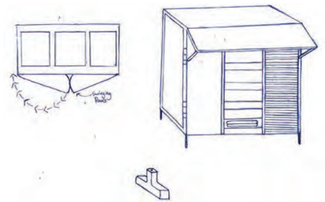


fig. 4.9. Design F: 10 x 8 x 8 Bike Storage/Repair

Materials

• Plastic panels that will be fastened together, ply-wood, or bamboo that will be used for the walls.
• 2 by 4's as well as 4 by 4's for framing.
• 2 bamboo stakes that will prey or hold the sun blocker open.
• 2 plastic panels or 2 sheets of plywood for the inner and outer worktables.
• Locking door.
• Storage bins.

How to Construct

Follow same steps as manufacturing storage unit.

Materyèl (Banbou oswa fos Coconut)

Etap 1. Premye koupe Banbou, oubyen kòf kokoye a mwatye ak men te wè.

Etap 2. Kalson Fè aranjman oswa banbou a vle kote
Etap 3. Mare ansanm ak kòd oswa palmis touf wozo si sa disponib.

Materyèl (plastik Opsyon nan boutèy)

Etap 1. Retire tèt seksyon nan boutèy la jis anwo a nan pwen kote boutèy la vin pi etwat ak evantyèlman ale nan kouvèti an.
Etap 2. Koupe anba seksyon osi ba ke posib.
Etap 3. Konekte chak boutèy, oswa si materyèl yo limite:
Etap 4. Koupe chak boutèy nan mwatye ki rete pou ou ansanm ak mwatye nan seksyon silendrik, ki kapab tache ak lakòl.

Design E

Depo pou fabrikasyon zouti / panno

Pral estrikti sa a dwe mete tou pre chanm lan goldeev ak fabrikasyon, epi yo pral 8 pye longè, 4 pye lajè, ak 8 pye wotè. pral byen lwen nan seksyon dwa apatman an depo lakay geri panno. seksyon nan presegondè, ap gen 2 a 5 fant kote moul kapab estoke. pral bò kote a lwen kite nan inite a dwe rezève pou zouti ak po-sode. Estrikti sa a pa bezwen lou ranfòse akòz gwosè li, ak lefèt ke li pa pral itilize pou vivan.

Materyèl

• deyò nan estrikti ki kapab fèt nan plywood, panno plastik, banbou, oswa nenpòt lòt materyèl rijid bilding nan.
• 8 depan pral nesesè pou pòt la antre, anwo twati balanse, ak pòt balanse.
• 2 poto Banbou separe andedan nan inite a, ak de moun ki pi piti sipò pliyan twati.
• blokaj envansyon.
• 4 pa 4 a menm jan tou 2 pa 4 la (nimewo ki nesesè se varyab epi yo pral depann de konbyen ranfòse es-trikti yo santi yo an pral bezwen ak materyèl deziye).

Kijan Pou Konstwi

Etap 1. Kouche 4ft. pa 8ft. fondasyon.
Etap 2. Tache mi fondasyon yo ak ranfòse ak sipò kwa si sa nesesè.
Etap 3. Tache panno plastik oubyen jwe bwa andeyò estrikti.

Design F

Transpòtasyon (bisiklèt boutik, depo, reparasyon)

Yo akòz aktyèl lit ekonomik, li ta durabl pou ayisyen nan depanse lajan sou gaz. Paske nou fèò yo kreye yon repons dirab difikilte yo, bisiklèt sanble mòd nan pi bon pou transpò. Ak sa yo te di ke li pral trè enpòtan pou gen yon estrikti ki ka kay bisiklèt, pati rezèv, ak zouti. estrikti a dwe gen ladan yon tablo travay ande-dan kay la epi deyò. mi an tounen ak bò kòt yo ta dwe ekipe ak etajè menm jan tou j Kwòk ki pral pèmèt pou bisiklèt yo dwe pann. Espas pou rou, tib, vis, materyèl reglaj, lwil, ak materyèl tankou ta dwe tou bay.

Materyèl

• plastik panno ki pral mare yo ansanm, plywood, oswa banbou ke yo pral itilize pou miray yo.
• 2 pa 4 a kòm byen ke 4 pa 4 a pou ankadre.
• 2 pike banbou ki pral karanklou oswa kenbe blokaj solèy la louvri.
• 2 panno plastik oswa 2 fèy plywood la pou worktables yo anndan ak deyò.
• blokaj pòt.
• Depo posode.

KOUMAN POU Konstwi

Swiv etap menm jan ak fabrikasyon inite depo

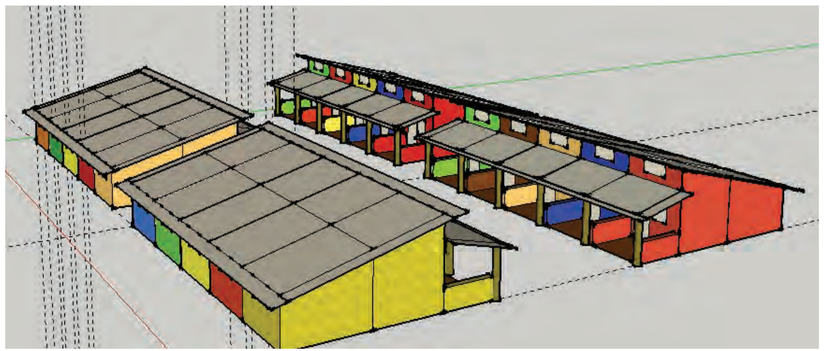
Chapter 5: Family Shelters 1

A Cluster Haitian housing style using native and innovative materials to create a permanent shelter for a typical Haitian family.
Jordan Stead, Rafa Gonzales

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. Tradition is just as important as effectiveness in the construction of the housing complex, so the materials used and the architecture of the homes must both compliment Haitian culture.

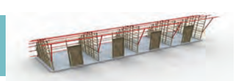
An easily adaptable, affordable home construction that satisfies Haitian cultural beliefs and maintains an ecologically sound existence is embodied in the technology of the already field-tested model of earthbag homes. The idea of stacking bags of sand (or other filler material) has been in practice since the early 1900s. Military use coupled with the ease of availability in almost every developing country in the world has proven 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 (sides) by 10” wide (front and back) with a 12’ front face, complete with a thatch roof descending down to 6.5’ 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 bags) 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 6’8” functioning door, leading into a cooking and storage area roughly measuring 8’x10’. 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 (2’x4’; upper, 3’x2.5’, front, [2x] 2.5’x4’; 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, shed-style roof is also constructed from thermoplastic. If this cannot be melted down in such a demanding surface area, corrugated metal sheets or thatch can be utilized for a roof.



Objektif Design nan

Etap sa a nan detay yo ayisyen devlopman vilaj wòl nan lojman pèmanan pou (160) pèp endijèn sou trase nan peyi chwazi. Tradisyon se jis enpòtan menm jan efikasite nan konstriksyon nan konplèks lojman an, pou materyèl yo te itilize ak achitekti nan kay yo dwe kilti ni konpliman ayisyen.

Yon fasil adaptab, konstriksyon kay abòdab ki satisfè ayisyen kwayans kiltirèl ak kenbe se yon egzistans ekolojik son konsakre nan teknoloji nan modèl la earthbag kay deja jaden-tès. gen lide nan anpile sak sab (oswa lòt materyèl resipyan) te an pratik depi kòmansman ane 1900 yo. Militè itilize makonnen ak fasilite a disponibilite nan prèske tout peyi devlope nan mond lan pwouve sak (ak dimansyon nenpòt kote nan 14 "x24" nan 18 "x30") yo dwe youn nan materyèl ki pi dezas ki reziste ak fasil-a-itilize achitekti pou konstriksyon.

Rechèch ak konparezon te fè sou desizyon an ki earthbag kay yo chwa ki pi bon pou pèp ayisyen sou trase peyi kliyan an. kay Earthbag fè grandizè yon pwosesis konstriksyon senp makonnen ak abondans la sou plas materyèl ki fè sa a style lojman ki pi apwopriye, pri a efikas ak dirab metòd pou lojman ki disponib.

Design Deskripsyon

Malgre earthbag kay kapab konstwi al kontre prèske nenpòt desen konsèp, plan pou lojman pèmanan an lonje pou pwojè sa a ta pi byen adapte kòm yon fòm rektangilè ki gen yon galeri ki kouvri ansanm pòsyon ki devan bilding lan. dimansyon yo nan kay la se jan sa a: 22 "long (bò) pa 10" (devan ak dèyè) avèk yon lajè 12 'fas devan, ranpli ak yon twati feutr desann desann nan 6.5' segondè figi dèyè. fondasyon nan kay la ka youn nan de opsyon, chwazi nan bòs mason yo: bati dirèkteman sou yon tranche fon plen ak gravye (kenbe dlo nan enfiltrasyon moute nan sache yo) oswa mete yo sou yon vide trase konkrè, parapò ak kantite moun ki nan chak kay endividyèl oswa gwoupman nan kay la.

Ka enteryè nan kay la jwenn aksè atravè yon pòt 6'8 "fonksyone, dirijan nan yon zòn pou kwit manje ak depo apeprè mezire 8'x10 '. Yon lòt pòt (tan sa a se sèlman yon espas, pa fonksyone) mennen nan trimès yo dòmi, yon chanm mezire 10'x11 ', depann de kote ~ 1' miray la Sak sab tonbe nan mitan kay la. Nan tout fenèt yo - konstwi de (2'x4 '; anwo, 3'x2 .5' devan,, [2x] 2.5 'x4'; dèyè) dra a 100 pousan resikle plastik, fonn desann sou-sou sit - gen kapasite nan Fèmen e bloke pou sekirite epi ajoute anpil sikilasyon-nesesè lè. Si gen plis sekirite nesesè, bwa yo ka itilize nan konstriksyon nan ankadreman an fenèt ak plak. Incline la anba, se koule-style twati tou konstwi soti nan plastik. Si sa pa ka fonn atè a tankou yon zòn sou sifas mande, dra metal corrugated oswa feutr kapab itilize pou yon twati.

Karakteristik & Benefis

Metòd konstriksyon tankou se sou earthbag kay ankouraje yo itilize sou sit-, materyèl natirèl, senp konstriksyon, fò tan rezistans-epi posiblite enfini pou adaptasyon itilizatè, swa nan tèm fòm grafik oswa bilding koloran (atravè itilize nan Texture natirèl oswa penti). Pri, antretyen ak rezistans yo neglijab lè w ap itilize earthbag materyèl ak metòd.

Features & Benefits
Construction methods as is on earthbag homes promote the use of on-site, natural materials, simple construction, strong weather-resistance and limitless possibilities 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 already active in Haiti. In addition, the earthbag home movement has since began in Haiti, and has been rapidly and successfully expanding across the countryside as less of an alternative housing solution, but nearing 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 "alternative," low-cost housing.

Earthbags are light, compact and can be shipped by the pallet load, enabling ease of transport. The 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

emergencies in large quantities. Ease and speed of assembly is nothing short of extraordinary; two recipients could construct a basic shelter core of two walls in about two days by following one page of visual instructions. To add to the possibilities of personal customization, individual shelters can also be incrementally improved and completed over time.

The earthbag home design on this particular plot keeps what is important for housing in the most simple, yet effective manner. Locals, used to the homes they had before the earthquake's destruction, will adapt to the minute changes found in the earthbag movement. The design includes indoor living quarters, which can function to serve the simple, traditional needs of the Haitian people, be it cooking or social interaction. Furthermore, the individual home design can be easily adapted to fit multiple styles of arrangement (i.e. blocks of homes, cul-de-sacs, ect.).

Building The Structure
(Without a concrete foundation) A flat, earthen plot is ideal. Builders must first dig a shallow trench, anywhere from 6" – 1' deep, outlining the shape of the outer wall of the desired home, and fill it 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 river rock to further ensure no seepage from damp ground caused by rain or water buildup in the soil affects the home.

When each bag has been laid long end to long end, every "level" must be packed down by hand. This 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 supportive 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.

Achte a ak transpò nan materyèl yo (sètadi, pèl, sache, fèr fil, [ochwa] zouti procesna) ki pa sou sit la cheap ak byen fasil anbake nan nenpòt kote nan mond nan, tankou nan yon sit deja aktif nan Ayiti. Anplis de sa, mouvman an kay earthbag gen depi te kòmanse an Ayiti, e li te elaji rapidman ak siksè atravè tout peyi a kòm mwens nan yon solisyon lojman altènatif, men pratikman yon estanda a la swit a nan tranbleman tè an. Nan peyi atravè tout glòb la, metòd la se pwan sou yo ak gaye kòm youn nan metòd ki pi bon - toude finansyèman ak estabilite-save - pou "lòt", kay ki ba anpil-koute.

Earthbags se limyè, kontra enfòmèl ant epi yo ka ekspedye pa chay la pale, pèmèt fasilite nan transpò. kay sa yo se yon solisyon ki trè parametrabl, tankou nimewo gwo inite lojman kapab anbake sou ti kras oswa ki pa gen avi avanse, depi sak yo tipikman ta pou ijans nan kantite gwo. Fasilite ak vitès nan asanble pa gen anyen ki kout ekstraòdinè; de benefisyè ta ka konstwi yon abri debaz fondamantal de miray ranpa a sou de jou sa yo nan yon sèl paj nan enstriksyon vizyèl. Add to posiblite yo adaptasyon pèsonèl, abri endividyèl kapab tou progressive amelyore ak ranpli sou tan.

Desen an kay earthbag sou sa trase patikilye kenbe sa ki enpòtan pou lojman nan fason ki pi senp, poko efikas. Lokalite, sèvi ak kay yo te gen anvan destriksyon tranbleman tè a, yo pral adapte yo ak chanjman yo minit jwenn nan mouvman an earthbag. desen an gen ladan trimès k ap viv andedan kay la, sa ki ka sèvi fonksyon senp, bezwen yo tradisyonèl nan pèp ayisyen, se pou l 'pou kwit manje oubyen sosyal entèraksyon. Anplis, yo ka desen an lakay moun dwe fasil adapte ak

adapte estil miltip nan aranjman (blòk sètadi nan kay, kilti-de-sak, ect.).

Bilding nan Estrikti

(San yon fondasyon konkrè) Yon plat, trase tè se ideyal. Builders dwe premye fouye yon tranche fon, nenpòt kote nan 6 "- fon 1 ',' montre fòm nan miray la deyò nan kay la vle, plen l 'ak plizyè (2" - 4 ") sache a ki lach gravye asire pa gen enfiltrasyon moute soti nan tè mou. Builders pral Lè sa a, yo kòmanse mete anba a twa a sis Sak sab "nivo" nan kay la. Li enpòtan pou sonje ke sak premye sa yo dwe ranpli ak wòch gravye oswa lach larivyè asire pa gen plis enfiltrasyon soti nan tè mouye koze pa rasanbleman lapli oubyen dlo nan tè a afekte kay la.

Lè gen chak sachè te mete fen nan fen tan lontan, yo dwe chak "nivo" ap chaje desann a men yo. Sa ka fè ak yon zouti wou oswa stamper ak ki yon builder va delivre plizyè frape fò nan tèt nan chak sachè ranpli soti anwo yo. Sa a asire ki ranpli nan sachè Konpact kòm byen ak sipò posib. Pa aplike Anprent a sou chak ak tout sak sou chak nivo kapab lakòz nan yon kay earthbag nan lavni strukturèl prêcher.

Li tou se nesesè sonje ke apre yo fin chak moun "nivo" mete ak bat desann, travayè yo dwe

It is also imperative to note that after each individual “level” is laid and beaten down, workers must lay two continuous strings of 4-prong barbed wire, 3” - 5” apart and parallel to one another, all along each and every bag on the latest “level.” This wire serves as the structural equivalent of an adhesive or fastener between each bag level of the home in progress. Two of the four prongs stick into the lower bag level, and two other prongs stick into the next layer to be laid.

Continue laying “levels” of sandbags, making sure to pack down the material as you go. For windows and doors, full-size bags are often ill fitting. This can be easily remedied by cutting bags in half, and using them the same way as normal to fit into awkward holes in the home construction. To hold a place for windows, scrap lumber cut to a specific window size can be built into the rising levels of the home, later to be “filled” with a thermoplastic windowpane.

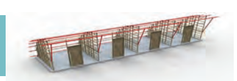
Refer to the wall measurements earlier in this chapter for accurate wall height and thickness for the dimensions of each home. Since sandbags make up over 90% of the construction material of each home, dimensions follow the 14”x26” size of standard bags. Do keep in mind, for example, that each bag (say, for the interior wall between kitchen and sleeping quarters) is 2” thicker than a foot wide, making any wall 14” thick.

Five sandbag “levels” from the highest point of each wall will provide a structure to attach the roof to. Five-foot pieces of rebar, bent to a 90-degree angle 6” from each end, will run through the top five sandbag layers as a structural strengthening method. The bent end that will lay parallel to the top sandbag layer of each wall can be used as an anchored lashing point for attaching the (ideally) thermoplastic roof sheeting. Using

the thermoplastic will not only be a free resource for home building, but also will help in cleaning up Haiti of the abundance of discarded plastic bottles and refuse that litters the land.

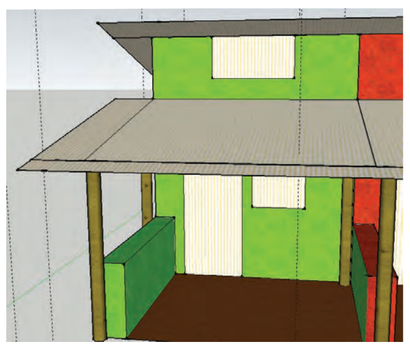
On the front side of each individual home, four 6” diameter bamboo poles support a thermoplastic sheet lashed on to serve as a porch roof, 8’ high from the front wall and sloping down to a height of 7’. The porch roof serves a simple protection from rainfall or baking sunlight, and provides a sheltered outdoor area for permanent housing residents 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. A common strategy is also to “pin” sheets of chicken wire with utility staple to the bags before any application of plaster, further ensuring wall bag stability and giving the plaster another texture to adhere to when applied. Lime plaster’s resistance to weathering makes it a top choice for earthbag home



kouche de kòd kontinyèl nan fil 4-dan fèr, 3 "-5"apa ak paralèl ak youn lòt, yo tout ansanm chak ak tout sak sou dènye "nivo la." Sa fil sèvi kòm ekivalan a estriktirèl nan yon adezif oswa fermeture ant chak nivo sak nan kay la nan pwogrè. De nan kat pwent yo kole nan nivo ki pi ba sak, ak de pwent lòt baton nan kouch nan pwochen yo dwe mete.

Kontinye mete "nivo" a sak, asire pake desann materyèl la kòm nou ale. Pou fenèt ak pòt, plen gwosè sache yo souvan tonbe malad sere. Sa ka byen fasil remedies pa koupe sache a mwatye, epi itilize yo menm jan ak nòmal nan anfòm nan twou gòch nan konstriksyon nan kay la. Yo kenbe yon plas pou fenèt, bwa Papye bouyon pou koupe nan yon gwosè fenèt espesifik yo ka bati nan nivo yo ap monte nan kay la, apre sa yo dwe "plen" ak yon vitr plastik.



Ale nan mezi yo miray byen bonè nan chapit sa a pou wotè miray egzat ak epesè pou dimansyon yo pou chak kay. Depi sak fè plis pase 90% nan materyèl la konstriksyon nan chak kay, dimansyon swiv 14 "x26" kantite moun ki nan sache estanda. Fè kenbe nan tèt, pou egzanp, ke chak sachè (di, pou miray la enteryè ant kwizin ak dòmi trimès) se 2 "pi epè pase yon lajè pye, fè nenpòt mi 14" epè.

Senk Sak sab "nivo" nan pwen ki pi wo a nan chak miray pral bay yon estrikti tache teras la yo. Senk-pye moso rebar, bese nan yon ang"90-degre 6 nan chak fen, yo pral kouri jiska senk anlè kouch yo Sak sab kòm yon metòd ranfòse estriktirèl. ka nan fen bese ki pral kouche paralèl ak tèt la Sak sab kouch nan chak miray ka itilize kòm yon pwen reprimand pou ancrage atache (depreferans) kouvèti plastik nan twati. Sèvi ak plastik la pa pral sèlman yon resous gratis pou bati kay, men tou yo pral ede nan netwaye Ayiti an abondans la jete boutèy plastik ak ki refize porte peyi an.

Sou bò devan chak moun lakay ou, kat 6 "poto Banbou dyamèt sipò yon fèy plastik fwete sou sèvi kòm yon twati balkon, 8 'soti nan gwo miray lavil la devan ak Incline desann nan yon wotè nan 7'. teras la balkon sèvi yon pwoteksyon senp soti nan lapli oswa limyè solèy boulanjri, epi li bay yon zòn proteje deyò pou rezidan lojman pèmanan detann yo ak chat ak vwazen yo nan devlopman an.

Apre fondasyon an ak miray yo te bati avèk siksè, yon kantite chwa ki disponib pou bòs mason pou aplike nan kay la pou plis estrikti ak rezon ayestetik. Anpil earthbag pwopriyetè kay kouvrir itilize (oswa lacho kouvrir) nan plizyè kouch ranpli a genyen siyon yo ak ata ant sak. Natirèl ajil melanje ak sab ak dlo kapab tou sifi. Yon estrateji ki komen se tou nan "PIN" fèy nan fil poul ak prensipal itilite sache yo devan nenpòt aplikasyon an kouvrir, plis asire estabilite sak miray epi bay kouvrir nan yon lòt teksti respekte lè yo aplike. rezistans Lime kouvrir nan dezagregasyon fè li yon chwa pou tèt earthbag aplikasyon lakay ou. Li se souvan melanje ak ajil 20%, 65% pwòp, byen file, lave grenn sab rivyè ak 15% Portland siman ($ 3.00 pou chak 80lb.bag) pou pi bon rezilta.

Anvan ou kòmanse kreye lacho kouvrir, yon atik kèk pral bezwen: de pati dlo, yon pati rapid lacho, yon veso an metal, yon zouti melanje ak yon veso ki sele pou sere. Lacho kouvrir ka enstabilite, kidonk fè egzèsis prekosyon lè travay ak materyèl la. Mete yon mask, mask ak gan si sa posib, lè travay ak sibstans la. Vide dlo nan yon beny metal. Depi ou ka jenere chalè lè fè lacho kouvrir, asire w benyen an pa sou zèb sèch oswa papye, jan sa te kapab yon danje dife ap kreye. Ajoute viv nan dlo a tou dousman, asire melanje li se te ajoute. Kontinye melanje jouk mas la se ale, jan fragman gwo kalkè pa pral reyaji ak dlo la. Magazen pou yon ideyal 3 mwa anvan w itilize nan yon kontenè ki fèmen pou anpeche lè soti nan reyaji avèk li.

Boudine ka trowled (ak Altènativman, flite) sou miray yo apre kouvrir te fin chèch nèt ajoute menm fòs plis mi yo, epi ajoute apèl ayestetik.

applications. It is frequently mixed with 20% clay, 65% clean, sharp, washed river sand and 15% Portland cement ($3.00 per 80lb.bag) for best results.

Before you begin creating lime plaster, a few items will be needed: two parts water, one part quick lime, a metal container, a mixing tool and a container that seals for storage. Lime plaster can be unstable, so exercise caution when working with the material. Wear a mask, goggles and gloves if possible when working with the substance. Pour water into a metal bath. Since you can generate heat when making lime plaster, make sure the bath isn't on dry grass or paper, as a fire hazard could be created. Add the quicklime to the water slowly, making sure to mix it is added. Continue mixing until the lumps are gone, as large chunks of limestone will not react with the water. Store for an ideal 3 months before using in a sealed container to prevent air from reacting with it.

Stucco can be trowled (and alternatively, sprayed) onto the walls after plaster had dried adds even further strength to the walls and adds aesthetic appeal.

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 home construction by $1,325 per five-home cluster.

Sandbags. Cost $.21 per bag

1 house (1,119 bags)	$ 235
5 houses (4,207 bags)	$ 883
20 houses (16,828 bags)	$3,534

4 point barbed wire. Cost $70 / 1,320'

1 house (4,456')	$ 336
5 houses (16,768')	$ 890
20 houses (67,070')	$356

Roofing (square feet) (molded collected plastic bottles)

1 house (892 sq. ft.)	$ 0
5 houses (1,971 sq. ft.)	$ 0
20 houses (7,8884 sq. ft.)	$ 0

Rebar #4 in feet. Cost $3.55
(#4 rebar 20' sticks cut into four 5' sticks)

1 house (48)	$ 43
5 houses (192)	$171
20 houses (768)	$682

Bamboo (porch posts-8'x4"). Costs ($18.95/pole)

1 house (4)	$ 75.80
5 houses (12)	$227.40
20 houses (48)	$909.60

Bamboo (roof joists) Costs ($4.46/pole)
http://www.bambooworld.com/bamboo%20poles.htm
8'x2"

1 house (22)	$ 98.12
5 houses (102)	$454.92
20 houses (404)	$1801.84

Pine 2"x4"x12'. Costs ($4.77/stick) http://www.homedepot.com/buy/lumber-composites/dimensional-lumber-studs/2-in-x-4-in-x-12-ft-kiln-dried-dimensional-lumber-43301.html

1 house (2)	$ 9.54
5 houses (10)	$ 47.7
20 houses (40)	$190.80

Plaster
Use of local clay and sand, purchase of cement may be necessary to add into the plaster mix, at %15 of total plaster.

Rough Total Cost of House

1 house	$ 800
5 houses	$ 2,675
20 houses	$10,700

Materyèl & Estime Frè
Ka majorite nan mas la egzije pou konstriksyon kay pou ekstrè pou gratis nan sous sou plas. Frè pou materyèl yo bezwen achte pral varye depann sou lokal aksè.

Mi Pataje ap diminye espas lojman ak total pri konstriksyon. Kòm wè nan pwi a, bati kay an grap nan senk (avèk pataje mi) radikalman redwi depans konstriksyon an konparezon konstriksyon kay endividyèl pa $ 1.325 pou chak gwoup senk-lakay yo.

Nan sak koute $ .21 pou chak sachè

1 kay (1.119 sache)	$ 235
5 Kay (4.207 sache)	$ 883
20 Kay (16.828 sache)	$3,534

Pye nan 4 pwen fèr fil Frè $ 70 / 1,320'

1 kay (4.456 ')	$ 336
5 Kay (16.768 ')	$ 890
20 Kay (67.070)	$3560

Roofing (pye kare) Frè
(Moulaj kolekte boutèy plastik)

1 kay (892 sq ft)	$ 0
5 Kay (1.971 sq ft)	$ 0
20 Kay (7,8884 sq ft)	$ 0

Rebar # 4 nan pye koute $ 3.55
(# 4 rebar 20 'baton koupe nan kat 5' baton)

1 kay (48)	$ 43
5 Kay (192)	$ 171
20 Kay (768)	$ 682

Banbou (posts balkon-8'x4 ")
Depans ($ 18.95/pole)

1 kay (4)	$ 75,80
5 (12 Kay)	$ 227,40
20 Kay (48)	$ 909,60

Banbou (twati treyi) Depans ($4.46/pole) http://www.bambooworld.com/bamboo% 20poles.htm

1 kay (22)	$ 98,12
5 Kay (102)	$ 454,92
20 Kay (404)	$1801,84

Pine 2 "x4" Depans x12 '($ 4.77/stick) http://www.homedepot.com/buy/lumber-composites/dimensional-lumber-studs/2-in-x-4-in-x-12-ft -sechwa-fin chèch nèt dimansyon-bwa-43301.html

1 kay (2)	$ 9,54
5 Kay (10)	$ 47,70
20 Kay (40)	$ 190,80

Kouvrir
Pou sèvi ak ajil lokal yo ak sab, achte nan siman pouvwar ka nesesè ajoute nan melanj la kouvrir, nan 15% nan kouvrir total.

Rough Pri Total nan House

1 kay	$ 800
5 Kay	$ 2.675
20 Kay	$ 10.700

Chapter 6: Family Shelters 2

Kaelene Nobis, Alex Maros

Introduction
This project entails building a sustainable and culturally relevant Haitian home, at minimal cost but with maximum functionality and hazard resiliency. The design teams approach to designing a model Haitian home integrates a plethora of natural building materials found on site including the usage of earthen material (sand, clay, straw) and ubiquitous waste materials (plastic pet bottles). The end result is a quaint home that is affordable, replicable, and aesthetically pleasing to the Haitian population that is intended.

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 location of the proposed Haitian village the design team looked into materials that could be found within a small distance and could be used as the major building blocks of 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 with the utilization of building material for shelters but it also will be alleviating the waste issue, while subsequently stimulating a micro- economy through localized trash recollection and recycling.

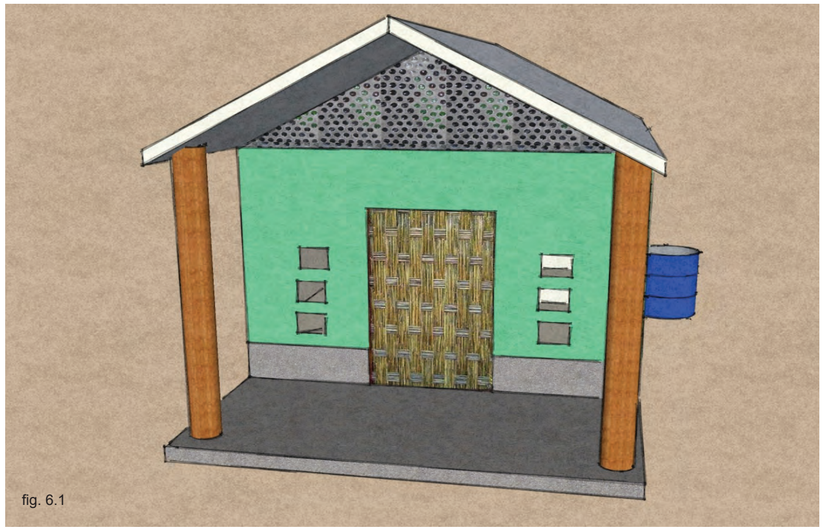


fig. 6.1

The traditional Haitian home is quaint with 2 rooms, a large porch and it often brightly colored. Our concept aims to model the traditional Haitian home stylistically through its use of bright green color and a small two room floor plan accommodating 6-8 family members per unit. Collectively there will be 20 housing units housing the proposed 140 Haitian residents of who will populate this village. In addition to PET bottles we have integrated COB as a natural building material. 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 weather and earthquake resistance. This utilization of COB combined with a concrete base and lime coating integrates disaster reduction strategies in the form of earthquake resistance, and also increases flood resistance.

Entwodiksyon
Pwojè sa a genyen ladan bati yon kay dirab ak kiltirèl ki enpòtan ayisyen, nan pri minimòm men ak maksimòm fonksyon ak rezistans danje. ekip yo konsepsyon apwòch desine yon modèl kay ayisyen entegre yon multitude nan materyèl bilding natirèl jwenn sou sit ki enkli itilizasyon materyèl nan tè (sab, ajil, pay) ak materyèl fatra partou (boutèy plastik bèt kay). Rezilta a fini se yon kay etranj ki abòdab, rprodwi, ak estetik plezi nan popilasyon ayisyen an ki se entansyon.

Konsèp
konsèp prensipal la dèyè sa a lakay modèl ayisyen se bay yon kay rprodwi ak pri efikas pou yon òganizasyon san bi likratif bati yon vilaj dirab an Ayiti. Apre li resevwa ki kote ki kote ti bouk yo pwopoze a ayisyen ekip la konsepsyon gade nan materyèl ki kapab jwenn nan yon ti distans e li kapab itilize kòm blòk yo bati pi gwo nan kay yo. konsantre sou prensipal desen an lojman an patikilye se itilize abondans nan fatra plas nan fòm nan PET boutèy. Lè l sèvi avèk materyèl sa yo pa sèlman pou ede ak itilizasyon nan bilding materyèl pou abri, men tou li pral soulaje pwoblèm nan fatra, pandan ke imedyatman enteresan yon mikwo-ekonomi atravè memwar lokalize fatra ak resiklaj.

Kay la tradisyonèl ayisyen se etranj ak 2 chanm, yon gwo chanm ak li souvan klere koulè. konsèp nou vize modèl tradisyonèl kay la ayisyen stylistically atravè itilizasyon li yo nan koulè vèt vif ak yon ti de plan pou planche chanm akòmode 6-8 manm fanmi yo pou chak inite. Kolektivman pral gen 20 lojman inite lojman pwopoze 140 rezidan yo ayisyen an ki pral peple sa a bouk. Anplis PET boutèy nou gen entegre epi kòm yon materyo konstriksyon natirèl. Sa a se paske li ka fè lokalman e li te yon materyèl bilding tradisyonèl pou dè dekad. Epi pwouve nan England kanpe tès la de tan pou rezistans tan ak tranbleman tè. Sa a itilizasyon chèf konbine avèk yon baz konkrè ak kouch lacho entegre estrateji pou rediksyon dezas nan fòm nan rezistans tranbleman tè, epi tou ogmante rezistans inondasyon.

Design Deskripsyon
Konsepsyon nan kay la ki swiv yon kay tradisyonèl an Ayiti, men yon zòn ti kras pi piti. desen an lakay se 12 pye pa 14 pye. espas ki la ap viv se 10x 12 pye, ak yon gwo chanm prensipal 8X10 ak yon chanm depo a 4X8. mi yo se 1 'epè yo paske yo te konpwomèt nan boutèy soda ak chèf.
Dimansyon sa yo pèmèt fanmi an gen ase fòm yon konfigirasyon dòmi nan Hammocks pandan y ap kite moun ki desann pou lajounen itilize. Atache a devan kay la se yon balkon ft 5. gwosè a balkon la se yon pati entegral nan desen an pou lojman. Pifò nan vivan ayisyen ak pou kwit manje pandan jou fèt la sou balkon la.

Baz nan estrikti a se 2 pye a konkrè anba kay la ak 1 pye nan konkrè sou vide pou galeri an. Yon sèl pòt antre nan sal prensipal la ki kondwi nan chanm nan dezyèm ak yon vout ti tankou pave. Sa a kreye yon aparans an ak santi yo yon chanm pandan jounen an ak Spacious louvri. Strukturèl, konsepsyon an entegre ti fenèt ki bay vantilasyon. Yo se ti pou sekirite ak sekirite nan moman jou lannwit, depi kreye pi gwo fenèt ta tou antrenman jwenn yon fason sekirite yo nan tan lannwit. sa a fason kay la kenbe l 'sekirite atravè tout pati nan jou, pandan y ap pèmèt pou fenèt yo dwe mete nenpòt kote dezi yo abitan. Yo se ti ase pa bezwen plis fondasyon yo ak men yo kapab entegre nan nenpòt kote nan desen an. Mi yo strukturèl sipòte boutèy bèt domestik epi li kòm chèf resipyan, apiye pa yon ankadreman post 6 ki antyèman konstwi nan banbou. se do kay la te fè moute nan yon ankadreman banbou ak yon tèt feutr. feutr a se yon materyèl lokalman yo jwenn ki ta dwe ranplase apeprè 3 chak ane.

fig. 6.2

Design Description
The design of the home follows that of a traditional home in Haiti but a little smaller area. The home design is 12 feet by 14 feet. The living space is 10X 12 feet, with a large main room of 8X10 and a storage room of 4X8. The walls are 1' thick because they are compromised of soda bottles and Cob.
These dimensions allow the family to have enough to form a sleeping configuration of hammocks while letting those down for daytime use. Attached to the front of the house is a 5 ft porch. The size of the porch is an integral part of the housing design. Most of Haitian living and cooking occurs during the day on the porch.

The base of the structure is 2 feet of concrete under the home and 1 foot of concrete over poured for the porch. One door enters into the main room which leads into the second room with a small arch like walkway. This creates the appearance and feeling of a spacious and open room during the day. Structurally, the design integrates small windows that provide ventilation. They are small for safety and security at night time, since creating larger windows would also entail finding a way to secure them at night time. This way the home maintains it security through all parts of day, while allowing for windows to be placed anywhere the inhabitant desires. They are small enough to not need extra framework and thus can be integrated at any location in the design. Walls are structurally supported by PET bottles and COB as filler, backed by a 6 post frame that is entirely constructed of bamboo. The roof is made up of a bamboo frame and a thatch top. The thatch is a locally found material that should be replaced about every 3 years.

figure 6.5 lashing

Building the Structure
Step 1: Foundations: In order to allow for the foundational piece of the house, it is key to begin by digging 2 deep trenches around the perimeter of the home to allow for concrete to be poured. This trench will outline the entire foundation, and will require a mixture of concrete and aggregate in order to fill it with. Continue from here by mixing the bag of concrete with pre disposed, concrete rubble for aggregate, sand (to add thickness to the mixture), and water. The ratio that you are aiming for is 1 part concrete, 2 parts sand, and 3 parts recycled concrete for aggregate, and an appropriate amount of water. The next stage requires the usage of the 12 stalk of bamboo. Begin by placing 1 stalk at each of the 4 corners of the foundation to act as support for what will later become the framing/roof support. Simply place the stalks with ample spacing at each corner, and proceed to pour the trench that was previously dug out with the concrete mixture, further cementing the poles into place. For pouring the porch foundation, follow the same steps as stated above, but instead pour only enough concrete mixture to fill the 1 ft porch foundation. Place bamboo stalks at the left and right corners and the middle (between each corner) of the foundation for support; allow concrete mixture to settle while keeping it damp and covered.

Step 2 Frame: When the concrete foundation is completely set up, attach bamboo stalks horizontally to the pre-existing vertical poles, creating a box like frame and then lash together with an imported wire to hold them into place.

fig. 6.4. Cross section of bottles, cob, and string

Step 3 Walls: The materials required for creating the cob mixture are clay, sand, straw, and water. The desired consistency of these materials should be as follows: 50-80% sand, 10-40% clay, and an additional 10-40% straw, and water to mix with. Additionally you will need to have on hand at least 500 PET bottles or so for added structural support within the walls. Begin by establishing a cob mixing area next to the foundation of the house. Place a tarp on the ground with some soil on top to contain the material. “Break up clods of dirt with your shoes while adding sand into the mixture.” “To add the sand, add a shovel full onto the tarp and stir it into the crushed soil until the two ingredients are mixed well.” To mix, simply stand on one end of the tarp while pulling the opposite side towards you, allowing the mixture to fall over on itself and mix evenly. Next add the straw and water to the sandy soil mixture. Continue the process by adding straw to the mixture, which will allow for greater bonding of the layers. Once you have reached your desired cob consistency, use your bamboo framework as a guide to apply

Konstriksyon Lojman Steps
Etap 1: Fondasyon: Nan ka pèmèt pou moso nan fondamantal nan kay la, li se kle kòmanse pa fouye 2 tranche fon lanmè alantou perimèt nan kay la pèmèt pou konkrè yo dwe vide. Sa a pral tranche deskripsyon fondasyon an, epi li pral mande pou yon melanj nan konkrè ak total nan lòd ranpli li avèk yo. Kontinye soti isit la pa melanje sachè a konkrè ak pre dispoze, blokaj konkrè pou total, sab (ajoute epesè melanj la), ak dlo. rapò a ke ou vize pou se 1 konkrè pati, 2 grenn sab pati, ak 3 pati resikle konkrè pou total, ak yon kantite lajan ki apwopriye a dlo. etap nan pwochen egzije pou itilizasyon nan keu a 12 nan banbou. Kòmanse pa plase 1 reye nan chak nan 4 kwen nan fondasyon an aji kòm sipò pou sa ki pral pita vin ankadre an / sipò pou twati. Senpleman kote epi yo ak spacing ase nan chak kwen, epi ale nan vide tranche ki te deja fouye deyò avèk melanj la konkrè, plis simante poto yo nan kote. Pou vide fondasyon an balkon, swiv etap sa yo menm jan yo endike anwo yo, men olye pour sèlman melanj ase konkrè ranpli ft 1 fondasyon an balkon. Kote epi Banbou nan kwen yo, epi kite ak dwa presegondè a (ant chak kwen) nan fondasyon an pou sipò; pèmèt konkrè melanj rete pandan y ap kenbe l mouye ak kouvri.

Etap 2 Frame: Lè se fondasyon an konkrè konplètman mete kanpe, epi tache Banbou orizontal poto yo pre-egziste vètikal, kreye yon bwat tankou ankadreman yo ak kout fwèt Lè sa a, ansanm ak yon fil enpòte yo kenbe yo nan kote.

Etap 3 Mi: materyèl yo mande yo pou kreye melanj la epi yo se labou, sab, pay, ak dlo. konsistans a vle nan materyèl sa yo ta dwe jan sa a: grenn sab 50-80%, 10-40% ajil, ak yon lòt 10-40% pay, ak dlo a melanje avèk yo. Anplis ou pral bezwen genyen sou men omwen 500 PET boutèy oswa sa pou te ajoute estriktirèl sipò nan miray yo. Kòmanse pa etabli yon siy melanje zòn akote fondasyon nan kay la. Mete yon prela sou tè a ak kèk tè sou tèt yo genyen materyèl an. "Pak leve mot nan pousyè tè ak soulye ou pandan y ap ajoute sab nan melanj la." "Pou ajoute sab la, ajoute yon pèl konplè sou prela a ak brase l 'nan tè a kraze jouk engredyan yo de yo melanje byen." Pou melanje, senpleman kanpe sou youn nan fen prela a pandan rale bò opoze a pou ou, ki pèmèt melanj a tonbe sou tèt li yo ak sou melanje regilyèman. Next ajoute pay la ak dlo nan melanj la tè Sandy. Kontinye pwosesis la pa ajoute pay melanj lan, ki pral pèmèt pou pi plis lyezon kouch yo. Yon fwa ou te rive konsistans vle chèf ou, itilize fondasyon banbou ou a kòm yon gid pou aplike pou melanj la epi. Kòmanse ak yon kouch chèf ki alantou 3 pous epè oswa konsa dirèkteman sou tèt fondasyon an konkrè. Ou pral bezwen nan tout boutèy bèt domestik ou yo ki pral nan miray la yo dwe ranpli nan lòd anpeche yo kraze anba pwa chak lòt la. Sa ka ranpli nan ranpli ak sab oswa tè.

Nan gen kòmanse nan plas ou resikle boutèy plastik PET bò pous bò 1 apa (fen poligòn rete soude soti), pandan y ap asire span yo lajè a vle miray ou yo. Kouche epi atravè anwo nan boutèy kenbe yon 1 pous kouch epè, sa a bay yon sifas ki plat pou kouch nan pwochen boutèy. Repete pwosesis sa a anpile jiskaske miray ranpa a nan tout plen ak boutèy ak siy (1ft. epè), epi ou gen rive wotè wap chèche ou.

Ou pral bezwen tou yo kreye ak miray ranpa enteryè; sa a pral miray dwe kreye jis nan chèf yo ak pral kreye de chanm. Pouvwa sa a mi ka konstwi tout kote moun ki rete ta renmen, men spesifik ekip yo konsepsyon antrenman yon chanm 8X10 ak yon chanm 4X8, ou pral bezwen yo kite yon repo nan miray la nan lòd yo kreye yon pòt enteryè "sa a pral rete ouvè nan lòd kreye yon pi gran an santi espas. Pouvwa sa a pòt ap mete nenpòt kote dezi abitan an.

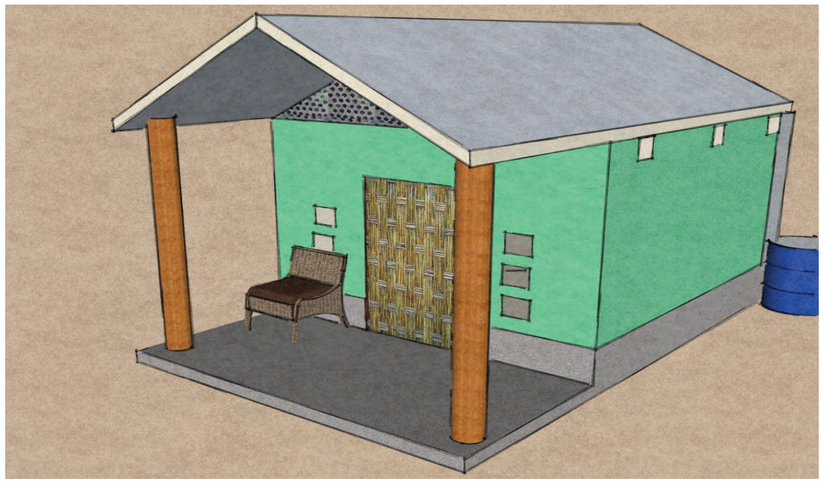


fig. 6.3

the cob mixture. Start with a layer of cob that is around 3 inches thick or so directly on top of the concrete foundation. You will need all of your PET bottles that are going to be within the wall to be filled in order to prevent them from crushing under each other's weight. This can be completed by filling with sand or dirt.

From there begin to place your recycled plastic PET bottles side by side 1 inch apart (butt end sticking out), while making sure to span them the width of your desired wall. Lay cob across top of bottles maintaining a 1 inch thick layer, this gives a flat surface for the next layer of bottles. Repeat this stacking process until the entire wall is filled with bottles and cob (1ft. thick), and you have reached your desired height.

You will also need to create and inner wall; this wall will be created just of cob and will create two rooms. This wall may be constructed wherever the inhabitants would like, but the design team specifics entail a 8X10 room and a 4X8 room, you will need to leave a break in the wall in order to create an inner doorway" this will remain open in order to create a greater feeling of space. This door may be placed anywhere the inhabitant's desire.

Step 4 Windows: In order to construct the windows for the home, it is important to do the following steps in sequential order. First, during the framing stage of the construction it is important to know before-hand where you would like your windows to be. To do this make sure to frame around the proposed window area with the bamboo poles for support. Second, when it comes time to apply the cob and bottle walls around your frame, simply fill in that proposed window space with the cob mixture without including the PET bottles in that particular area! This will ensure smooth incisions through the cob in its curing stage (i.e. while the cob is still damp) and make for a more structurally sound window openings, while preventing the collapse of the cob while wet.

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;

Spread the dried straw on the ground or a barn floor. Pour water over it with a bucket, tossing the straw with a fork to make sure it's thoroughly wetted. Gather the straw into bundles 12 to 18 inches wide and 4 to 5 inches thick. Pull out any straws that are lying crooked or crosswise, and then pull the bundles together tightly. Tie each of these bundles in the middle with twine that's been impregnated with tar to make it water-resistant. Stick four to six of these bundles between the tines of a two-tine thatching fork. Carry them onto the roof, securing the fork there with a peg and string. Cut several rods of flexible wood, such as hazel, about 2 inches in diameter and 2 feet long. Split each rod into

Etap 4 Windows: Nan ka konstwi fenèt yo pou lakay la, li enpòtan pou fè etap sa yo nan lòd sekans. Premye, pandan etap nan ankadre nan konstriksyon an, li enpòtan yo konnen anvan-men kote ou ta renmen fenèt ou yo dwe. Pou fè sa Asire w ke w frame otou zòn nan fenèt yo pwopoze ki gen poto yo banbou pou sipò. Dezyèmman, lè li rive tan pou aplike pou miray yo siy ak boutèy alantou frame ou a, tou senpleman ranpli nan espas sa fenèt pwopoze avèk melanj la epi san yo pa enkli boutèy yo PET nan zòn sa an patikilye! Sa a ap asire antay lis atravè chèf la an etap geri li yo (sètadi pandan ke chèf la toujou mouye) epi fè pou yon ouvèti fenèt plis strukturèl son, pandan y ap anpeche efondreman an chèf la pandan mouye.

Etap 5 twa: Nan ka bati kay la feutr li te nesesè pou ranpli kèk kèk sou entènèt rechèch. Ekip la konsepsyon pa janm te bati yon twati feutr anvan, kidonk dokiman sa a yo pral konte sou enstriksyon yo bay nan EHOW.com. Tanpri, gade sou sit wèb la pou plis detay. enstriksyon sa yo adapte;

"Gaye pay la fin chèch nèt sou tè a oswa yon etaj etab. Vide dlo sou li ak yon bokit, voye pay la avèk yon fouchèt asire w li byen mouye. Ranmase pay la nan pakèt 12 a 18 pous nan lajè ak 4 a 5 pous epesè. Rale nenpòt pay ki kouche kwochi oubyen Atraver, epi rale pakèt yo ansanm byen. Mare pakèt chak nan bagay sa yo nan mitan an ak fil sa a yo te fekonde ak pran asfat fè li dlo-reziste. Baton kat ak sis sa yo pakèt ant dan yo nan yon fouchèt de-dan thatching. Pote yo sou do kay la, sere fouchèt la gen ak yon Peg fisèl ak. Koupe branch bwa plizyè nan bwa fleksib, tankou Hazel, sou 2 pous an dyamèt ak 2 pye nan longè. Split chak baton nan uit moso li koupe pwent a yon pwen avèk yon kouto. Tranpe branch yo nan dlo pou èdtan plizyè lise yo. Sa yo pral itilize pou "lonjron" nan ede tache pakèt yo nan pay youn ak lòt.

fig 6.6 Man filling bottles with sand

Kouche pake nan premye sou bò dwat nan twati a nan kornich yo. Mare l 'bay taso yo, ki kouri orizontal ant ti vwalye yo, oswa PIN li desann ak yon poto sou 1 pous an dyamèt, kloure ti vwalye yo sou swa bò. Kouche ase pakèt kòt a kòt yo kouvri yon seksyon nan twati sou 3 pye lajè. Mouye pakèt yo ankò, li peny yo ak yon rato rale nenpòt pay ki lach. Bat yo plat avèk tounen nan rato la. Koupe pla yo nan pakèt yo sou kare nan kornich yo. Kouche pakèt kap vini yo anwo a yo menm premye, rekouvreman yo pou mwens pase mwatye pakèt yo an premye yo montre. Bend yon SPAR an de, lè sa a tòde li de fwa alantou poukont li epi pouse li nan pay a tache yon pake pake ki anba la a li. Espas yon SPAR sou chak pye sou chak ranje nan pakèt.

Kouche yon lòt ranje nan pakèt anwo a yon dezyèm lan, fikse l 'menm jan an, lè sa a kontinye jiska pik do kay la. Kite mwatye nan pake nan dènye rete soude depase pik la. Kòmanse nan kornich yo ankò, li kouche plis pakèt bò kote yo menm premye, travay jiska pik la. Repete pwosesis la jiskaske se yon sèl bò nan kay la kouvri, lè sa a kòmanse nan kornich yo sou lòt bò a epi kontinye menm jan an. Lè ou vini nan somè a, pliye sou lyas la pase soti nan bò premye epi tache l 'desann sou bò sa a. Kouche lyas la dènye sou bò sa a ak kèk nan li rete soude leve. Bend li sou pou ou kapab tache l 'sou bò la an premye. "(Thompson, 2010)

eight pieces and cut the ends to a point with a knife. Soak the rods in water for several hours to soften them. These will be used for "spars" to help fasten the bundles of straw to each other.

Lay the first bundle on 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 side by side to cover a section of roof about 3 feet wide. Wet the bundles again and comb them with a rake to pull out any loose straw. Beat them flat with the back of the rake. Trim the bottoms of the bundles off square at the eaves. Lay the next bundles above the first ones, overlapping them so that less than half the first bundles show. Bend a spar in two, then twist it twice around itself and push it into the straw to fasten one bundle to the bundle below it. Space one spar about every foot along each row of bundles.

Lay another row of bundles above the second one, fastening it down the same way, then continuing up to the roof's peak. Leave half of the last bundle sticking beyond the peak. Start at the eaves again and lay more bundles beside the first ones, 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 over the last bundle from the first side and fasten it down on this side. 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)

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 rectangle 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.

Materials List

Materials	Cost	Notes
Bamboo (30 canes)	$44.60 for 10 canes	(2 inches wide 8 feet tall) http://www.bamboo world.com/bamboo%20poles.htm
Cob	$ 0	Naturally recovered
Plastic bottles (~2200)	$ 0	Salvaged
Concrete	$8.50 per 47 lb. bag	
Lime plaster	$37.00 per tub	
Thatch for roof	$ 0	Naturally recovered materials/salvaged
Lashing material	$12 w/shipping	Available online; spool of 200ft twine
Door Hinges	$6 each	http://www.directdoorhardware.com/Hinges.htm
Soft wood for thatch roof	$ 0	Can be salvaged from pre-existing site
Simple wooden door lock	$5 (for doweling)	http://www.instructables.com/id/Woodworking-Making-wood-projects-without-using-na/step8/Making-Wooden-Latches/

References:
Thomoson, David. "Thatch roof instuctions." eHow. N.p., 2010. Web. 19 May 2011. <http://www.ehow.com/how_6462294_thatch-roof-instructions.html>.

Etap 6 Pòt: Pou sa-a de poto banbou long ki nesesè nan wotè pòt la fèt ak de moun ki pi kout yon longè egal ak lajè nan pòt la. Banbou la dwe fwete ansanm nan kwen yo kreye yon ankadreman rektang. (Gade pi bonè image reprimand) Plis pase devan nan ankadreman an pral gen itilize yon Mat Banbou mele tankou kouvri an. Sa ka tache ak materyèl la reprimand. pral pòt la dwe tache nan kay la lè l sèvi avèk de depan enpòte, epi li pral mekanis a bloke dwe mete sou andedan a kòm yon senp lock "sliding tache nan miray la nan kay la ak sant lan an pi pre a poto nan miray la.

Lis materyèl (toujou konpile pri pou kèk items)

Materyèl	Frè	Notes
Banbou (30 baton)	44.60 pou chak pake nan 10 baton	(2 pous lajè 8 pye wotè) http://www.bambooworld.com/bamboo 20poles.htm%
Epi pa koute Natirèlman refè		
boutèy plastik (~ 2200)	Non pri	sove
Konkrè	8.50 pou chak 47 liv sachè	
Lacho kouvrir	$ 37,00 chak basen	
Feutr pou twati pa koute		Natirèlman reprann materyèl / sove
Reprimand w materyèl	$ 12 / anbake	disponib sou entènèt nan yon tanbou nan 200ft nan trese
Pòt charnyèr	$ 6 chak	http://www.directdoorhardware.com/Hinges.htm
Mou bwa	pou twati feutr pa ka koute	ka sove nan sit pre-egziste
an bwa pòt Simple lock	$ 5 (pou yon moso doweling)	http://www.instructables.com/id/Woodworking-Making-wood-projects-without-using-na/step8/Making-Wooden-Latches/

Referans:
Thomoson, David. "Chom twati instuctions." eHow. N.p., 2010. Entènèt. 19 me 2011. <http://www.ehow.com/how_6462294_thatch-roof-instructions.html>.

Chapter 7: Family Shelters 3

A Portable Housing Alternative

David Conrad, William Wrede

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 location. The consideration of bamboo as a material was solidified when the practicality of the material and its proficiency in sustainability were learned. Bamboo is 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. Deforestation also compounds the problem of erosion in Haiti. Decreased forest cover has led to a depletion of soil nutrients and has diminished the landscape in general. 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. One that is prominent in the minds of those in the first world is the carbon retention capacity of bamboo. Bamboo's fast growth coupled with its density make it a veritable carbon sink which can soak up carbon faster that many trees. Bamboo can and will provide a needed economic base to the community in Les Cayes. This stems from the above factors as well as from its exceptional and versatile use as a building material.

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 individuation up to those that will be residing in the units. This serves to encourage a feeling of personal ownership. 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

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 sekirite ak yon opsyon nan kote nan lavni. te konsiderasyon nan banbou kòm yon materyèl konsolide lè yo te komodite nan materyèl la ak konpetans li nan durable aprann. Banbou se materyèl ki se patikilyèman fasil pwodui nan klima twopikal, se byen vit renouvlab e li te pwouve yo dwe genyen materyo konstriksyon ekselan.

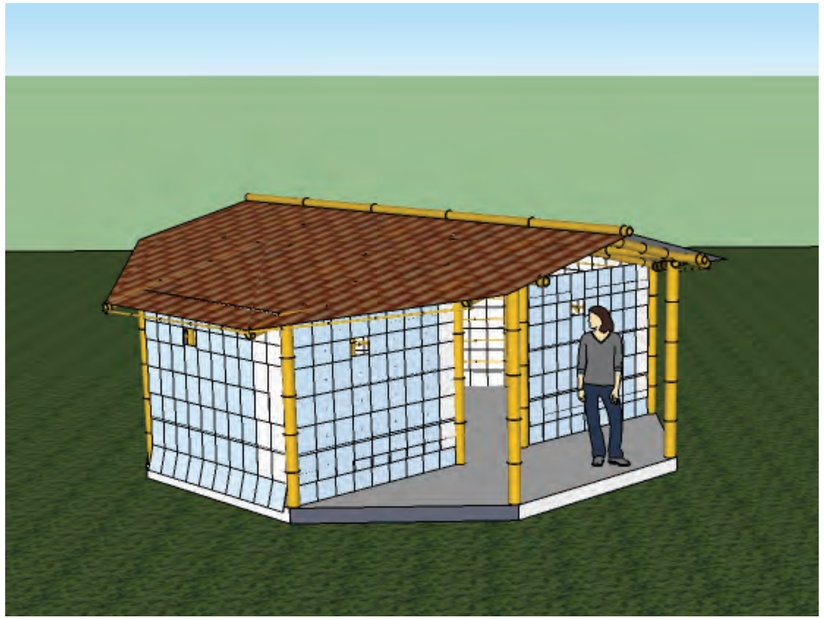


fig. 7.0. Perspective of Portable Bamboo Family Shelter

Materials and Cost

Bamboo Pieces	Quantity	Length (ft.)	Diameter (inches)	USD Cost (each)
Foundation	3	18	3	114
Corner/ Interior Posts	4	6	4-6	85
	7	7.5	4-6	213
	21	8	1	21
Horizontal Wall	70	8	1	70
Roof Frame	8	8	3	153
	4	10	3	66
	3	20	3	150
Bamboo Roof Tiles	120	10	3	386
	Total Cost			**$ 1.258**

Additional Materials

1. Concrete. 5.5 Yards. $330 @ $60 per yard
2. Sand or gravel fill (TBD)
4. 60' of 2"x6" forming material for slab (reusable). $15
5. 11 tubes of heavy duty epoxy. $10 each
6. 11 rebar couplers (½"). $12 each
7. Waterproofing for bamboo (paint, varnish, tar). $20
8. Total cost approximation. $1,500

Tools

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

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 decomposable or soft material.

Step 2. Level excavated area with gravel or sand to the top of the highest point the adjacent landscape. This will allow the slab to sit 6" above the grade of the area surrounding it, giving the residents a barrier against light flooding and rain.

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

Step 4. Layout post anchors per vertical 5" post and fix in place for pour (figure 7.4/7.5) Anchors set with female coupler (figure 7.7) extended 1" above slab grade to allow for spacing between slap and post preventing rot.

a. At this time the threaded male end of the rebar coupler (figure 7.7) should be epoxied in place in the 5" posts. The rebar needs 10" embedment into epoxy.

b. Female anchor placement (figure 7.4 / 7,5)

Step 5. Slab should have a smooth finish with no slope.

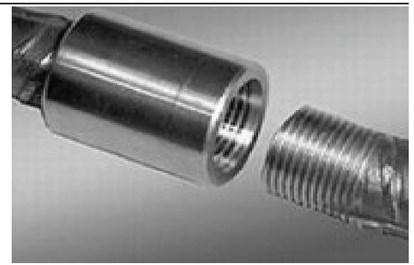
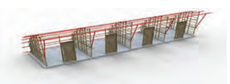
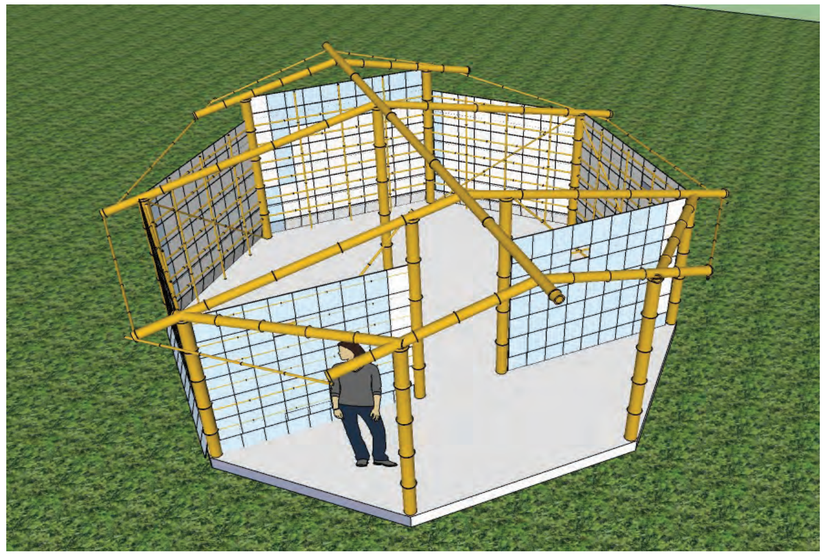


fig 7.7. A simple method for connecting rebar with a threaded coupler. The male on the right will be epoxied into the 5" bamboo uprights and the coupler end of the rebar will be poured into the slab in accordance with the layout of figure 7.5.



Durable

Itilize nan banbou nan konstriksyon e kòm yon resous ekonomik gen anpil enplikasyon pratik ak dirab pou Ayiti, an premye ki te kwasans Banbou se jèn, bay yon pwodwi bilding ka itilize nan lespas twa zan. itilize nan banbou gen yon lòt kalite vital Ayiti, miltiplikasyon li yo epi sèvi ak ka ranplase bezwen pou bwa ak bwa dife soti nan mal apovri forè yo natif natal nan peyi a; sa a ka gen pwofondè efè pozitif sou yon ekosistèm sa yo te fè twòp mal. debwazman a tou konpoze yon lòt pwoblèm pou pèp ayisyen e ke se pwoblèm nan ewozyon ki te diminye retansyon nan eleman nitritif nan tè a ak apovri peyizaj la an jeneral; banbou kapasite grandi nan apovri sol ak anpeche ogmante ewozyon komodite li ak itilite . Beyond bezwen imedya a an Ayiti tankou yon kilti, Banbou gen lòt kalite dirab ki kontribye nan efikasite li ak sensibleness. Youn ki enpòtan nan lespri sa yo nan mond lan se premye kapasite pou retansyon kabòn nan banbou. Banbou kwasans rapid makonnen ak dansite li fè l 'yon koule kabòn otantik ki ka tranpe moute kabòn pi vit ki pye-bwa anpil. Banbou ka epi yo pral bay yon nesesè baz ekonomik nan kominote a nan Les Cayes. Tij sa a soti nan faktè ki anwo yo mansyone kòm byen ke nan itilize a kòm yon materyo konstriksyon eksepsyonèl ak versatile.



Estrikti

Te estrikti a bay yon anprint oktogon prensipalman bay kay la pi plis lavi. plan an etaj oktogon pèmèt tou inite sou anfòm avèk efikasite nan grap sere pandan y ap evite pataje mi. devan la oktagòn nan sèvi kòm yon balkon. entansyon la te kenbe yon degre nan vi prive pandan maksimize espas nan yon kominote piti. Yon gwo te entansyon yo devlope yon estrikti ki fèy yon degre gwo endividuasyon jiska moun ki pral finalman ki ap viv nan li. Sa a sèvi prodwir kòm anpil nan yon sansasyon posesyon pèsonèl posib pandan ke yo ap fè li pi fasil pou fè pou evite enpoze prejije pèsonèl nou ayestetik nan santi final la nan estrikti an. enkòporasyon an panno plastik nan devlopman pa depatman teknoloji jeni WWU la sipòte resiklaj an plastik HDPE pou bati materyèl pandan y ap tou pèmèt pwopriyetè kay la nan plas fenèt ak vantilasyon yo kote yo wè anfòm.

Estrikti a se yon 18 'a 18' oktogon etaj konkrè. mi yo ak sipò yo konpoze yon sistèm Banbou estriktire ki ka pran apa epi deplase avèk fasilite relatif. yo twati a ak Siding ki fèt isit la ak banbou, men sa a se yon chwa baze sou disponibilite nan materyèl. Yon twati chom ta tou pou apwopriye ak lòt materyèl Siding yo tou yon konsiderasyon.

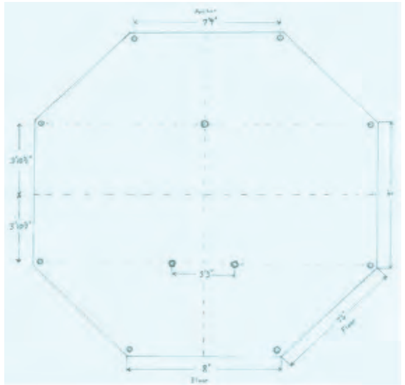


fig. 7.4. The layout of the 5” upright posts and the adjoining rebar coupler layout from figure 7.5; it also shows the measurements and the basic floor plan. The couplers are placed off the dotted center lines and the perimeter couplers are more accurately descripted in figure 7.5 which is an enlarged depiction of the indicated section.

fig. 7.5. An enlargement of the detail in 7.4; note that the layout is specific to the orientation of the corner of the slab. All other perimeter couplers are placed as this, 1½” to the inside of the 8’ sides.

Frame

Step 1. Set 5” corner posts in couplers the day after slab is poured.

Step 2. Connect horizontal bamboo to 5”vertical uprights(figure 7.2). Bottom row will be 6” off slab, each row above this will be at 11” centers to allow for overlap of panel siding.

Step 3. Connect Vertical Bamboo slats (detail 7.1)

Step 4. Connect diagonal supports between each 5” post to insure against racking (figure 7.2)

fig. 7.1. A simple bamboo lashing technique. Interlacing strips cut from green bamboo, the intersecting culms are interwoven with this lashing. When the bamboo lashing dries over the following weeks, the bond will get tighter.

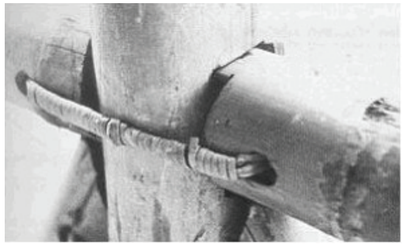


fig. 7.2 The horizontal culms drilled and tied similarly to figure 7.3; the interlocking key of this makes the vertical connection secure.

Roof Frame

Step 1. Connect 3” horizontal top rung around perimeter over 5” posts (figure 7.3)

Step 2. Place 3”x20’ roof laterals extending 1’ over each end and connected to center and adjacent interior posts.

Step 3. Split and Place roof tiles (detail 7.6). Roof tiles should be split down the length of the culm using a dull blade. Then the center of culm needs to be hollowed.

Step 4. Roof tiles will stay in place with their own weight.

Step 5. Attach bamboo gutters and down spouts as needed.

Step 6. Attach Plastic Shingles (figure 7.8).

KOUMAN POU Bati

Fouy

Etap 1. Retire anlè kouch tè ak tout materyèl òganik ki desann nan difisil sifas tè (labou). Se konsa, ki tranch lan rezoud tankou ti posib, retire tout materyèl dekonpozabl oswa mou.

Etap 2. Nivo fouye zòn ki gen sab oswa gravye nan tèt nan pwen ki pi wo a peyizaj la adjasan. Sa ap pèmèt tranch yo chita 6 "pi wo klas la nan zòn nan ki antoure li, bay rezidan yo yon baryè kont inondasyon limyè ak lapli.

Etap 3. Bann ranfòsman Layout banbou a 18 "a chak sant fason (gade deskripsyon sèvi ak banbou nan ranfòsman)

Etap 4. Lankr post Layout chak vètikal 5 "post yo ak ranje an plas pou pour (figi 7.4/7.5) ancrage ansanm akoupleman fenmèl (figi 7.7) pwolonje 1" pi wo klas tranch pèmèt pou spacing ant kalòt ak apre anpeche pouri.

A. Nan tan sa a ta dwe Threaded nan fen gason nan akoupleman a rebar (figi 7.7) ap epoxied an plas nan 5 posts yo ". rebar a bezwen 10 "embedment nan epoksidik.

b. Fi lank plasman (figi 7.4 / 7,5)

Etap 5. Tranch ta dwe gen yon lis fini ki pa gen menm pant lan.

Etap 5. Tranch ta dwe gen yon lis fini ki pa gen menm pant lan.

Frame

Etap 1. Mete 5 "posts kwen nan akoupleman jou apre tranch se vide.

Etap 2. Konekte orizontal Banbou 5 "montan vètikal (figi 7.2). Anba ranje yo ap 6 "off tranch, chak ranje anwo a sa a ap fèt nan 11" sant pèmèt pou kouvri nan Siding panèl.

Etap 3. Résolution konekte planch Banbou (detay 7.1) 4. Konekte sipòte dyagonal ant chak 5 post "a asire kont (figi 7.2) anbrochaj

Twati Frame

Etap 1. Konekte 3 "orizontal tèt baro alantou perimèt sou 5" posts (figi 7.3)

Etap 2. Kote 3 "x20 'Latexo twati pwolonje 1' sou chak fen ak ki konekte nan sant epi adjasan posts enteryè.

Etap 3. Split ak kote twati mozayik (detay 7.6). mozayik twa dwe fann desann longè nan kulm a sèvi ak yon lam mat. Lè sa a, sant la kulm bezwen kreze.

Etap 4. mozayik twa ap rete an plas ak pwa yo.

Etap 5. Tache goutyè banbou ak desann jayi lè sa nesesè.

Sèvi ak Banbou nan ranfòsman konkrè

Etap 1. Banbou dwat la ki nesesè asire fòs ak rezistans. Chwazi Banbou gwo dyamèt e omwen twa lane. Jèn oswa Banbou vèt pa anfòm pou itilize.

Etap 2. Fann Banbou nan bann ¾ ", sèvi ak yon lam mat kouri desann longè nan kulm la. Sa a pral fann kulm a dwat avèk fib nan banbou an.

Etap 3. Bon tretman pou banbou ki nesesè, sèk oswa tranpe banbou pou twa a kat semèn Lè sa a, aplike yon izolasyon dlo (penti, vèni oswa pran asfat) nan yon kouch mens asire banbou an pa pral ogmante lè yo ekspoze a konkrè mouye, sa pral lakòz yo fann .

Etap 4. Kouche Banbou ranfòsman deyò tankou si se te rebar ranfòsman oswa re fil.

Etap 5. Mare travèse entèval ansanm ak fil oswa bann banbou.

Etap 6. Banbou yo pa dwe pi pre 1 1 / 2 "nan sifas fini konkrè (anba, anwo oswa kwen).

Etap 7. Banbou yo ta dwe mare nan entèval regilye konsa ke li pa flote pandan vide.

Etap 8. yo ta dwe ranforseman Banbou ka anpyete 2 'epi kouri kontinyèlman atravè tranch.

Travo site

Banbou Costa Rica, konstriksyon, Polonè Banbou ak mèb. Entènèt. 22 me 2011. <http://www.bamboocostarica.com/index.html>.

"Banbou ranfòse Concrete KONSTRIKSYON." Rechèch Concrete Women nan Moore David. Entènèt. 20 Me 2011. <http://www.romanconcrete.com/docs/bamboo1966/BambooReinforcedConcreteFeb1966.htm>.

"Green Building Home: Banbou Konstriksyon House." Green Building Home: Index. Entènèt. 20 Me 2011. <http://www.greenhomebuilding.com/QandA/bamboo/construction.htm>.

Tout peyi Shipping - Products Banbou, Banbou klotur, poto Banbou, epi grandi Gardens Bed, Konte Orange. Entènèt. 15 me 2011. <http://butlerbamboo.com/index.html>.

"Reyalite a sou Building ak Banbou." Guadua Banbou Costa Rica. Entènèt. 20 Me 2011. <http://www.guaduabamboo.com/the-reality-about-building-with-bamboo.html>.

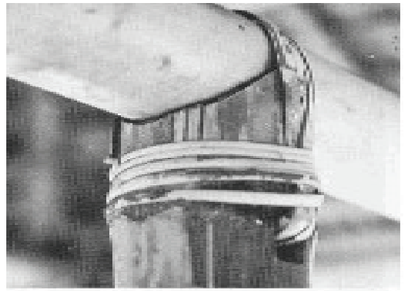


fig 7.3 Illustrates how the top rung of the structure will be secured. The uprights will be cut into a U-shaped cup that is approximate to the size of the culm that will sit within it. The posted upright is drilled with a ½ inch drill bit 3 inches below the highest point of the upright. Green bamboo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

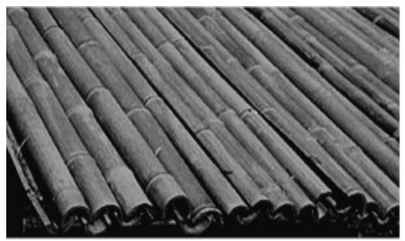


fig 7.6. The final product of a bamboo tiled roof. The culms are cut in half lengthwise and placed alongside each other to allow for a spillway. The other half of the culms is turned over and placed on top of the first row to route the water into the upright culms creating a attractive and practical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

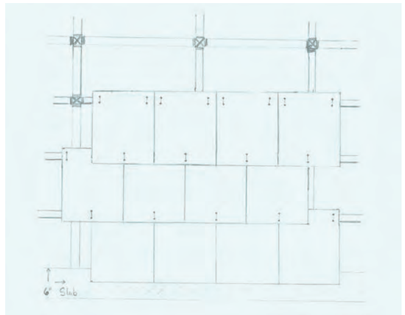


fig. 7.8. Plastic shingle siding should be drilled with ¼" drill bit to allow for lashing. Begin at lowest rung of horizontal 1" bamboo and work up. Bottom shingle should overlap slab to allow for runoff. Shingles can be cut to fit for row endings.

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.

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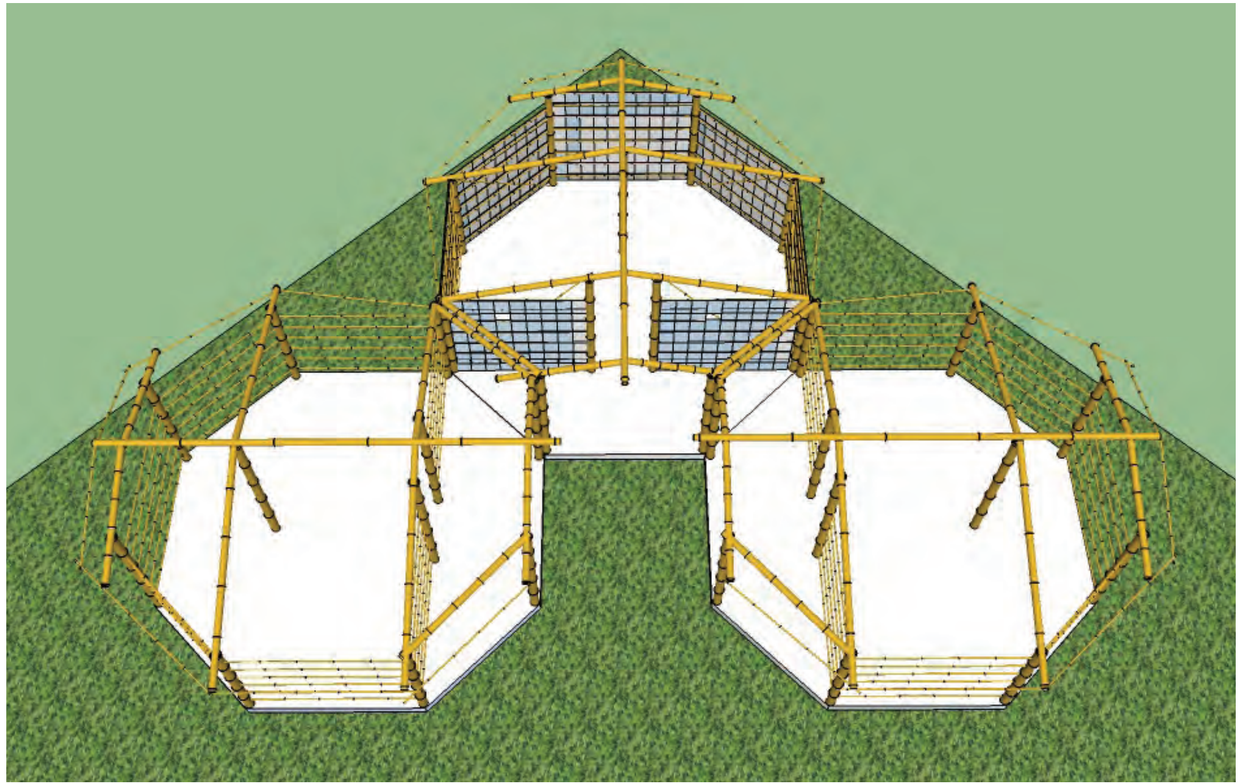


fig. 7.9. Perspectiving showing clustering of Shelter Units

Chapter 8: Transitional Resident Dormitory

A variation on traditional building methods, constructed with readily available materials to create an adaptable permanent structure for 30 people.

Martin Eizik, Stren Pipkin

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. Each of the structures has four rooms, each of which will 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 rainwater for residents. Cooking, which is traditionally done outdoors, will be done in the commons between the buildings. Restrooms and bathing areas will be located away from the building. 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 30-person dormitory for Les Cayes residents. These often conflicting considerations were reconciled first of all through the unique design of the roof, which was brought down in an arc so that it covered the rear of the building. In this way one less cob wall needed to be built, replaced instead with sustainably produced recycled HDPE panels which place minimal vertical load on the structure. The walls, spaced to accommodate a room of four people each, have a T-shaped profile when viewed from the top (fig. 8.1). This provides strong resiliency against earthquakes, minimizing the effects of lateral forces. There is a doorway and aisle through the middle of each room which separates the sleeping area of each half of the room by over three feet, providing even more privacy within the room. The layout of the dormitory provides a balance of personal privacy as well as a sense of community, which is aided by the orientation of the two main structures towards each other, resulting in a shared commons in which cooking meals or relaxing in the shade of the awning can be done together (fig. 8.2). The building orientation also shields the front of each building from rain and strong winds, since the curved part of the roof faces outwards, increasing the surface area over which a given wind force is distributed (fig. 8.3). While protection from the wind is a necessity, providing adequate ventilation to the structure is also important. The dormitories have airways along each row of roofing panels at the space where the corrugated panels sit atop the purlins. There is also a large opening above the door for ventilation. Gutters for collecting rainwater attach to bamboo cross members from the wall framework and slide underneath the roofing panels. The gutters are elevated at one end to ensure fall, and drain into a series of drums at the end of the building.

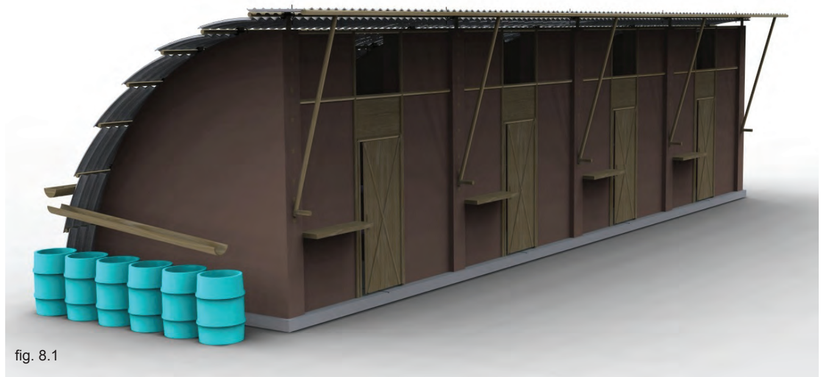


fig. 8.1

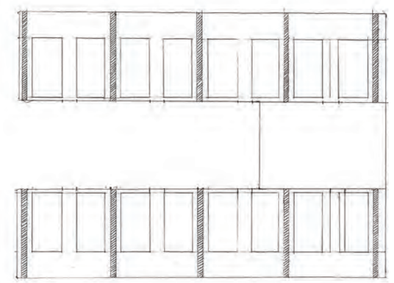


fig. 8.2

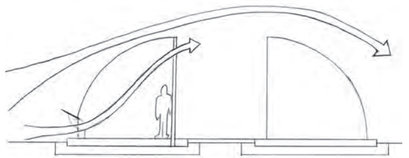


fig. 8.3

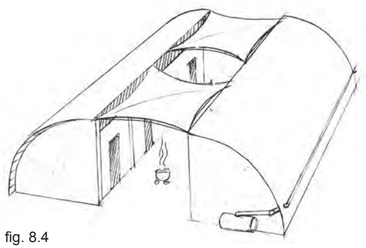


fig. 8.4

Deskripsyon Design

Dòtwa a pou rezidan Tranzisyonèl pral kay jiska 32 rezidan deplase ayisyen. Li konpoze de estrikti yon istwa ki gen yon zòn komen nan ant chak estrikti rezilta nan yon 36'x52 'nan zòn bilding total. Chak nan estrikti yo gen kat chanm, chak a ki pral kay kat moun. fonksyon prensipal bilding sa yo se bay yon zòn ap dòmi ak espas yon valè magazen. bilding lan ap tou ranmase dlo lapli pou rezidan. Kwit manje a, ki se tradisyonèlman fè deyò, yo pral fè nan commons yo ant bilding yo. Saldeben ak zòn benyen ap sitiye lwen bilding lan. rezidans yo pral enkòpore surtou materyèl lokal tankou chèf, banbou, ak panno ROOFING HDPE te fè soti nan boutèy yo kolekte nan zòn nan.

Karakteristik ak Benefis

Ekonomi pou sèvi ak materyèl ak konfò imen se de objektif prensipal lè desine yon dòtwa 30-moun pou rezidan Les Cayes. Sa yo souvan konsiderasyon konfli yo te rekonsilye premye nan tout nan desen an inik nan do kay la, ki te desann nan yon arc pou li kouvri dèyè nan bilding lan. Nan fason sa a yon sèl mwens miray chèf nesesè yo dwe bati a, ranplase olye ak durable pwodui panno resikle HDPE ki kote minimòm chaj vètikal sou estrikti an. mi yo, reparti akomode yon chanm nan kat moun chak, gen yon pwofil T-fòm, lè wè depi anwo a (fig 8.1). Sa a bay rezistans kont fò tranblemanntè, minimize efè yo nan fòs lateral. Gen yon pòt epi ale nan mitan a chak chanm ki separe zòn nan ap dòmi nan chak mwatye nan chanm lan pa plis pase twa pye, ofri menm plis enfòmasyon prive ki nan sal la. layout nan dòtwa a ofri yon balans nan vi prive pèsonèl menm jan tou yon sans nan kominote a, ki se ede nan oryantasyon de estrikti prensipal yo anvè chak lòt, kifè nan yon commons Pataje nan ki te manje manje oswa ap detann nan lonbraj a ban ka fè ansanm (fig 8.2). oryantasyon bilding la tou devan gwo plak pwotèj an nan chak bilding soti nan lapli ak van fò, depi pati a koube nan do kay la fas deor, ogmante zòn nan sou sifas ki se yon fòs van bay distribiye (fig 8.3). Pandan pwoteksyon kont van an se yon nesesite, founi ase vantilasyon estrikti ki enpòtan tou. rezidans yo gen pasaj ansanm chak ranje nan panno ROOFING nan espas ki la kote panno yo corrugated chita soutèt pan yo. Genyen tou yon gwo anwo ouvèti pòt la pou vantilasyon. Goutyè pou kolekte dlo lapli tache Banbou manm kwa sot nan fondasyon miray la ak glise anba panno yo ROOFING. goutyè yo elve nan yon fen nan asire tonbe, ak drenaj nan yon seri de tanbou nan fen bilding lan.

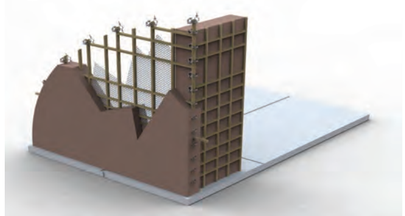


fig. 8.4

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 formwork 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.

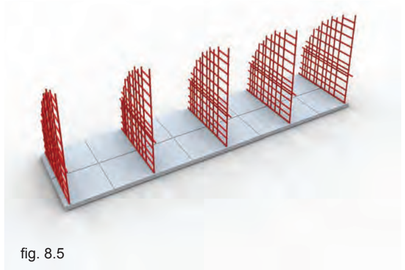


fig. 8.5

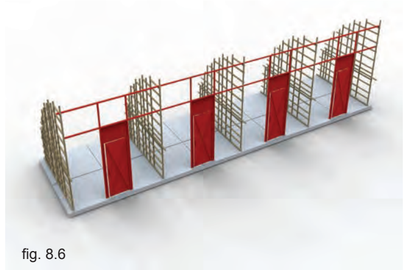


fig. 8.6

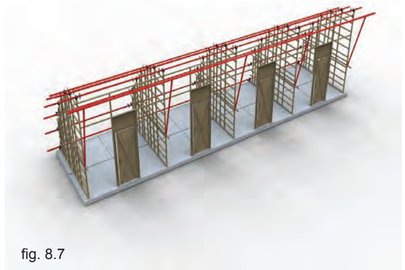


fig. 8.7

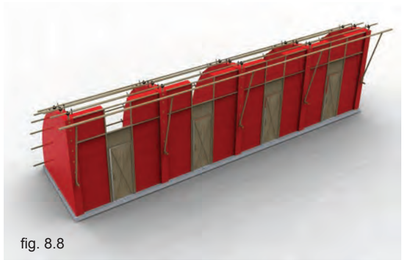


fig. 8.8

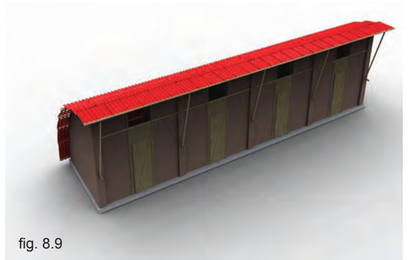


fig. 8.9

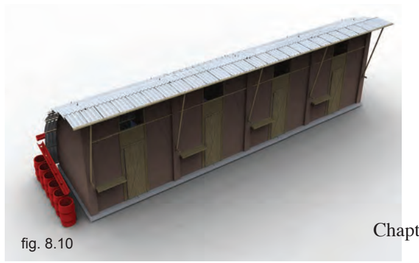


fig. 8.10

KOUMAN POU Bati

Etap 1: Fouye tè a soti nan yon pwofondè 19 an "pou anprint bilding chak 12'x50 '.

Etap 2: Ranpli 4 "ak total koryas (de preferans kraze wòch, men blokaj ta kapab tou yon opsyon).

Etap 3: Ranpli yon lòt 2 "ak total amann ak 2" pi plis ak sab. Kontra enfòmèl ant total nan fen ak sab otank posib swa mekanikman oswa nan men bouraj.

Etap 4: Fè fòm pou beton an. Kondwi nan miz alantou perimèt nan bilding lan epi mete planch sa yo avèk fil. Kouri yon liy fisèl atravè lajè a ak longè kofraj a ak asire tèt yo se nivo.

Etap 5: Mete nan jwenti ekspansyon. Itilize sove plywood 3 "lajè ak divize chak anprint nan 16 kare ak jwenti yo ekspansyon. Evite plase jwenti ekspansyon anba kote miray yo ap ale.

Etap 6: Mare 6 "x6" file fil 1.5 "nan anba nan fòm yo pou ke li pral entegre nan tranch lan konkrè.

Etap 7: Rasanble frame la banbou pou miray yo chèf. Kout fwèt moso yo ansanm ak fil oswa kòd. Sèvi ak yon kreyon mare nan yon kòd yo ak ancrage nan yon sèl kwen fondasyon an trase reyon yo 12 'sou travay la ankadreman, lè sa a koupe fini an kòmsadwa. Insert lankr nan 3 anba a "nan ankadreman an.

Etap 8: drese ankadreman yo banbou. Mete ankadreman yo sou 2 "anndan fòm yo. kalaj Itilize tanporè kwa jalonné desann andeyò fondasyon nan kenbe miray yo byen nivo jiskaske konkrè a vide.

Etap 9: Mix konkrè (1:3 siman nan sab) ak pour fondasyon an nan yon pwofondè nan 3 ", tès depistaj sifas la konkrè a imedyatman apre vide.

Etap 10: Slide 2 eye sou chak 12 pan. " Chalè jwen 2 'la x 3' panno plastik nan seksyon 12 '. Drill twou nan kwen yo reyini komite plastik chak 12 'ak tranble yon ranje nan panno bay chak pan. Tou egzèsis twou tanzantan nan rebò yo nan seksyon 12 a 'ak kout fwèt pan yo ak fil.

Etap 11: Depi anba nan do kay la epi travay leve, tache pan ki genyen ant chak nan miray yo, de preferans itilize kouple doub oswa konektè metal lòt nan chak nan fen pan an.

Etap 12: Boulon nan fen gratis nan chak ranje nan panno pan a anba. Pran mezi sekirite ki nesesè tankou sa a ap enplike trape sou teras la. Lè se teras la reyini taye rebò yo pou yo kole.

Etap 13: Tache fil poul fondasyon an banbou pou miray yo epi sèvi ak bailing oswa lòt fil metal.
Etap 14: mare Banbou Mare frame la Banbou anwo pòt la.

Etap 15: Mix chèf la (50% -85% sab, 10% -40% ajil, 10% -40% pay ak dlo). Melanje nan yon prela, rale moute kwen a pandan melanje entegre materyèl yo. Aplike epi ankadreman an pa men.

Etap 16: Coat miray ak kouvrir lacho.

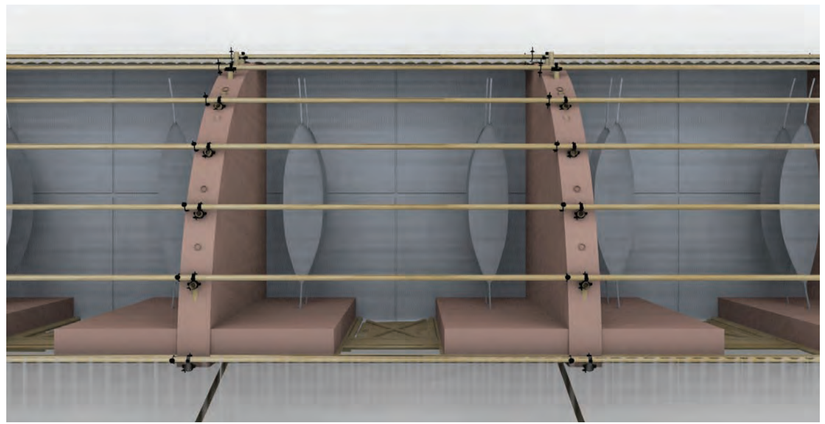


fig. 8.20

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.

fig. 8.11

Materials and Cost

Coarse Aggregate (salvaged)		
Fine Aggregate ($40/yd³ x 67yd³)		$ 2,680
Sand ($30/yd³ x 67yd³)		$ 2,010
Concrete ($100/yd³ x 100yd³)		$10,000
Plywood Expansion Joints (salvaged)		
Woven Bamboo Mats (native materials)		
Eyelets ($1.50 x 90)		$ 135
Washers ($0.30 x 90)		$ 27
Nuts ($0.30 x 90)		$ 27
Double Couplers ($2.50 x 154)		$ 385
HDPE Panels: native materials		
50 gal drum ($100 each x 12)		$ 1,200
Cob (native materials)		
Slaked Lime ($100 per ton x 0.5 ton)		$ 50
Bailing wire ($5 per roll x 4 rolls)		$ 20
12' Bamboo Poles ($5 each x 260)		$ 1,320
Chicken Wire ($20/ 2' x 150' roll x 12)		$ 240
6"x6" Mesh ($40 per 3' x 100' roll x 4)		$ 160
Total Cost:	USD	$18,254

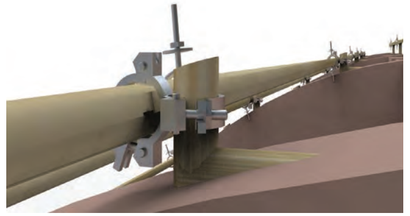


fig. 8.12

figs. 8.18, 8.19

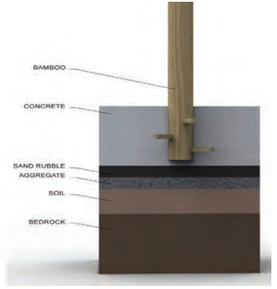


fig. 8.13

Materyèl ak Pri

Koryas global: sove		
Fine global ($ 40/yd ³ x 67yd ³)		$ 2,680
Sab ($ 30/yd ³ x 67yd ³)		$ 2,010
Konkrè ($ 100/yd ³ x 100yd³)		$ 10,000
Plywood Ekspansyon jwen: sove		
Trikote Banbou Mats: materyèl natif natal		
Eye ($1.50 x 90)		$ 135
MACHIN POU LAVE ($ 0,30 x 90)		$ 27
Nwa ($ 0,30 x 90)		$ 27
Kouple Double ($ 2.50 x 154)		$ 385
HDPE pano: materyèl natif natal		
50 Gal tanbou ($ 100 chak x 12)		$ 1,200
Epi: materyèl natif natal		
Etent Lime ($100 pou chak tòn x 0.5 tòn)		$ 50
Bailing fil ($ 5 pou chak woule woulo x 4)		$ 20
Banbou 12 'Polonè ($ 5 chak 260 x)		$ 1,320
Poul Wire ($20 / 2 'x 150' woule x 12 woulo)		$ 240
6 "x6" may ($40 chak 3 'x 100' woule woulo x 4)		$ 160
Total Pri:	USD	$ 18,254

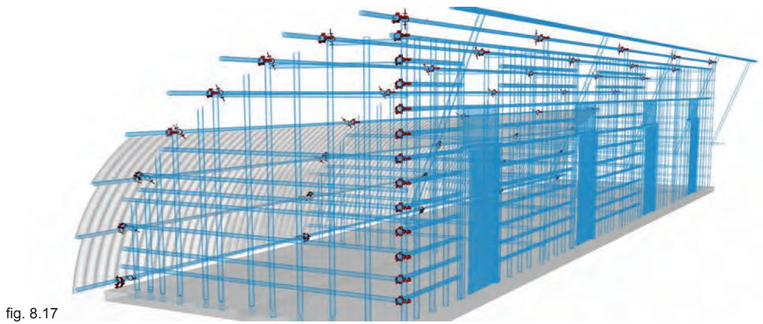


fig. 8.17

fig. 8.15

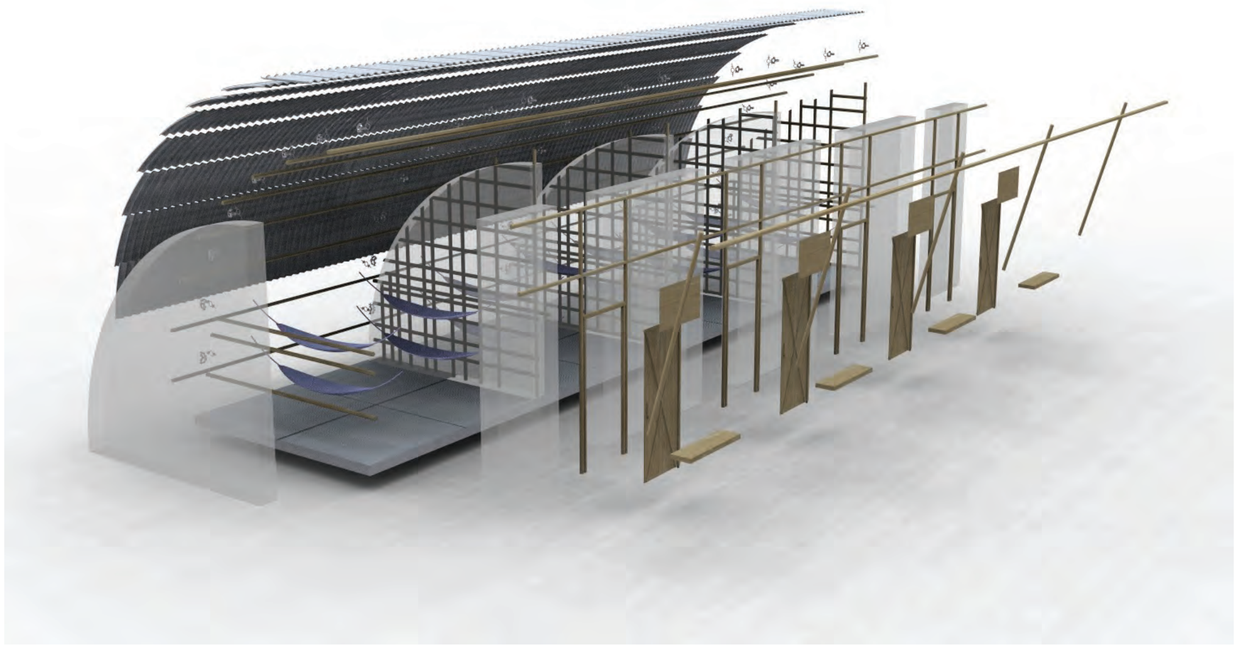


fig. 8.16

fig. 8.21

fig. 8.22

Chapter 9: Staff and Visitor Shelters

Evan Croton, Hannah Thomas

Design Goal

The goal of team research was to provide a more permanent form of housing for medical professionals, educators, staff, and groups visiting the site in Les Cayes. The client requests that Medical Teams International's wishes be fulfilled, which includes a private housing and living area for the MTI team, as a place to get away from the workplace and relax. With this in mind, multiple options have been planned for housing, one as a second floor on the Medical Clinic and the other as a separate housing cluster. The recommendation is Option A, the second floor of the clinic, to be used as the primary housing option due to the space it saves on the site and keeps the doctors very close to their work, while still allowing extensive privacy. Option B, the separate housing cluster of smaller buildings, can be used if chosen by the client, but as a whole works for another housing option, regardless of its occupants.

Description of Design

Option A

Option A is divided into 2 parts, A1 and A2. These correlate to the presentation in Chapter 4 of alternative designs for the medical facility. 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 building. 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 can adjust this room style because the wall layout makes little difference structurally.(Fig 9.2) A1 also has the possibility of including a green roof which unlike the heavy load of a roof garden, bears less weight onto the roof of the 1st floor, provides insulation to the 1st floor, as well as an aesthetically pleasing green space for those living on the second floor. Option A2 is a 2-building structure, with each side symmetrical. Each side contains a 5' wide porch spanning the entire inside of the building. Each side will also contain 1 5-person bedroom, and 2 2-person bedrooms in addition to a 25' by 15' common living space and kitchen. This area could be open air or closed, depending on the client's wishes. (Fig 9.3) Option B is a housing option utilizing plastic paneling as well as a form of bamboo latticing and matting. Each home has a pitch roof, concrete foundation supported with rebar, and walls formed out of woven bamboo mats that allow sufficient ventilation.

3 designs have been created to accommodate 2, 4, or 6 people, depending on the type of group 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 10' by 30'. These homes will be clustered in a Haitian lakou fashion, which is native to Haiti and also allows for a community feel amongst those living there. This lakou will also ideally contain a 10' by 20' kitchen and common area for the doctors and visitors to spend their time, considering the homes are built with a compact, sleeping-only idea in mind.

Materials and Cost

Options A1 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 skills and construction knowledge to build such a structure. To create a more environmentally sustainable design, we have looked into creating Insulated Concrete Forms or ICF blocks to replace building with concrete alone. ICF's use Styrofoam as the aggregate, which can be found everywhere as scrap in Haiti. By blending the Styrofoam pellets and concrete mix, blocks are then created and shaped to allow for the steel rebar to be threaded through the blocks laterally and vertically. (Fig 9.4) The holes are then filled with concrete and the gaps that form between the ICF blocks occasionally can be filled with mortar. This plan of using ICF's could also work with the locals' knowledge of construction and the client has advised the creation of ICF's in Haiti could be easy and effective. In addition to being sustainable, ICF's also provide the benefit of being stronger and more durable then wood built structures,

Design Bi / Rekòmandasyon

Objektif rechèch ekip yo te bay yon fòm pi plis pèmanan nan lojman pou pwofesyonèl medikal, edikatè, anplwaye yo, ak gwoup vizite sit la nan Les Cayes. demann yo kliyan ki vle Medikal Ekip Version rive vre, ki gen ladan yon lojman prive ak zòn viv pou ekip la MTI, tankou yon kote ki jwenn lwen nan travay la ak rilaks. (Fig 9.1) Avèk sa a nan tèt ou, opsyon miltip yo te planifye pou lojman, youn kòm yon dezyèm etaj sou Medikal klinik la ak lòt la kòm yon grap lojman apa. rekòmandasyon an se yon Opsyon, dezyèm etaj la nan klinik la, yo dwe itilize kòm opsyon pou lojman prensipal akòz espas ki la sove li sou sit la ak kenbe doktè

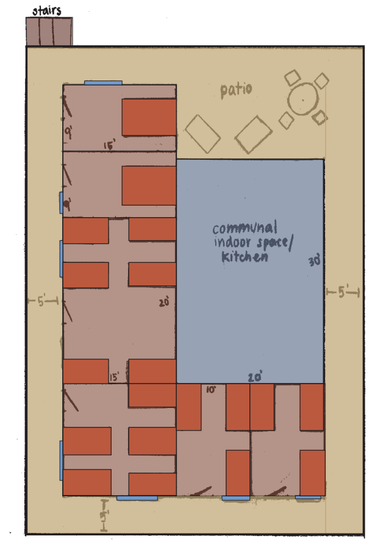


fig. 9.2

yo trè pre travay yo, pandan yo toujou pèmèt anpil konfidansyalite. Opsyon B, grap rezen nan lojman separe nan pi piti bilding, yo ka itilize si chwazi pa kliyan an, men kòm yon antye ap travay pou yon lòt chwa lojman, kèlkeswa okipan li yo.

Deskripsyon Design

Opsyon A

Se Opsyon A divize an 2 pati, ak A1 A2. Sa yo tou de correspond prezantasyon Chapter 3 an de desen nan fasilite medikal. A1 karakteristik yon 40 'pa 60' bati, ak mach eskalye nan kwen an tounen nan bilding lan ki mennen jiska dezyèm etaj la. Sa a gen ladan etaj lajè yon 5 'louvri-lè balkon ki devlope alantou bilding la. Genyen 6 chanm pou lojman doktè yo ak vizitè yo, ki enkli 2 chanm doub, 1 6-moun sal, 1-5 moun ki sal, epi 2 chanm 3-moun. kliyan an ka ajiste sa a style sal paske layout nan miray ranpa ki fè diferans ti strukturèl. (Fig 9.2) A1 genyen tou posibilite pou enkli yon twati vèt ki kontrèman ak chay la lou nan yon jaden yon twati, lous mwens pwa sou do kay nan etaj la 1st , bay izolasyon etaj la 1st, menm jan tou yon estetik plezi espas vèt pou moun viv sou dezyèm etaj la. A2 Opsyon se yon estrikti 2-bilding, ak chak bò simetrik. Chak bò balkon gen lajè yon 5 'alan anndan an nan bilding lan. Chak bò ap tou gen 1-5 moun chanm, ak 2 chanm-2 moun nan adisyon a yon 25 'a 15' espas komen vivan ak kwizin. Zòn sa a ta kapab louvri syèl oswa fèmen, depann de volonte kliyan an. (Fig 9.3) B Opsyon se yon chwa lojman an plastik itilize pano menm jan tou yon fòm Banbou latticing ak tapi. Chak kay gen yon twati goudwon, konkrè fondasyon sipòte avèk rebar, epi miray ranpa ki fòme soti nan trikote Mats banbou ki pèmèt ase vantilasyon. 3 desen te kreye akomode 2, 4, oswa 6 moun, ki depann sou kalite a nan gwoup moun ki rete kay la. Chak kay ki baze sou yon 10 'a 10' espas pou 2 chak moun, fè kay la 4-moun 10 'a 20' ak kay la 6 moun ki 10 'a 30'. Kay sa yo pral gwoupe nan yon tan lakou ayisyen, ki se natif natal an Ayiti epi tou pèmèt pou yon kominote santi pami moun ki ap viv la. Lakou sa a ap tou depreferans gen yon 10 'a 20' kwizin

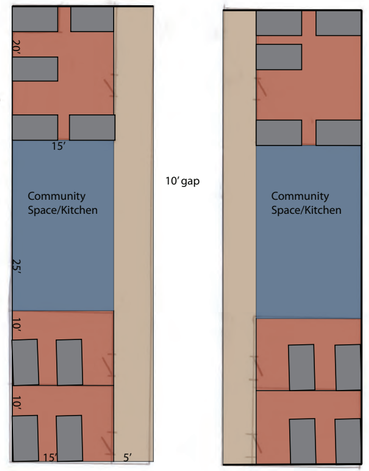


fig. 9.3

ak zòn komen pou doktè yo ak vizitè yo pase tan yo, konsidere kay yo bati ak yon kontra enfòmèl ant, lide nan tèt ou ap dòmi-sèlman.

Materyèl ak Pri

Opsyon ak A1 A2, nan asire fò sipò estriktirèl, yo pral bati nan style an tradisyonèl ayisyen sèvi avèk blòk konkrè ak asye. Lokalite nan Les Cayes gen ladrès ak konesans konstriksyon bati tankou yon estrikti. Yo kreye yon desen pi plis anviwonnman dirab, nou te gade nan kreye izole Concrete oswa fòm ICF blòk ranplase bilding ak konkrè pou kont li. Polistirèn itilize ICF la tankou total la, ki ka jwenn toupatou kòm bouyon

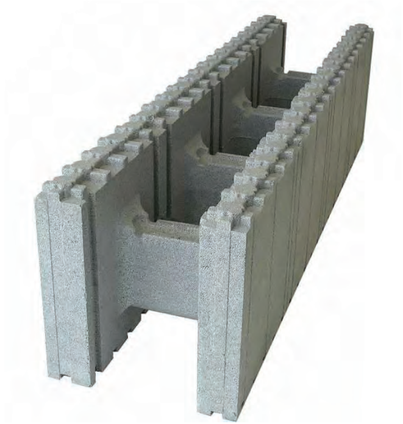


fig. 9.4

fig. 9.5

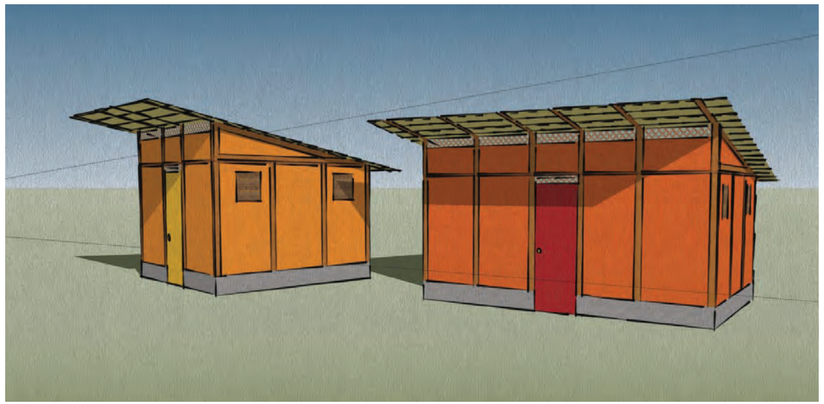


fig. 9.6

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 rise one foot above the surrounding surface elevation. This wall should rest on a wider footing, one and one half feet wide. Steel reinforcement bar should be placed throughout, with at least two feet of overlap where bars splice. Steel tie wire shall connect bar at all contact points. Additionally, when poured, stubs of re-bar shall be placed vertically into the center of the wall every six inches, with at least four inches exposed above the concrete. Note: These stubs shall be omitted where bamboo columns will be placed. Bamboo columns must be prepared prior to pour of the foundation.

Step 2: Bamboo Column Preparation
For the support columns, 4” diameter prepared bamboo shall be cut to lengths of seven feet. The first culm (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 with mortar. The bar shall protrude six to eight inches from the end of the bamboo. The top chamber shall be filled with mortar securing a threaded anchor bolt with 1-1/2 inches of the threaded end exposed. The protruding rebar on the end of these columns shall be placed plumb and centered into the foundation at the corners and every 3.5 feet maximum. Drill holes and insert one foot sections of bar horizontally at six inch intervals so four inches of bar protrudes from each column in line with the foundation and columns. These pins must all be at corresponding elevations with pins on adjacent columns.

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

an Ayiti. Pa melanje boulèt yo polistirèn yo ak melanje konkrè, blòk yo se lè sa a kreye epi ki gen fòm pèmèt pou rebar an asye dwe Threaded nan blòk yo lateral ak vètikal. (Fig 9.4) twou yo lè sa a plen ak konkrè ak twou vid ki genyen yo ki fòm ant blòk yo ICF detanzantan ka plen ak mòtye. Plan sa a yo sèvi ak ICF a ka travay tou ak konesans moun nan lokalite yo 'nan konstriksyon e li gen kliyan an avize kreyasyon an ICF la an Ayiti kapab fasil e efikas. Anplis yo te dirab, ICF a bay tou benefis la te vin pi fò ak pi dirab Lè sa a, bwa bati estrikti, espesyalman van ak tranblemanntè. (Fig 9.5)

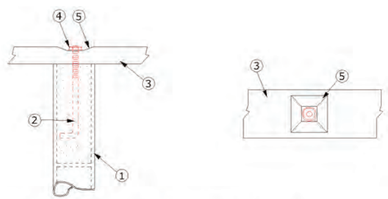
Opsyon B

KOUMAN POU Bati

Etap 1: Fondasyon an
Fondasyon an konkrè yo ta dwe sis pous epè, epi li ta dwe monte yon pye anwo a elevasyon an sifas ki antoure. Sa a mi yo ta dwe repoze sou yon pozisyon pi laj, yon ak yon pye edmi lajè. yo ta dwe Steel bar ranfòsman dwe plase toupatou nan, avèk omwen de pye de kouvri kote ki ba epise. Steel mare fil va konekte bar nan tout pwen kontak. Anplis, lè yo vide, souch la bar re-yo dwe mete vètikal nan sant la nan miray ranpa a nan chak sis pous, ak nan omwen kat pous ekspoze anwo a konkrè la. Note byen: sa yo souch va omisyon kote kolòn Banbou y ap mete. kolòn Banbou dwe pare anvan yo vide nan fondasyon an.

Etap 2: Banbou Preparasyon pou Kolòn
Pou kolòn yo sipò, va 4 "dyamèt Banbou pare pou koupe longè nan sèt pye. se kulm Premye (manbràn manbràn) pwen soti nan sa ki ka nan fen pi ba. Sa a se yo dwe ranpli ak yon seksyon nan bar asye fèt nan ak mòtye. bar la va leve sis a uit pous soti nan nan fen Banbou la. va chanm nan tèt yo plen ak mòtye sere yon Threaded lank tranble avèk 1-1/2 pous nan fen Threaded ekspoze. va rebar a essayant sou la fen sa yo kolòn dwe mete byen nivo ak santre nan fondasyon la nan kwen yo ak tout pye 3.5 maksimòm. Drill twou ak insert yon seksyon nan pye bar orizontal nan sis pous entèval pou kat pous depas bar nan chak kolòn nan liy ak fondasyon an ak kolòn. Sa yo pen tout dwe fèt nan elevasyon korespondan ak pen sou kolòn adjasan.
Etap 3: Top Plak
Yon plak anwo nan 2 "x6" bwa dwe tache ak kolòn yo pou yon plak tèt. ankadreman yo pral kouche plat epi yo dwe santre sou kolòn yo banbou. Twou yo pral komanse fouye akomode Threaded lank boulon yo nan banbou an. ½ nan tèt "dwe freze akomode konektè yo machin pou lave ak nwa. Ant kolòn yo, santre twou vètikal dwe komanse fouye chak sis pous pou seksyon bar asye yo dwe eleman, ak kat pous ekspoze anba a epi ak kote ki bezwen sipò kadriyaj anwo a panèl. Pen sa yo dwe leve liy vètikal ak pen yo ekspoze nan fondasyon an.

Etap 4: Panèl Wall
Panno yo miray yo pral bati sou yon griy a fann poto 1-1/2 Banbou pous. Apre yo te fann longueur sèvi ak yon manchèt, sa poto yo tache ak pen yo bar asye

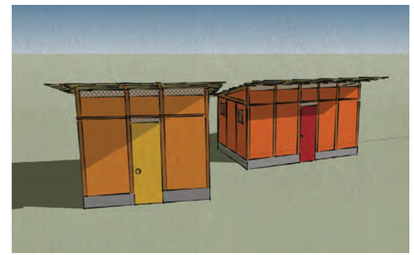


1)-Top culm of 4" dia. bamboo column, filled with mortar
2)-Threaded anchor bolt
3)-Timber top plate
4)-Washer and nut
5)-Countersunk recess in top plate

fig. 9.7

vètikal ak orizontal nan yon modèl griy. Tout koneksyon ak asye ba a ak nan entèseksyon va tou mare ak fil asye. Pòt ak fenèt twou kapab ankadre ak bwa epi yo mete yo kote yo vle. sa a se kadriyaj Lè sa a, kouvri ak fil poul sou toude bò yo, tache nan fil asye nan pwen kontak anpil. ka eksteryè sa yo panno dwe kouvri avèk boudine ak pentire (oswa kite kri). ka enteryè la ap bere (ak pentire). Total epesè miray yo pa dwe depase de pous.

fig. 9.8



ETAP 5: Bandaj
Estrikti yo ki fèt avèk yon senp twati koule style, pou fasilite nan konstriksyon, vantilasyon gwo, ak lonbraj ase. bandaj yo se triyang senp nan 4 "poto Banbou dyamèt bati nan yon goudwon 3 / 12. Tout jwenti pral itilize boulon asye, MACHIN POU LAVE, nwa, ak tiran plywood. Sa yo dwe santre sou kolòn yo banbou. Yo pral sèvi ak tache asye L-parantèz ki pral Boulogne atravè plak yo soufle ak sistèm ranfòse. Lag boulon ap tache anba a L parantèz yo-a plak a anlè. menm Banbou griy-poul fil-boudine panno yo pral kouvri de bandaj yo deyò ak devan an (pi wo bò kote) nan estrikti an. pan Banbou va gen kote pik sou ti vwalye yo. pan a ta dwe apeprè 1-1/2 pous an dyamèt yo ak kote ki nesesè pou mande materyèl ROOFING. Vents pral ant chak ranfòse, pan anba a anwo a yo ak panno yo mi.

be centered over the bamboo columns. Holes will be drilled to accommodate the threaded anchor bolts of the bamboo. The top ½" shall be countersunk to accommodate the washer and nut connectors. Between the columns, centered vertical holes shall 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 can 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). The interior can be plastered (and painted). Total wall thickness should not exceed two inches.

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" diameter bamboo poles built at a 3/12 pitch. All joints 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 will 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 place perpendicularly over the rafters. The purlins should be approximately 1-1/2 inches in diameter and place where needed for desired roofing material. Vents will be between each truss, below the purlins and above the wall panels.

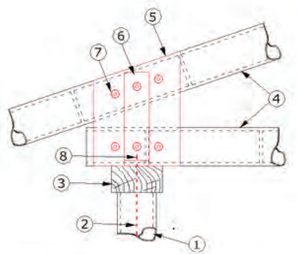
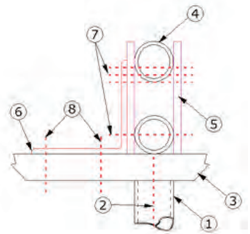


fig. 9.9

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



Etap 6: Roofing
ROOFING la kapab nenpòt ki divès kalite pwodui ki disponib ROOFING corrugated tankou plastik, Fiberglass, oswa metal. Chom ROOFING ta kapab tou ki apwopriye. pwodwi corrugated ta anplwaye yon Threaded J-abandone ki ta zen pan yo banbou yo epi yo dwe tache ak ROOFING a pa yon machin pou lave kawotchou ak nwa.

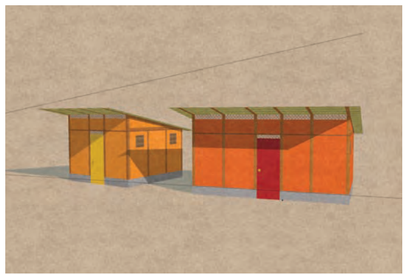


fig. 9.11

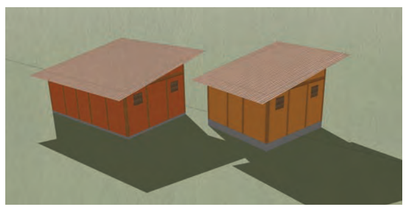


fig. 9.10

PRODUCT LIST

Product Name	Quantity 2 person	Quantity 4 person
Bamboo 4" dia.	128.75'	308.5'
Bamboo 1.5" dia.	384'	484'
Rebar _ "	Quantity	Quantity
Door	1	1
Wire	Quantity	Quantity
Hinges	One set	One set
Bolt 6"X3/8"	96	144
3/8" washer	188	280
3/8" nut	108	160
Chicken wire	324.5 sq. ft.	411.5 sq. ft.
2"X6" lumber	42'	54'
3/8"X6" threaded anchor bolt	12	16
2"X4" lumber	39'	32'
5/8" plywood	Two sheet s	Two sheet s
Roofing J -bolt _ "X4 -5"	224	320
_" nut w/ rubber washer	224	320
L-bracket 3"x3"	8	12
Lag bolts	16	24

HAITI HOUSING RELIEF

AYITI LOJMAN SEKOU

DESIGN BOOK II

Les Cayes Site Study

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