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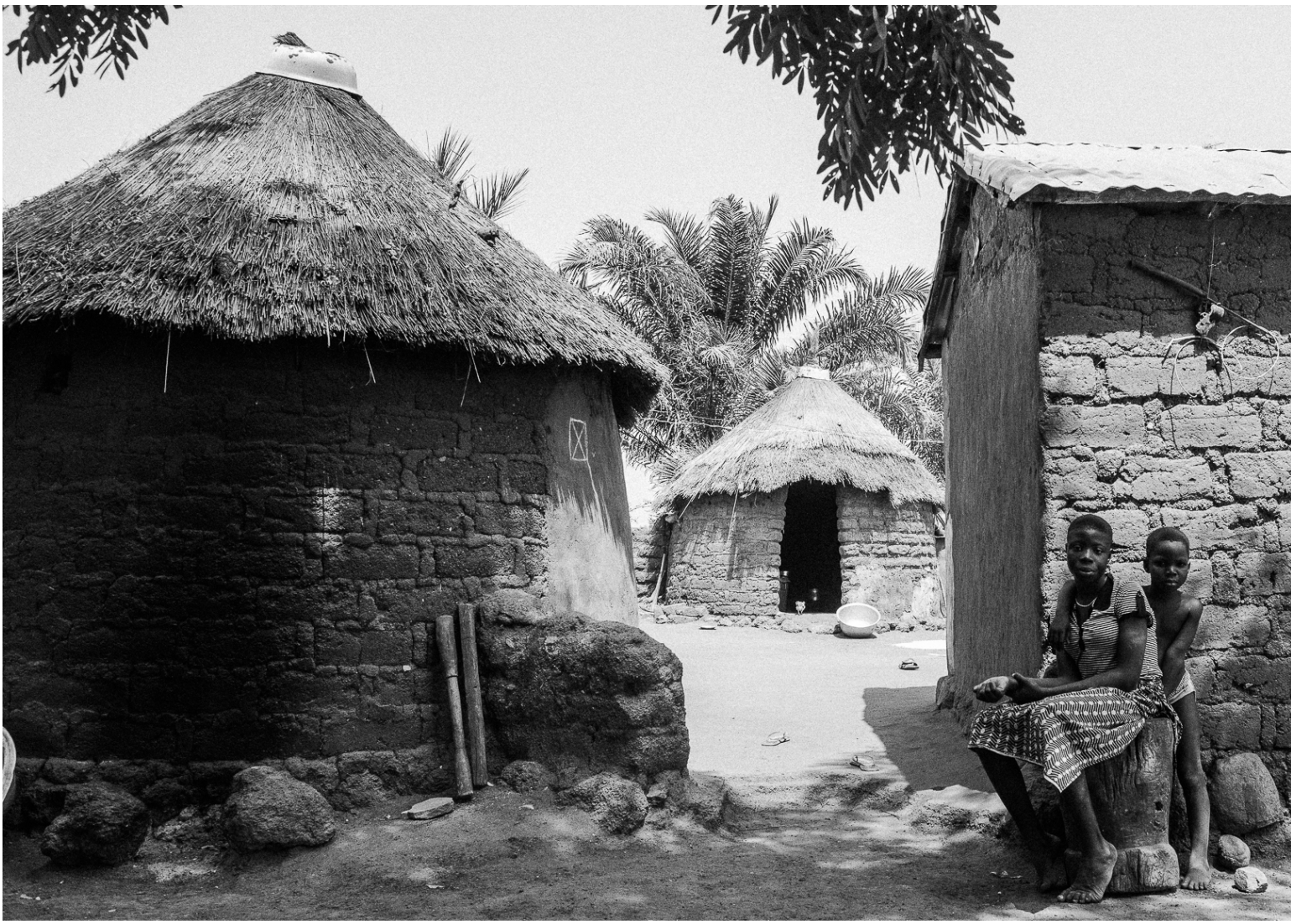
CONSTRUCTION METHODS

CONSTRUCTION for CHANGE

Project Manager Manual
for International Projects



Photographer: *Zoe Rain*

Location: *Togo, Africa*

CONTENTS

PROJECT MANAGER MANUAL

PACKET OVERVIEW

Construction for Change (CFC) seeks to implement sustainable building practices in all projects while ensuring the highest standard of quality and safety. It is first and foremost the primary objective of each project.

Building design is either provided by the host country- often times provided by the Ministry of Health- or developed by architects in the states. Building design, materials and methods should be site specific and reflect the regional culture of each site.

In order to implement sustainable building practices project managers have the ability to work with architects in host-countries or CFC architects in the United States. Building plans should be vetted by project managers upon arrival to mitigate any challenges prior to construction with an understanding challenges may also arise during construction and require alteration.

The following document describes CFC's building guidelines and references examples of implementation. Due to the variability of each site, the examples should be viewed as ideas and construction methods should be based on individual project context.

Further questions should be addressed to CFC' Seattle office.

WHY EQUITABLE + SUSTAINABILE GUIDELINES ?

In 1974 British economist P.T. Bauer wrote an essay in Encounter Magazine questioning the ethics, effectiveness, unintended consequences and the theory behind foreign aid to underdeveloped countries... that has led to "sometimes brutal consequences, enormous costs, [and] little success..."[1]. Multiple authors since then from Judith Tendler's Foreign Aid (1976), Timothy Morris's "The Despairing Developer" (1991) to more recent Ben Remalingam's "Aid on the Edge of Chaos: Rethinking International Cooperation in a Complex World" (2015) all reiterate the same critique- that foreign aid creates dependency for countries on the receiving end and detours progression towards independence. Organizations have been criticized for their technical solutions to poverty rather than addressing the underlaying issues. Similarly, organizations are often comprised of foreigners or local elites that provide employment for elites of a similar status and background rather than empowering local populations to organize. [2]Countries experiencing consistent impoverishment are faced with brain drain within communities as abled individuals seek alternative locations.

Funds that do reach communities are often treating immediate issues but not empowering communities' long term. Ugandan Journalist Andrew Mwenda stated we need to reframe aid, "rather then viewing aid as a means to reduce poverty, it should be viewed as a means to create wealth". He goes on to say sending people to school and giving them medicine, does not create wealth for them. Wealth is a function of income, and income comes from you finding a profitable trading opportunity or a well-paying job"[3]

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1 "When Criticism Falls on Deaf Ears: The Case of U.S. Foreign Aid," accessed February 22, 2019, http://www.afsa.org/when-criticism-falls-deaf-ears-case-us-foreign-aid.

2 Sally Matthews, "The Role of NGOs in Africa: Are They a Force for Good?," The Conversation, accessed February 21, 2019, http://theconversation.com/the-role-of-ngos-in-africa-are-they-a-force-for-good-76227.

3 Mwenda, Andrew. n.d. Aid for Africa? No Thanks. Accessed May 27, 2019. https://www.ted.com/talks/andrew_mwenda_takes_a_new_look_at_africa.

World Bank Economist William Easterly states “it is a fantasy to think that the West can change complex societies with very different histories and cultures into some image of itself. The main hope for the poor is for them to be their own searchers, borrowing ideas and technology from the West when it suits them to do so”.[4] After all the ‘developed’ nations of this world arrived at their current state independently- more or less, and were not receiving substantial amounts of foreign aid or assistance; nor were they exploited.[5]

Considering monetary assistance is available, distribution of aid should be benefitting the receiving countries. Facilitating a model for monetary distribution that benefits recipients long term creates opportunities for communities to be empowered and sustained over generations compared to short term gratification.

With the complexity of foreign aid distribution and multifaceted non-profit sectors, the following packet solely examines the built environment and possible methodologies for implementing sustainable building strategies.

The examples demonstrate how changes in development work can empower communities and combat the effects of international aid- monetary donations making no significant improvement within communities. This packet is meant to educate persons involved in international infrastructure projects so that assumptions of what countries want are replaced with an understanding of what they can provide.

4 “When Criticism Falls on Deaf Ears: The Case of U.S. Foreign Aid.”
5 Dermot McAleese, “Economic Exploitation of the Less Developed Countries: A Survey,” Studies: An Irish Quarterly Review 62, no. 246 (1973): 139–53.

BUILDING MATERIALS

Building material can be both natural and unnatural products. Selection and integration should be a continual conversation before project implementation, during the course of construction, and reviewed before project completion to inform future maintenance practices.

Whether utilizing natural resources or manufactured materials, materials used should reflect regional context and strive to stimulate the local economy with mindfulness towards the environmental impact.

This section is broken apart into three categories; site context, local resources, and traditional building practices. Each category will be defined and followed by an example of implementation.

Location: *Togo, Africa*

HISTORY

Currently It is estimated that 2 billion people, which equates to 30 percent of the world's population, still live in homes constructed of Earth.[1] Today, these dwellings are located in the most impoverished regions of the world. In regions such as the Middle East and North Africa some mud brick buildings present today were constructed over ten thousand years ago and stand nearly ten stories tall.[2] These shelters were derived from local materials; primarily wood, stone and mud, gathered from the surrounding region. Compared to modern building materials, traditional materials offer a number of benefits from cost savings, longevity; lasting for centuries compared to the 49-year average of wood frame buildings,[3] and are excellent in passive heating and cooling. Earthen materials and methodologies such as sun-dried blocks and rammed earth, absorb heat slowly in the afternoons which keeps interiors cool. At night the accumulated heat dissipates slowly keeping interior rooms warm during colder periods.[4] Earthen construction also consumes less "energy compared to the extreme heat necessary to make cement, the firing process required to make bricks, and the deforestation required to build with wood" . And the material is easily accessible and cost effect. Although more often seen in drier climates, wetter regions such as England have a variety of mud construction.

Today the complexity of modern building technologies is more often directly tied to waste- relying on non-renewable resources for production. While the systems may be beneficial in their functions to mitigate climate, they can also be time intensive and costly compared to traditional methods[5] . Climate-sensitive architecture and design can serve as a strategy for climate mitigation and adaptation. And combing vernacular building methodologies can reduce exhaustion of resources and pollution that would otherwise be incorporated in the production and construction processes.

Local materials also draw attention to different aspects of a location's natural and cultural history. When outside parties approach [foreign] countries and try to instill western ways of thinking the inhabited spaces of the receiving population is threatened by new processes- imported materials with vast supply chains that override cultural norms and traditions such as traditional construction knowledge and associated micro-businesses. So, while modern methods of construction have a lot of upfront benefits in terms of cost savings and maintenance, there are indirect concerns like social change. It is critical to visualize a hybrid between both modern and traditional methods- what are the contemporary benefits of vernacular techniques? A locally driven agenda is more likely to develop a partnership with communities and facilitate a dialogue between traditional practices and modern methods.[6]

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6 "Compressed Earth Block Construction | CEB FAQ," Dwell Earth (blog), accessed February 25, 2019, https://dwellearth.com/faq-compressed-earth-block/.

7 Hamed Niroumand et al., "Earth Architecture from Ancient until Today," Procedia - Social and Behavioral Sciences, 2nd Cyprus International Conference on Educational Research (CY-ICER 2013), 89 (October 10, 2013): 222–25, https://doi.org/10.1016/j.sbspro.2013.08.838.

8 "Compressed Earth Block Construction | CEB FAQ."

9 Olumuyiwa Bayode Adegun and Yomi Michael Daisiowa Adedeji, "Review of Economic and Environmental Benefits of Earthen Materials for Housing in Africa," Frontiers of Architectural Research 6, no. 4 (December 1, 2017): 519–28, https://doi.org/10.1016/j.foar.2017.08.003.

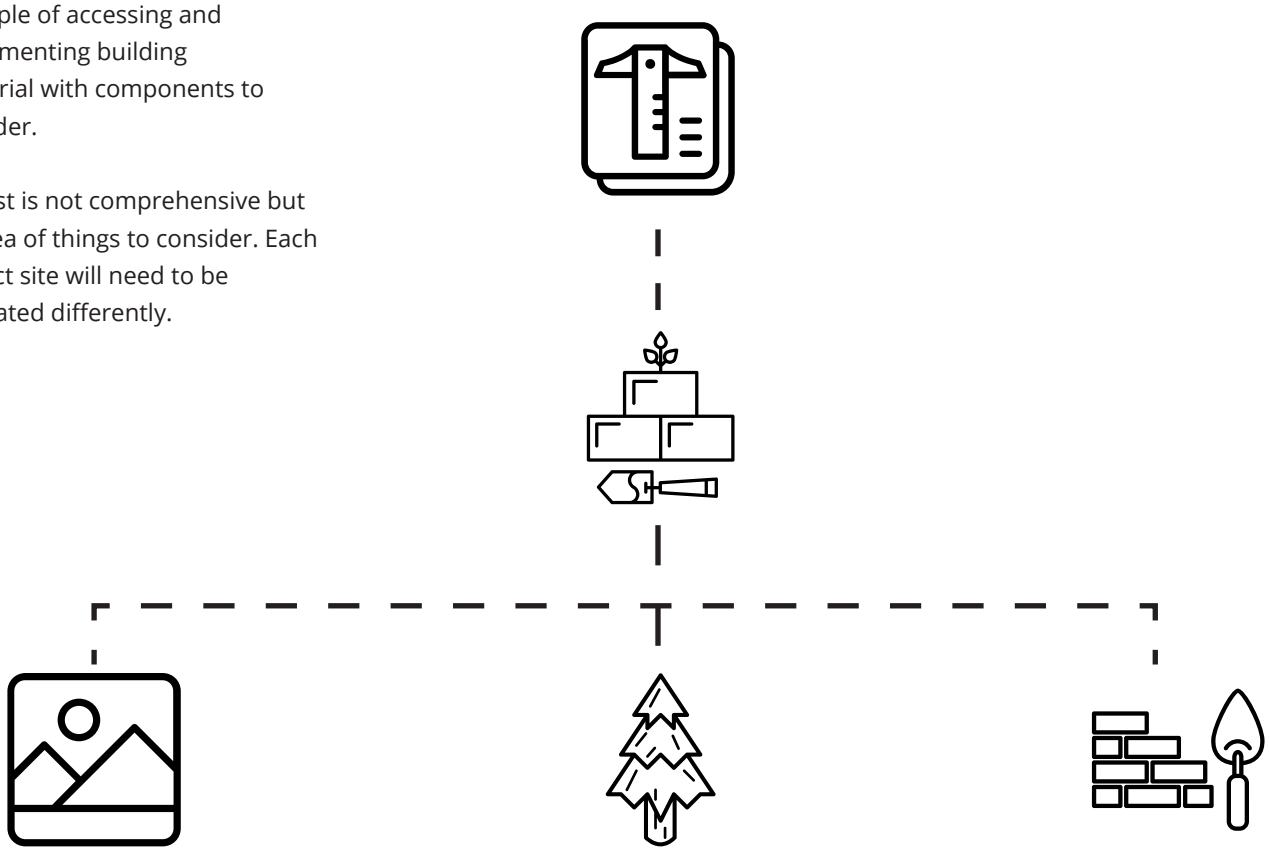
10 Sandra Piesik, HABITAT: Vernacular Architecture for a Changing Planet (New York, NY: Abrams, 2017).

11 Piesik, HABITAT: Vernacular Architecture for a Changing Planet.

FLOW CHART

Described in the flow chart is an example of accessing and implementing building material with components to consider.

The list is not comprehensive but an idea of things to consider. Each project site will need to be evaluated differently.



site context

- culture
- climate
- topography
- economy

local resources

- salvaged + recycled materials
- natural resources
- locally manufactured products
- durability

traditional building practices

- natural
- unnatural / manufactured

SITE CONTEXT

Site context refers to the features of a given area. It can refer to the ground and sky and everything in between. Looking at the typography and composition of the site, the vegetation/animals/structures that that fill the space, and taking into account the regional climate are all incorporated in site context.

Photographs: *CBF Construction*

Organization: *BASE*

Location: *Philippines*

EXAMPLE

BASE, a building foundation in the Philippines, developed a building typology for the construction of quality socialized homes with the use of bamboo as its primary building material. The method was created after the assessment of site context

Bamboo was deemed the most appropriate material in the Philippines due to availability, environmental impact, cost and ability to benefit regional farmers through demand. Traditionally, bamboo was widely used in the region for housing, however today it is now associated with poverty due to the materials lack of structural performance in natural disasters. The material has been demoted to woven mats and flattened panels while concrete and steel are viewed as superior materials, due to stability and strength, and used in construction.

Since bamboo had not been researched as a building material in urban settings and disaster-prone areas, BASE had to conduct research on the material as well as its economic, social, political and environmental implications. Data was gathered through case studies in Latin America and Europe and their forestry practices and interviews with local Filipino builders. Latin America demonstrated the "bahareque" method which used bamboo as the stud framework which is then covered with flattened bamboo and coated in lime or cement plaster. As a result, the building method proved to be structurally sound in earthquakes and was later added to the Colombian building code. Europe demonstrated the systematic use of timber in a way that created a market for the material. The research also concluded that the number of skilled bamboo builders in the Philippines was declining due to the transition to contemporary materials. The team realized to rebrand bamboo as a viable building material they would have to create a supply chain. Another aspect the team had to consider was financing. Presenting a new building typology would mean homeowners investing in an unverified building system which could prevent individuals from receiving home financing. The BASE team needed to verify the quality of their building processes.

As a result of the case studies the BASE team developed a process for improving and verifying the performance of bamboo systems, upgrading the material supply chain, as well as strengthening connections with affordable housing stakeholders[1]. The team created the "cement bamboo frame" (CBF) which was based on the "bahareque" system and incorporated fire and typhoon resistant elements. The construction methodology, with the plaster finish, allowed the buildings to look like the regional concrete block homes which prevented the outcome to look of lesser quality. The plaster also aided in durability and fire resistance.

12 Golden, Building From Tradition: Local Materials and Methods in Contemporary Architecture.

EXAMPLE CONTINUED...

The bamboo type used in construction was a result of testing at the Research Institute of the Philippines which solidified strength, quality, and treatment methods for native bamboo species. Structural performance was further verified through full-scale prototypes and digital testing. The new found knowledge was taken to local farmers to educate them on the growing, harvesting and curing process of the correct species. The result assisted farmers in cultivating structural-grade bamboo for the new housing market.

Three building typologies ended up being produced; a single-story stand-alone bungalow, single-story row houses, and a two-story duplex. All typologies use a traditional concrete foundation in conjunction with the CBF wall assembly. An additional feature was prefabrication which allowed the walls to be constructed under cover and detoured from weather setbacks.

By identifying the site context Base was able to conduct research and reinterpret the use of bamboo in a new way that created standardization in production and benefitted bamboo farmers and local craftsman with a new, in demand, skillset. Since the initial housing was implemented new housing projects have utilized the same building system. BASE continues to work with other non-profit organizations implementing affordable housing and/or housing for disaster relief.

The BASE foundation illustrates the use of traditional material in a modernized way such that the building outcome reflects current building practices. The ability to produce a building that conforms to its surroundings relieves the stigma on traditional materials as a "poor mans" material. BASE also demonstrates how research can breed new ideas on building practices and how to develop buildings that are not only supporting local populations and using renewable resources but producing structures that are up-to-code. Since the foundations initial homes were constructed the building practice has been replicated in the surrounding cities.

Image: *Wattle + Daub construction (similar methodology to CFB)*

Photograph: *BASE Housing*

Organization: *BASE*

Location: *Philippines*

Website: *www.base-builds.com*

LOCAL RESOURCES

Local resources are both the natural and unnatural materials accessible within a given distance. Natural materials comprise of earth-based products such as soil, rocks and trees, while unnatural local resources may be produced at a local factory utilizing locally derived material.

Incorporating local resources on a project helps to stimulate the local economy and sometimes even creates new markets if a new building practice is implemented. Local resources also help to promote a sense of place.

1. trench
2. filter Fabric: geotextile
3. crused stone
4. Stonework
5. sloped soil
6. earth block

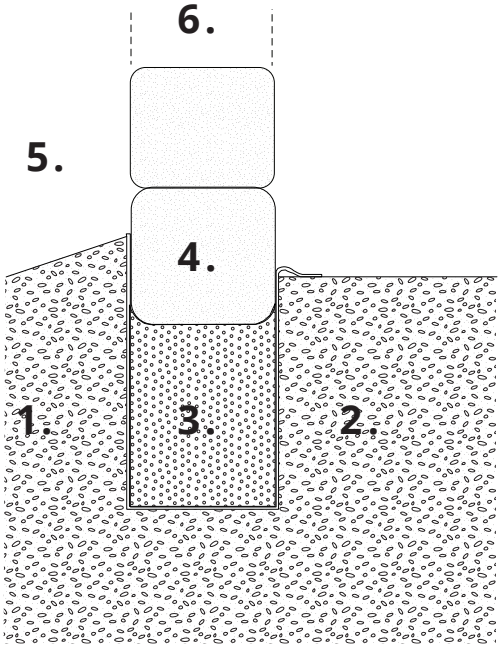


Diagram: *Rubble Trench Foundation*

EXAMPLE

The country of Afghanistan is striving to promote female contribution and inclusion in their society. With the creation of the Gohar Khatoon School, located in Mazar-i-Sharif, the fourth largest city, the school has been integrated into the national education system and educates 3,000 students each day from kindergarten through grade twelve.

The project was a collaborative effort between Seattle-based architect Robert Hull, and the Department of Architecture at the University of Washington Seattle, the school staff and the Balkh Ministry of Health.

The photograph is a depiction of a rubble trench foundation which utilizes stone and a portion of cement as a binder. This methodology helps to reduce the amount of cement typically used in traditional foundations. Stone is also a local resource that is widely available. The size of the rock and height of the foundation is larger than traditional stone foundations due to the site being in a seismic zone.

Photograph: *Gohar Khatoon Girls School*

Architect: *Robert Hull + University of Washington Department of Architecture*

Location: *Mazar-i-Sharif, Afghanistan*

Website: *millerhull.com*

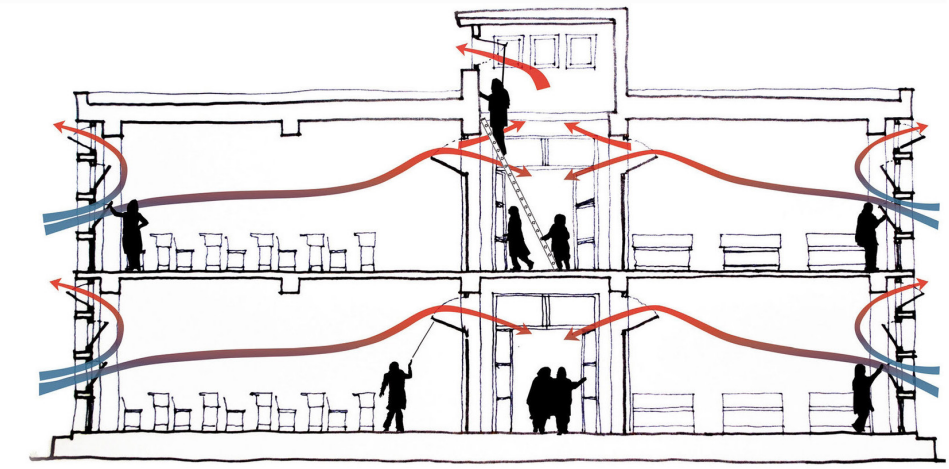
EXAMPLE CONTINUED...

The school's physical development included students, staff, and community members through visioning sessions and incorporation into the construction process. Female-only artwork competitions were held, and winners had their artwork displayed as murals on the interior of the school. The competition was completed in response to the end of the Taliban rule which had banned most forms of artwork.

The exterior façade reflects the regions history of masonry construction with red, yellow, and turquoise windows made by local craftsmen and reference the city's famed blue mosque. While some elements were imported a significant portion of the construction materials were local.

School is one of the only times most women are allowed to socialize outside their home's so the school was equipped to promote traditional outdoor activities for fitness as well as seating and gathering areas for interaction. The campus layout also allows for educational gardening, a tradition in Persian culture. Outdoor green space is decreasing in the area due to urbanization so providing greenspace through fresh air, plants and trees was a goal of the project.

In terms of heating and cooling the building uses passive strategies through a central hallway in the middle of the building that draws air in from the exterior of the building and into the hallway. The strategy allows the hallway to be heated during the winter months and keep the interior warm. Cooling in the summer months is achieved with cross and stack ventilation.



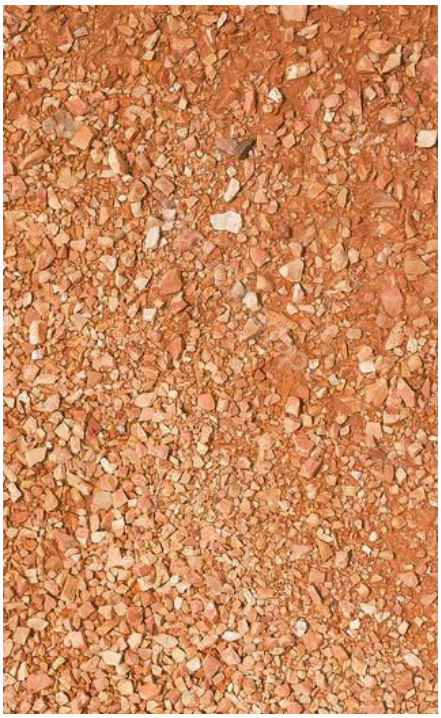
Photograph: *Diagram of ventilation*

Photographs: *Gohar Khatoon Girls School*

TRADITIONAL BUILDING PRACTICES

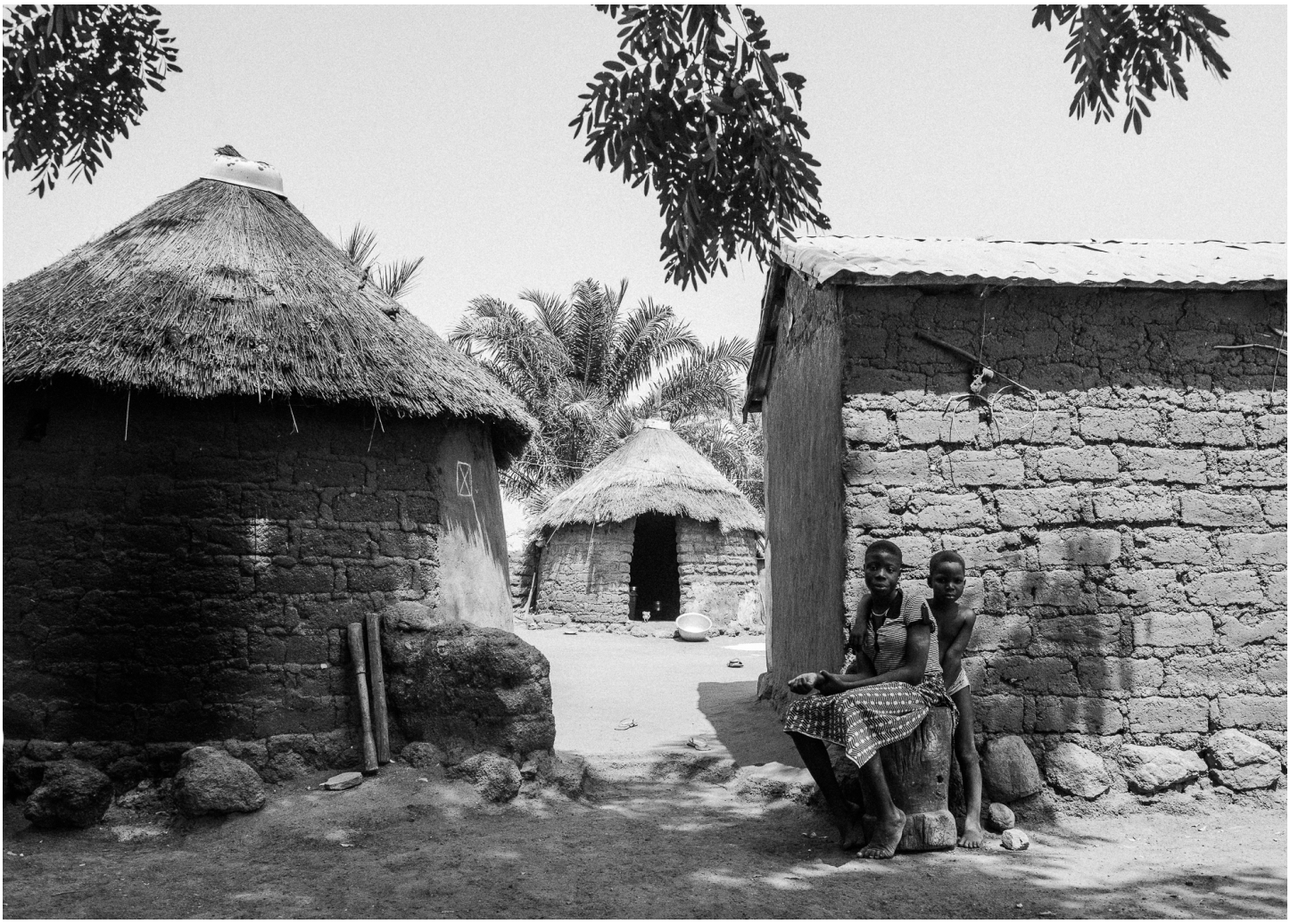
Traditional building practices refers to the cultural practices of a region that are customarily performed. In regard to building practices this refers to both materials and methods traditionally utilized.

Traditional building practices also reflect the cultural heritage of the region and are an important component to incorporate on a project to promote the local population.



Photograph: *Laterite Soil*

Photograph: *Thatch*



EXAMPLE

The photograph above depicts tradtional building practices of Togo, Africa. The community used local resources-mud, stone and thatch, to construct their buildings.

Photographer: *Zoe Rain*

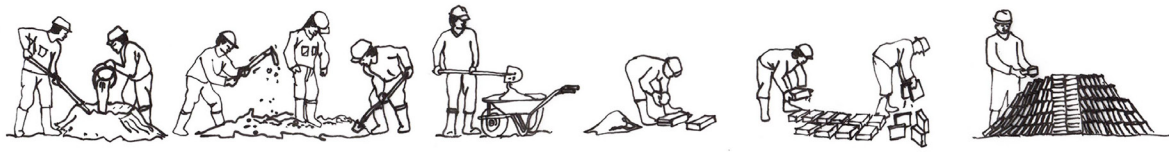
Location:*Togo, Africa*

Described on the following page is a description of a few traditional construction processes and modern methods using natural materials. As noted in the introduction, it is critical to visualize a hybrid between both modern and traditional methods- what are the contemporary benefits of vernacular techniques? A locally driven agenda is more likely to develop a partnership with communities and facilitate a dialogue between traditional practices and modern methods. Construction projects are not about imposing western ways of building but working within the context of each project to support the local community.

EXAMPLE CONTINUED...

The traditional building material in Togo, Africa and other parts of Africa include earth block; comprised of mud and water, mortar; also mud based, thatch; for roofing and foundation comprised of stone.

Illustrated in the diagram below a a traditional process of making earthblock. Material is gathered and mixed, placed into formwork and left to dry.

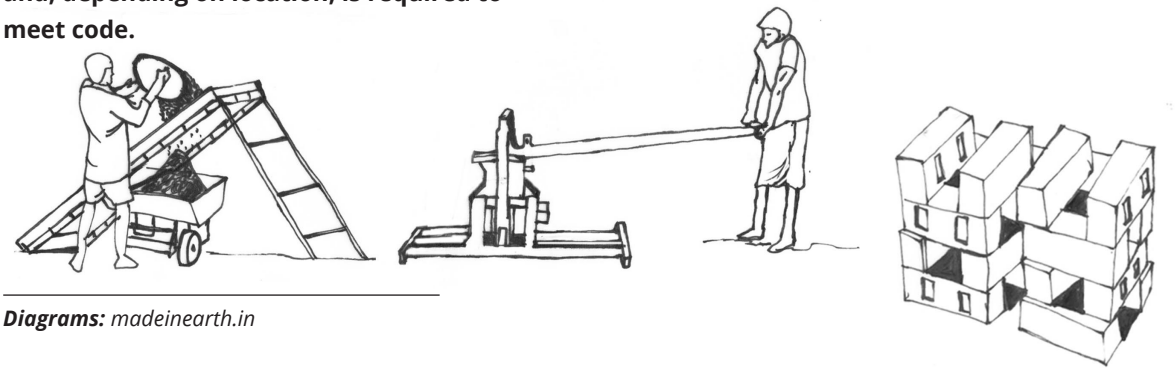


A superior methodology to traditional mud brick is fired brick and compressed earth brick (CEB), succeeded by cement stabilized eath block (CSEB). These methodologies have been proven to increase the structural strength of earth blocks.

Fired brick is done by placing mud brick in a kiln such that the bricks lose their moisture and become permanently solid.

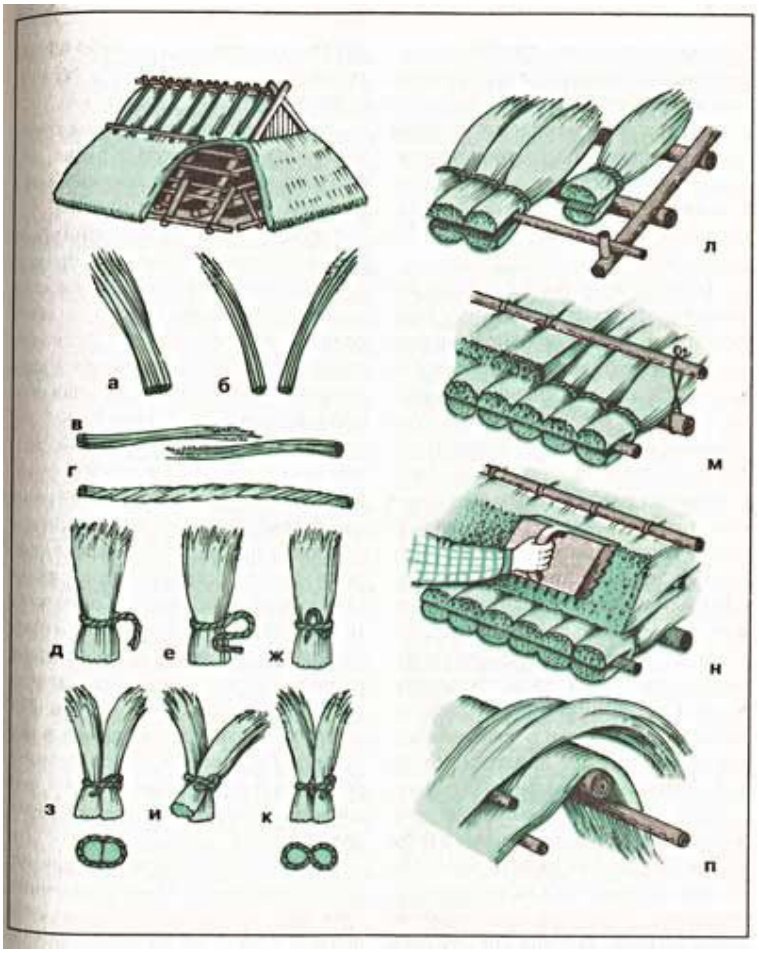
CEB and CSEB entail the same methodology with the exception of cement. Cement is the extra additive that separates the two processes. The added material is used for structural stability and, depending on location, is required to meet code.

Illustrated below is a process for compressed block. A mechanical press is needed in this process to compress the block.



Diagrams: *madeinearth.in*

Photo: *Strawbale construction*



Straw bale is a traditional roofing method used in various parts of the world from dry, hot regions of Africa to more cooler and wetter regions such as England. Thatch roofs can last 40-50 years which is comparable to most roofs. The roof ridge should be replaced every 8-10 years.

Thatch roofs are created by first creating an appropriate roof structure to attach the thatch too. Thatch is a combination of living and dead organic material- typically reeds and grasses, that are cut down and tied into tight bundles. The bundles are then woven into the existing roof structure. Exposed edges of the thatch bundles may be trimmed for aesthetics.

A detailed description and methodology of all these techniques can be found at the websites and manuals listed on the right.

Stone Foundation: *naturalhomes.org*

Compressed Earth Block: *Compressed Earth Blocks: Manuel of Construction by Hubert Guillaud*

Mortar: *mudandwood.com*

Thatch: *thatchinginfo.com*

Diagrams: *thatchinginfo.com*

SITE APPLICATION QUESTIONS: BUILDING MATERIALS

WHAT IS THE PROJECT SITE CONTEXT?

EX. CLIMATE / CULTURE / TYPOGRAPHY / ECONOMY

WHAT ARE THE RESOURES OF THE REGION? COUNTRY?

NATURAL / UNNATURAL / MANUFACTURED

WHAT ARE THE TRADITIONAL BUILDING PRACTICES OF THE REGION?

LOCATION: **DATE:**

NOTES:

SOCIAL EQUITY

Foreign projects are for the benefit of the receiving populations. Integrating local community members into project construction can instil ownership and pride in new building systems.

There are several approaches to mitigating social equity including local labor, local trade, handicraft, and gender equality. The following pages will define each category and give an example of implementation.

Project Managers overseeing construction should seek ways to promote equality through traditional methods or implementing new standards of fairness.

Photographer: *Zoe Rain*

Location: *Togo, Africa*

BACKGROUND INFORMATION

Based on the Oxford English Dictionary (2003 edition) equity concerns impartial justice and fairness. Social equity is thus applying the definition to human beings creating a level playing field for all parties. The World Bank's 2006 World Development Report (WDR) declared individuals should have equal opportunities to pursue a life of their choosing and be spared from extreme deprivations in outcomes[1]. In correlation with international work, equity ties into rights-based development which implies a broad understanding of equity that is not limited to income distribution, and which embraces the provision of health, education, and other basic service. Equity also encompasses land rights, cultural rights, minority rights, and democratic rights[2].

In applying these definitions to development work policy experts believe economic growth is a vital factor in reducing poverty and injustice[3]. Jeremy Hobbs author of "Rights Based Development" a section of the World Development Report stated "people's rights to a livelihood, to decent social services, to a secure existence, to participation in political life, to respect for their diversity and differences-and to social and cultural innovation-must lie at the heart of public policy and economic planning". These statements reiterate the need to promote and stimulate international economies for regional economic growth. Depending on implantation, development work has the power to support regional efforts.

The following section are examples of social equity strategies to support the local populations of project sites.

13 Tamar Manuelyan Atinc et al., "World Development Report 2006 : Equity and De velopment" (The World Bank, September 19, 2005), http://documents.worldbank. org/curated/en/435331468127174418/World-development-report-2006-eq uity-and-development.

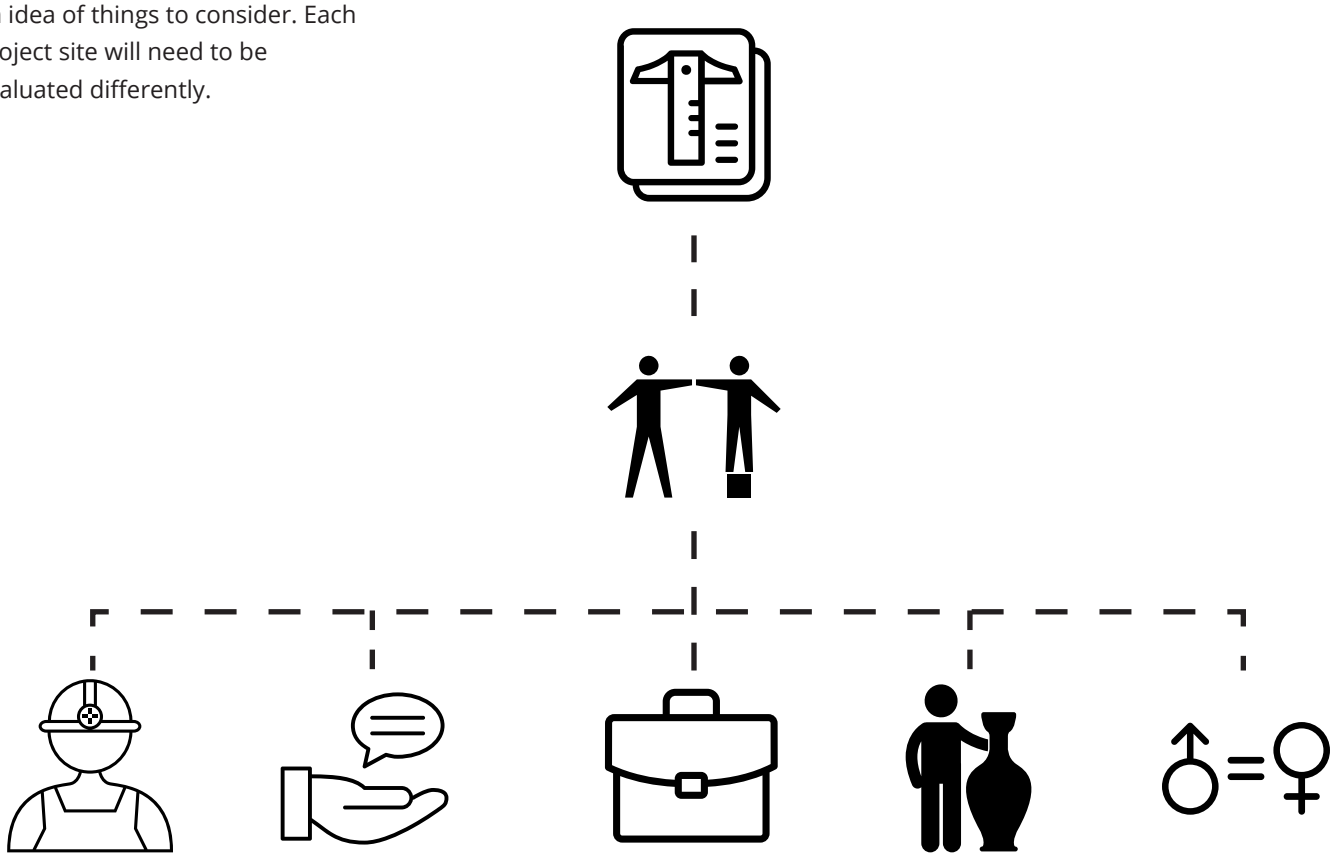
14 Kochendorfer-Lucius and Pleskovic, Equity and Development.

15 Atinc et al., "World Development Report 2006."

FLOW CHART

Described in the flow chart is an example of accessing and implementing social equity with components to consider.

The list is not comprehensive but an idea of things to consider. Each project site will need to be evaluated differently.



local labor
- men
- women
- trained
- untrained
- local wage

local input
- design decisions

local trade
- building related
- non-building related
- cultural trades

handicraft
- pottery
- painting
- weaving

gender equality
- equal opportunity

LOCAL LABOR

Local labor refers to abled persons (adults) capable of performing necessary building-related tasks. Local labor may hold different connotations depending on project type which require different skillsets. The term also incorporates identifying both trained and untrained local populations and viewing them as a potential.

Photograph: *Construction Crew + School buildings*

EXAMPLE

The proposed Opera Village in Burkina Faso was a reference to German film and theater director Christopher Schlingensief's Opera House for Africa which would act as a gathering space for local and international artist. While Burkinabe architect Francis Kéré was hired as the project architect the project was never brought to fruition due to a flood in 2009 which left thousands of families homeless and a pressing need for housing.

Since the original site was destroyed by the flood, the government donated a five-hectare piece of land 30 kilometers northeast of the Capitol, Ouagadougou, near the village of Laongo. The bowl-shaped form of the site reinforces the program with orientation around a central gathering space. Additional program includes a school, cafeteria, sound studio, offices, clinic, residences and an 800-meter facility for medical, obstetric and dental care. Later development will include a performance theater.

Photograph: *Opera Village*

Location: *Laonga, Burkina Faso*

Website: *kere-architecture.com*

EXAMPLE CONTINUED...

The layout of the site references the traditional cellular form of Burkinabe Compounds which expand and contract based on needs of the inhabitants. In the case of the clinic the layout is organized in clusters around inner courtyards. The courtyards enable ventilation to adjoining rooms; examinations rooms, inpatient wards and offices and allows patients and families to gather in enclosed, ventilated, spaces. The courtyards help to mitigate the temperature of the region which fluctuates to highs of 50 degrees Celsius.

Akin to most of Kéré's work the project incorporates local material and labor. With the exception of cement and metal used for the roof, window frames, and reinforcement on the Opera Village the remainder of the building materials were native. And while Kêrê strives to incorporate tradition to retain cultural heritage, he also understands contemporary need. Therefore, in keeping with the tradition of earth block, he upgraded to Compressed Earth Block (CEB) which is formed in a mechanical press. The regional soil used was laterite, a reddish soil that hardens when exposed to the air. By making bricks onsite the team was able to avoid purchasing them and train the construction crew with a new building methodology. The soil was also used in the walkways around the village. Large pieces of soil were cut fresh from the ground and laid to form pathways which then hardened to create walkable surfaces.

Involving the community in the project created an opportunity for training. The construction industry in Burkina Faso currently lacks skilled labor and implementing new building techniques created a new market for the recently trained crew members. The German non-profit Grünhelme oversaw the construction of the clinic and reached out to neighboring villages to ask for assistance. In response about 80 individuals from five neighboring villages participated. Workers were paid adequately for their work and received training in carpentry, metalwork and bricklaying. Upon completion the construction crew received a letter of completion. The certificate verified their knowledge and acts as a recommendation to future employers. Kêré believes in having community members build their own infrastructure such that they can take ownership over their work and likewise replicate their skills.

Due to the continued loss of indigenous architectural traditions Francis Kéré often times creates 1:1 mock ups on site to experiment with new building techniques and material. The opportunity allows local populations to be trained and equipped with new construction skills and allows the community to witness and be informed about the benefits of new building methodologies. Kéré Architecture's methodology is a reflection of their commitment to architecture that is reflective of its context for the benefit of local populations.

Photograph: *Courtyard*

LOCAL INPUT

Local input incorporates community members in decision making processes concerning design and construction.

Photograph: *Community Workshop*

EXAMPLE

Esperanza Series is a project series completed in Puerto Cabuyal in the Manabi Province of Ecuador by architect Al Borde; it includes three building projects: The Nueva Esperanza; a school, Esperanza Dos; an addition to the school, and La Ultima Esperanza (Last Hope); an additional building. The design and construction of the buildings were a reflection of project location. The community of 150 people is located along the Ecuadoran coast 30 kilometers from other populations.

The Cabuyal community is untraditional in the sense that bartering remains the main source of exchange. Due to limited financial resources the first two buildings were constructed with budget constraints of $200-$700 per building. Al Borde was able to keep the budget low by utilizing local natural resources and volunteers for the construction process. The budget also meant the architect had to relinquish conventional construction methods and develop plans that could be implemented by unskilled labor.

Photograph: *Esperanza Dos*

Location: *Puerto Cabuyal, Manabi Province, Ecuador*

Website: *albordearq.com*

EXAMPLE CONTINUED...

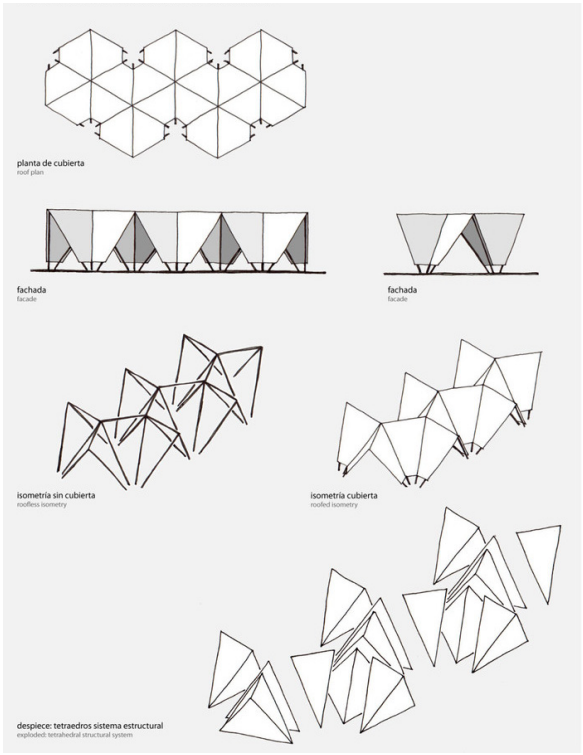
In response to the constraints of the design the building utilized traditional building practices- materials and techniques- but altered the construction methodology. A versatile design that could be modified for communal need. Esperanza Dos is a series of tripod modules formed with laced wooden poles. When the modules are connected the structure becomes structurally reinforced. Split bamboo lath was nailed over the triangular forms and assist in structural stability and the support of the thatch roof.

Rather than traditional construction documents the architecture firm used physical models to convey building strategies to construction volunteers. The construction process was fluid and organic. There was no set time frame for project completion but was completed efficiently due to commitment. The community volunteers organized themselves in the construction process, and as individuals succeed in a task, they began to train others.

After project completion of Esperanza Dos the building began to be manipulated by the community to accommodate need. New surrounding buildings also began to mimic the construction methods of Al Borde's designs. The architecture firm realized the opportunity for community members to be their own designers such that when the community invited the firm back to design public amenities, the firm decided to train the community in the design process.

In the final project Al Borde led community workshops for the design of the La Ultima Esperanza, or Last Hope. The courses were a series of monthly four-day design workshops which were attended by 16 individuals ranging in ages from 14-72. Instruction was catered to participant abilities. The result of the workshop highlighted community awareness of locality and assistance was only needed in design guidance. Due to the remoteness of the Cubuyal people strategies and designs were locally inspired without outside influence.

While the first two projects by Al Borde were designed by the architects, all projects accepted community input. Even the initial two structures remained relatively open ended in the construction process to include community resolution. The projects allowed community members to be their own designers and create buildings and systems that reflect their culture and context. While architects can strive to implement the same strategies. Residents remain the most knowledgeable of context.



Photograph: *(Above) Interior*

Photograph: *(Left) Construction Methodology*

LOCAL TRADE

Local trade involves local products produced and sold. The term can refer to existing models or identifying opportunities for new trade potential.

Photograph: *Metal worker*

EXAMPLE

After the 2010 earthquake in Haiti that destroyed the regions tuberculosis hospital, Dr. Jean Pape reached out to architectural firm Mass Design Group to design a new facility. However, after a cholera epidemic broke out following the natural disaster plans changed and the need for a permanent facility to treat cholera patients was issued. Prior to the new facility patients were being treated in tents, and the lack of sanitation continued to spread the disease.

In partnership with Les Centres GHESKIO, Mass Design Group designed a 7,500 square foot facility which treats the regions 60,000 people. The facility is able to treat 100 patients at a time which includes thirty-five mild cases and sixty-five severe cases. The building was created using compressed stabilized earth blocks (CSEBs)[1]. The remainder of the materials were fabricated in-house or locally sourced. The use of the block allows CO2 emissions to be cut in half compared to traditional concrete-based construction. The process also creates jobs because 10-12 men are required to operate the mechanical press to make the blocks.

Photograph: *GHESKIO Cholera Treatment Center*

Location: *Port-au-Prince, Haiti*

Website: *massdesigngroup.org*

16 "GHESKIO Cholera Treatment Center -." n.d. World-Architects. Accessed May 29, 2019. https://www.world-architects.com/en/architecture-news/reviews/gheskio-cholera-treatment-center.

EXAMPLE CONTINUED...

Local construction workers were used in the building process. The building structure uses reinforced concrete and a steel structure to create an earthquake proof facility with an additional 3 foot above-grade slab to mitigate flooding. The elevated slab also accommodates the cistern placed under the building to collect rainwater from the gutter and roof. The water is treated on site and is then used for nursing and cleaning. To avoid ground contamination the cistern only punctures the ground by 6 inches. The system was developed by California-based Fall Creek Engineering to develop a wastewater decontamination system, unlike a traditional 3 chamber anaerobic biodigester the GHESKIO system uses four. Annually the system treats up to 250,000 gallons of wastewater.

Local craftsmen were incorporated on this project as well construction crews. In the case of the perforated façade Mass Design Group created the design and had metal sheets digitally plotted. Local craftsmen then took the sheet and used the template to create the punctured opens. The design aids in the building natural daylighting and ventilation.

Photograph above: *Aerial photo of hospital*

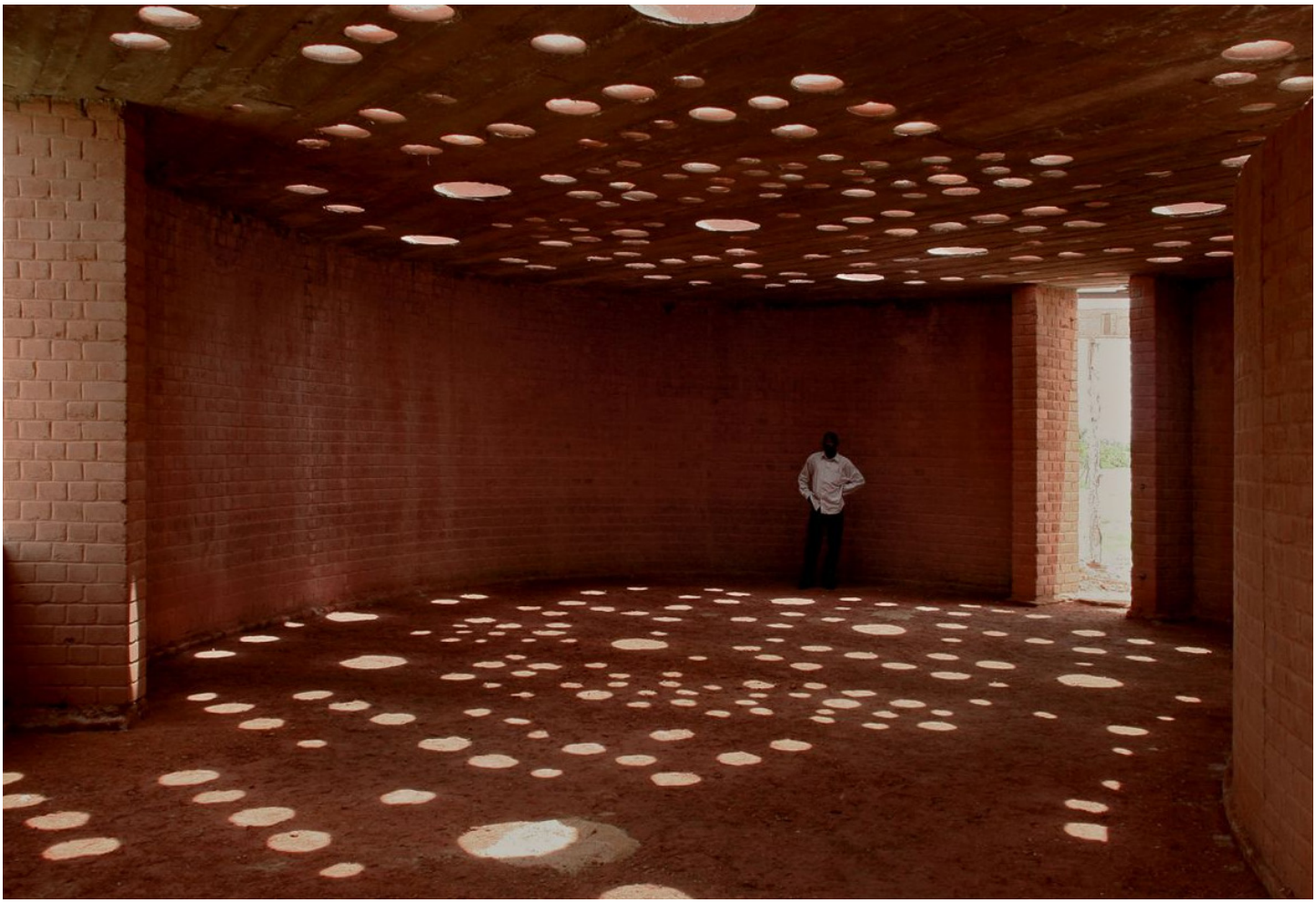
Photograph left: *Interior of hospital*

REGIONAL HANDICRAFT

Regional handicraft includes local artisanal craft and/or products. In terms of building material it refers to viewing untraditional building practices (artisanal craft) as potential application to the design and construction process.

Looking for unique ways to add to projects has the potential to reflect and promote regional culture and traditions.

Photograph: *Women in Rwanda with pottery for building project*



EXAMPLE

The library was built after the construction of the Gando Primary School. Due to the success of the primary school- which resulted in an influx of students, an extension and library were made possible. The library acts as a connection between the initial school and extension providing protection from dusty exterior conditions. The library not only acts as a resource for the school but for the surrounding community.

The layout of the building is elliptical which offsets the layout from the neighboring rectilinear buildings. The walls are made of compressed earth block which utilized local clay. The design references traditional building types amongst the villages. Like all of Kere's international projects he employed the local population for construction.

The ceiling of the library incorporates locally made clay pots. Clay pottery is a regional handicraft of the region and adding this component to the building supported local artisans. The pots were cut in half and placed in the ceiling as light shafts and passive ventilation. A corrugated metal roof sits atop the ceiling to protect from sun and rain. As the metal roofs is heated by the sun the stack effect is created and cool air is pulled through the windows of the building and out the ceilings openings creating a passive cooling system.

Photograph: *Gando School Library*

Location: *Gando, Burkina Faso, Africa*

Website: *kere-architecture.com*

EXAMPLE CONTINUED...

An additional feature is the use of eucalyptus. Eucalyptus is typically viewed as a weed in the country and used for firewood since it dries out the soil and doesn't provide any sun protection. But the plant works well as a building material. The plant is able to be manipulated and in the case of the Gando School creates alcoves to protect individuals from the sun.

Photograph: *Profile of Library*

Photograph: *roof construction*

GENDER EQUALITY

While gender equality is practiced and promoted in western cultures, there are regions of the world where occupational gender separation is socially acceptable by both parties. Gender equality- in the construction processes- should be evaluated on an indivual project basis. In cases where women are unable to participate in construction finding ways to integrate them in to the design process should be sought out.

"I will stay a mason, it got stuck in me.
What made me continue to like it is it dignified me"

Photograph: *Anne Marie Nyiranshimiyimana (Kankwanzi)*

EXAMPLE

The Butaro District Hospital was the first project completed by Mass Design Group. The four Harvard graduates lived on site for months at a time to develop the site through trial and error. As Alan Ricks noted the term 'architect' did not even exist at the time and no one was specifically using design to address healthcare. The graduates had to prove to the local community, through design interventions, how design could improve staff experience- resulting in longer retention rates, improve health outcomes, reduce infection rates, and improve recovery times by having views to nature, and improve patient retention. Similarly, the team had to demonstrate how the project could be affordably built and benefit the community through developing equitable building processes.

After researching and examining the availability of local resources building practices included volcanic rock. Traditionally not used due to lack of trained stonemasons. Mass Design Group hired local craftsmen to experiment with the rock to configure a functional wall. Craftsmen were also employed to use local wood to construct windows frames, doors and door frames.

Photograph: *Butaro Hospital Facade*

Location: *Burera District, N. Province, Rwanda*

Website: *massdesigngroup.org*

EXAMPLE CONTINUED...

Landscape features included trees and shrubs to stabilize the hillside and additional seating to promote outdoor leisure and reduce the chance of airborne diseases. Semipermeable surfaces were implemented for a similar reason- to avoid pools of water which breed vector borne diseases.

Mass Design Groups integration of women in construction broke traditional gender roles. Anna-Marie Nyiranshimiyimana, who goes by the name of Kankwanzi- meaning "rising star that refuses to conform to society's expectations", is now a Master Mason thanks to the employment on the site. She detailed her work experience in a personal interview with Mass. Growing up she was told that women do not build and were limited in skills. The opportunity created by Mass enabled her to become a mason and inspired 200 women to join the project . Anna-Marie is now foraging a path for generations of women to come to reach beyond traditional gender roles. Kankwanzi says "[Women] bring great value to construction sites. They are better implementers and more equipped to budget time and resources...hiring [women[supports the whole family"[1].

The result of the Butaro District Hospital gave the regions their first hospital. Prior to the campus there was one doctor for the areas 350,000 inhabitants. Additional benefits led to training and employment of 3,500 people during construction. The stonemason's configuration of the volcanic rock lead to the Cooperative of Technicians and Constructor of Rwinkwavu, which now train workers in community-based construction and are highly sought after in other parts of the country. Likewise, the hospital currently provides training to 1,500 volunteers who offer basic health services on site in rural regions. The establishment of the Butaro Hospital set new standards for hospital buildings in Rwanda.

Due to efforts made by Mass Design Group the field of design for social impact is gaining momentum and their conscientious efforts have produced buildings that integrate into site context. The group is also mindful to assess the impact of their work on social structures; being cautious to avoid creating innovative designs that would override indigenous culture.

17 Latest News | Page 2 of 8," UGHE, accessed May 16, 2019, https://ughe.org/news/.

Photograph: *Butaro Hospital Campus*

However there has been push back from communities within architecture that the groups designs disrupt traditional forms of architecture with western methods. Matika Shiori-Clark responded to similar comments made about the Butaro Hospital saying "placing an entirely un-contextual building in a place like rural Rwanda without thought to the community and its culture is irresponsible. But blindly recreating what is found in a community, even if that model doesn't serve the health and livelihood of its members, is equally irresponsible. We are paralyzed as a field if we are afraid to use our design skills to move beyond the strictly vernacular"[2]. The creation of Mass Design Groups themes are therefore a tool to guide and mitigate western principles with African Vernacular. The group extends their reach with the creation of the African Design Center's, being intentional about training the next generation and instilling a form of self-sufficiency as a continent. Statistically the impact is clear, creating buildings that respond to a vernacular context has created healthier spaces. Incorporating local populations in the process of construction has initial and long-lasting benefits for community members. As the group continually self asses, they continue to appropriately evolve and adapt their human centered design approach.

18 "How to Balance Local Traditions and New Solutions in Public-Interest Design | ArchDaily," accessed February 25, 2019, https://www.archdaily.com/342838/how-to-balance-local-traditions-and-new-solutions-in-public-interest-design.

SITE APPLICATION QUESTIONS: SOCIAL EQUITY

WHAT IS THE LOCAL LABOR OF THE AREA?

EX. MEN / WOMEN / TRAINED / UNTRAINED?

WHAT ARE THE TRADES OF THE AREA?

EX. BOTH MALE + FEMALE TRADES / BUILDING RELATED + NON-BUILDING RELATED

WHAT ARE SOME REGIONAL HANDICRAFTS?

EX. POTTERY

IS GENDER EQUALITY PRACTICE AND/OR ACCEPTED? COULD WOMEN BE INTEGRATED INTO CFC PROJECT?

LOCATION: **DATE:**

NOTES:

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FIGURES

Order of packet:

Togo Africa. Credit: Carolyn McGunagle
Togo Mud Building. Credit: Zoe Rain
Togo Africa. Credit: Carolyn McGunagle
BASE Housing. Source: BASE (base-builds.com)
Diagrams. Source: MADE IN earth (madeinearth.in)
Rubble Trench Foundation Diagram. Credit: Carolyn McGunagle
Gohar Khatoon Girls School Photographs. Source: Elizabeth Golden (elizabethgolden.space)
Laterite + Thatch. Source: google images
Togo Mud Building. Credit: Zoe Rain
Thatch Diagram: Source: google images
Thatch Photograph: thatchinginfo.com
Togolese Children. Credit: Zoe Rain
Opera Village. Source: Kere Architecture
Community Workshop. Source: Architizer
Esperanza Dos. Credit. Sebastian Melo
Interior. Credit: Andrea Vargas
Construction Methods. Source: Al Borde
GHESKIO Cholera Treatment Center. Source: Mass Design Group
Gando School Library. Source: Kere Architecture
Butaro Hospital. Credit: Iwan Baan
Anne Marie: Source: University of Health Equity

Icons. Source: Noun Project