DUAL CITY

INTERNALLY DISPLACED PERSONS (IDP) SETTLEMENT DESIGN PROPOSAL (A RESILIENT DESIGN STRATEGY TO COMBAT FLOOD)

8th ICBR Lisbon | Nov 2018
Building 4Humanity DESIGN COMPETITION
Category 3: Resilient Projects (Student Teams)
Team Members: Chilaka Daphne; Nelson Sonia; Nnatuanya Chigozie; Oti Obinna, Udezi Benjamin
Supervisor: Arc. Tunde Sholanke
University/School: Covenant University, Nigeria
Project Location: Girei, Adamawa State, Nigeria
Team Code: B4H-DC3124

Social conflict occurs abruptly and unexpectedly in Nigeria, thereby displacing people and leaving them without a home for as long as it takes to provide a suitable shelter over their heads.
As previously stated, Girei is prone to flooding from the Lagdo Dam in Cameroon, which has been the cause of one of the most devastating floods Nigeria has ever experienced, claiming over 2000 lives and destroying properties worth millions of naira, both in 2012 and 2015.

The design presents a solution through SOCIAL RESILIENCE AND PHYSICAL RESILIENCE

Round XXI Figures

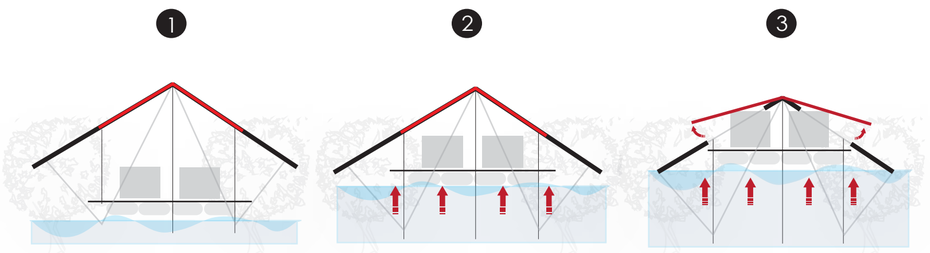
- 1,782,490 Displaced individuals
- 339,037 Displaced households
- 28% of the IDP population are children under 5 years
- 79% of the IDP population are women and children
- 1,386,229 Returnee individuals
- 230,366 Returnee households
- 46% of the IDP population are male
- 54% of the IDP population are female

SOCIAL RESILIENCE

Resilience speaks of a reconfiguration of identity, of innovations in the nucleus of a 'self', who can be an individual or a collective subject, even both at the same time, always considering its social nature." – Serena Oswald, 2016 .Our design enables social resilience in two aspects; It enables them develop preventive strategies against what displaced them, by participating in the building of the camps. While also taking into consideration their present challenges such as sexual harassment and threats and tries to remedy them through design and It integrates their culture into the residences provided for them, which in turn fosters societal robustness within the camp.

PHYSICAL RESILIENCE

Unfortunately for the victims, some areas designated for the settlements are prone to flooding, thereby creating a need for resilient design solutions that can withstand the flood as well as other possible perceived threats.
Besides the use of sustainable materials, the design utilises it's problem and betters itself by adapting into a new design. The building utilises floatation theory and allows the flood to push the floor platform vertically upwards thereby trigerring the roof dormers and creating a new design entirely.
Presently, the highest recorded flood level in Adamawa is 3m, while the average flood level is1.5m.

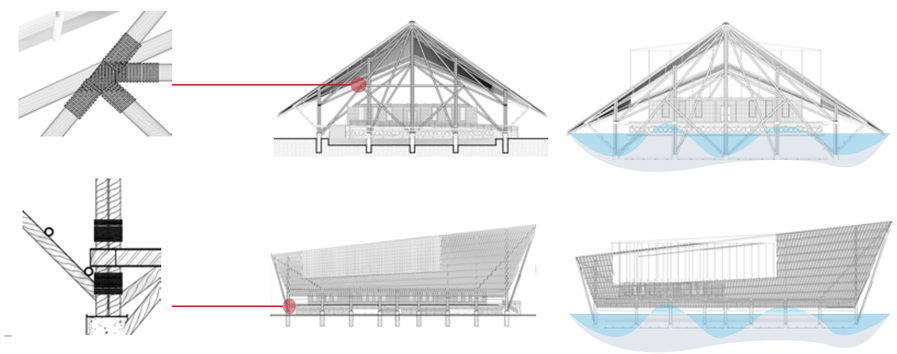


1. In order to utilise the flood to produce a better design, the structure allows the flood to push the platform vertically upwards. It does this through the use plastic barrels as the predominant substructure, because it cannot be immeresed in water and so must fully stay afloat, therefore continously pushing the platform above it .
2. The platform is pushed vertically upwards along the columns with the buildings on it. The various typologies are gradually pushed to the level of the roof.
3. The buildings while in continous movement begin to push the roof, thereby triggering the roof dormers to open until they reach their maximum height, thereby creating a new design and establishing a new relationship between the people and their once percieved problem . the design restores natures true identity while enhancing that of the people.

TOTAL AREA; 419,685,988 **BUILT AREA**; 27%

PLATFORM SCHEMATICS

In order to acheive the floatation theory for physical resilience, we still attempted to acheive social resilience by creating a platform to resonate with something they are used to; the *bukaru*, which is a native term for grasshouse. The design is made of locally sourced materials comprising of a canopy, a platform and partitions. The design schematics was carried out to acheive the dynamic structure.



INCREMENTALITY

In order to acheive easy expansion of each building layout , the typologies are designed to easily add spaces and remove spaces without comprimising primary finctionality

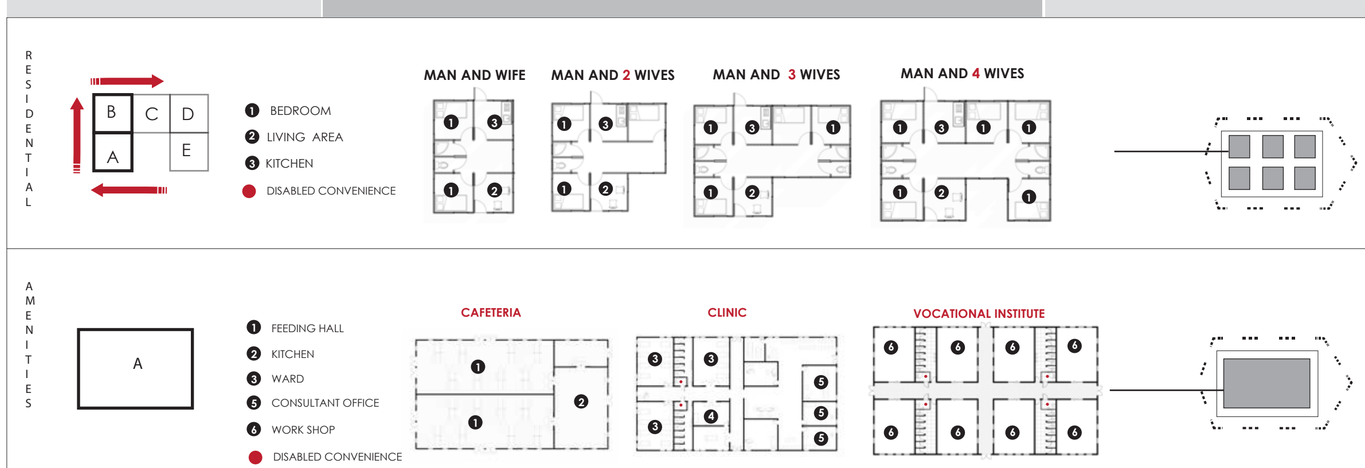
DESIGN LAYOUT

Each typology was designed to enable a safe place for the displaced people to live regular lives while maintaining their identity and their way of life.
Family house: This is the residency facility for displaced people that have a family. In order to maintain family bond, these typologies are provided with the modularity concept and with consideration to the Fulani culture of polygamy.
Clinic: Usually displaced persons come with an illness or injuries, this is due to the fact that they are displaced as a result of social conflict thus the need for a clinic on the site.
Vocational insttitute: This provides a centre for the people to develop themselves in the trades peculiar to the geographical region, which include; basket weaving, clay works amongst others.
Cafeteria: This is an eating facility to be run by the administrators of the settlement. It would provide food for the elderly people as well as the children in the dormitories.
Dormitories: This provides residency for the elderly people and children displaced without their families. These are grouped into the male and female, placed at different parts of the site.

LAYOUT ON PLATFORM

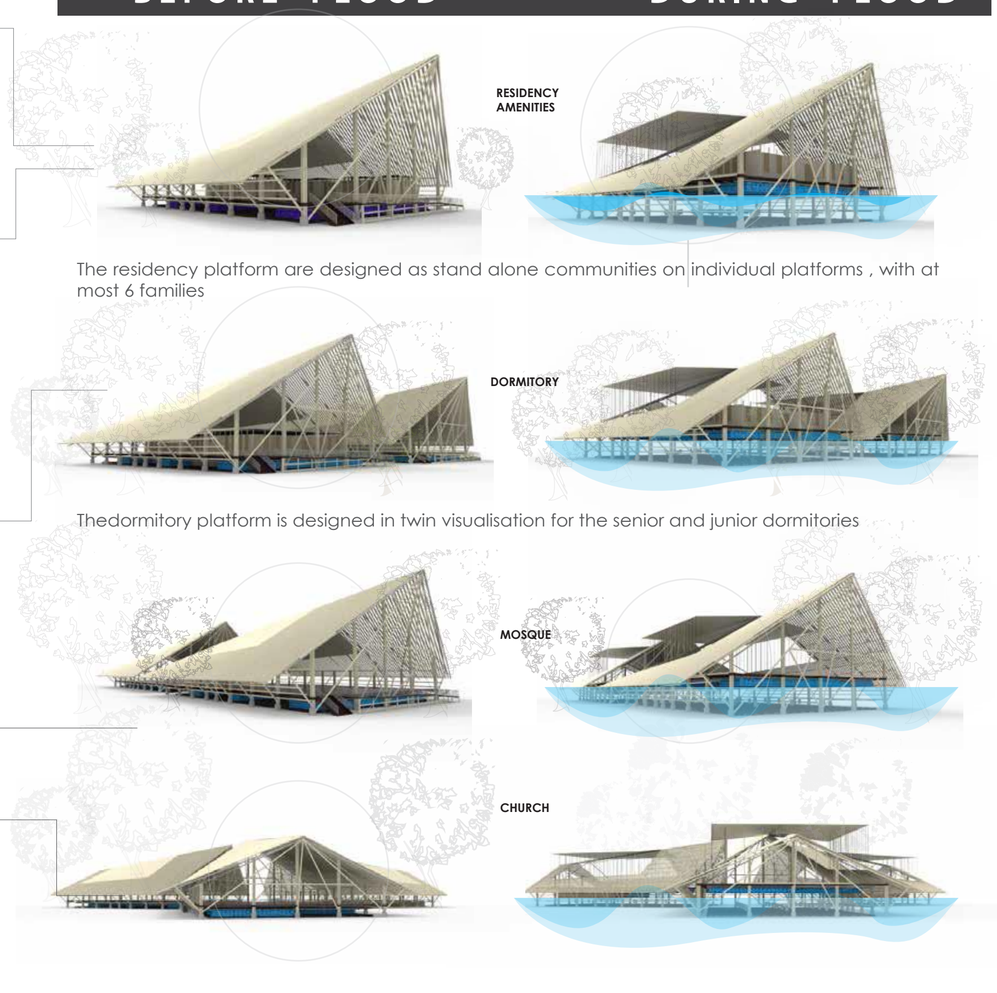
The platform is the base of all building typologies. It is influenced directly by the buoyant foundation of the amphibious structure. It is the only member that moves vertically upwards along the steel and bamboo supports, with the capacity to return to its original position after the flood.

The platform is modular and can be arranged to differentiate between typologies. Canoes can also be anchored to the platforms to aid movement between platform during the flood.



BUILDING SITUATION

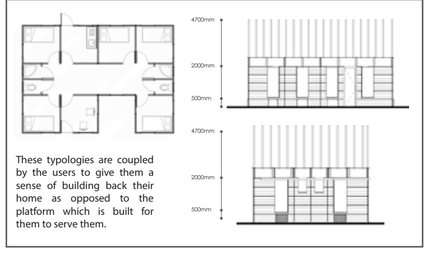
BEFORE FLOOD DURING FLOOD



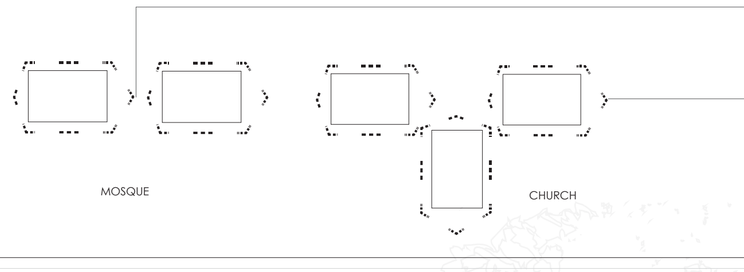
The residency platform are designed as stand alone communities on individual platforms , with at most 6 families

Thedormitory platform is designed in twin visualisation for the senior and junior dormitories

TYPOLOGY SCHEMATICS



These typologies are coupled by the users to give them a sense of building back their home as opposed to the platform which is built for them to serve them.

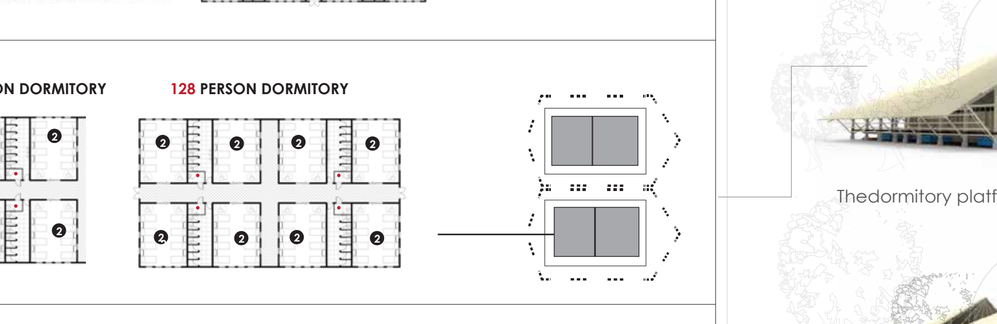


BUILDING FINISHES

FINISHES creates an understanding of spatial context in the view of physically challenged people especially the blind, to allow easy navigation.

	WALL	FLOOR	CEILING
BEDROOMS	50mm diameter bamboo wall system held in place by U- shaped hardwood floor bracing.	Timber floor system laid on tarpaulin (Damp Proof Membrane), supported by 50mm by 75mm floor joists, without raffia mat.	Woven rafia mat ceiling system inserted in support poles.
BATHROOMS	50mm diameter bamboo wall system held together by U-shaped hardwood floor bracing.	10mm woven rafia mat laid on timber floor system encased with tarpaulin (DPM), supported by 50mm by	Woven rafia mat ceiling system inserted in support poles.
LIVING AREA	Scratched 50mm diameter bamboo wall system held in place by U-shaped hardwood floor bracing.	30mm woven rafia mat laid on timber floor system encased with tarpaulin (DPM), supported by 50 by 75 floor joists	Woven rafia mat ceiling system inserted in support poles.

BUILDING SERVICES



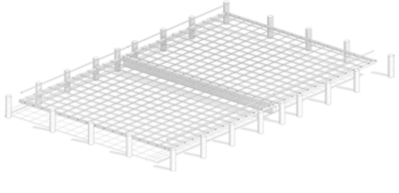
HUMUS TOILET
A humus toilet is used to help manage human waste and recycle it for other uses, the toilet can be used up to 10 times before disposal and saw dust is added to catalyze decomposition.

LOCAL AIR CONDITIONER
The air conditioner is made up of a crate filled with plastic bottles, which are chopped open at both ends to change the temperature of the air as it passes through two different diameters. This is designed to mitigate the thermal discomfort associated with the high tepmperature of the geographical region. The air from outside is cooled as it enters into the building through this crate.

BUILDING COMPONENTS

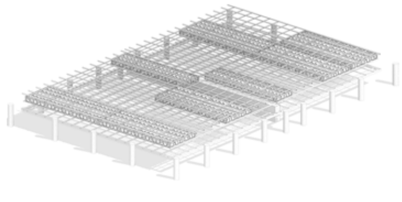
STEP BY STEP BUILDING DESIGN

Steel pegs are hammered into the dry sand along the perimeter of the proposed platform. This is done to establish skin friction between the sand and the steel to form the primary support for the platform. Bamboo poles are then attached to the steel pegs.



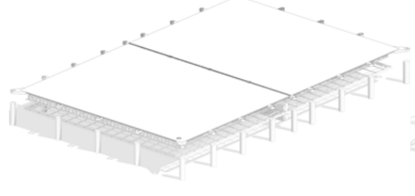
1

In order to create an easy base for the floatation mechnism, a grid bamboo system is created which allows the water to pass through the spaces and interact with the plastic barrels to float the platform. The grid system is made by tying horizontal and vertical bamboo sticks together at stipulated intervals. The barrels are then laid within the boundaries of the grid.



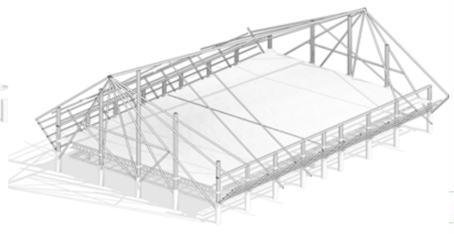
2

The damp proof membrane (monolithic tarpaulin), is used to encase the plywood in order to protect the water from harming the base. The plywood floor system is then attached to the bamboo poles with the aid of 5mm steel brackets.



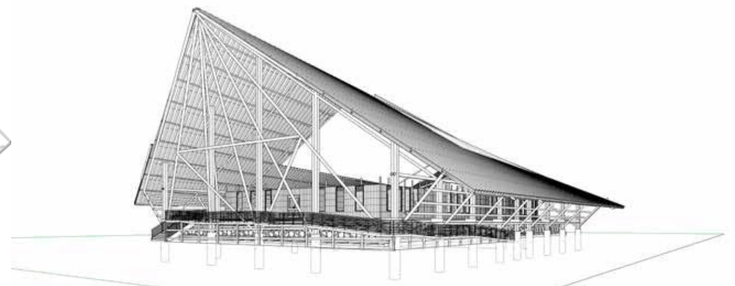
3

The 100mm bamboo rafters are tied together to form the shape of the platform and emulate the design concept. Then sandbags are laid on top of the rafters tc provide an impervious membrane to moisture.



4

Finally, the roof is made by interlocking bamboo poles cut in half. After which it is attached to the previously pegged bamboo posts/columns and rafters.



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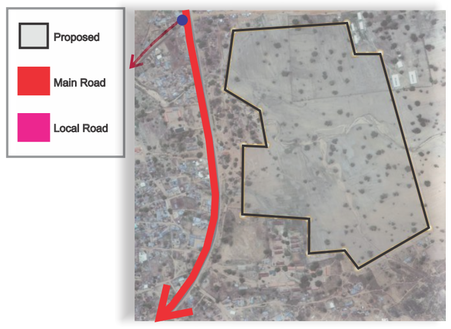
Project Location: *Girei, Adamawa State, Nigeria*
Team Code: **B4H-DC3124**

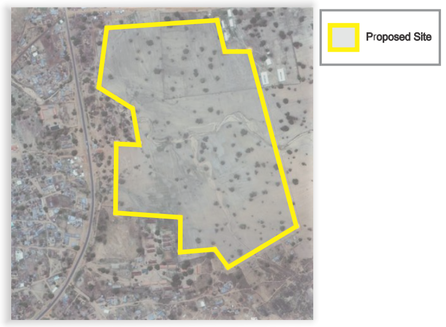
SITE AND LOCATION

The site is located in Girei, which is a town and local government area of Adamawa state, Nigeria. The dominant tribe in the area are the Fulibe or Fulani tribe.



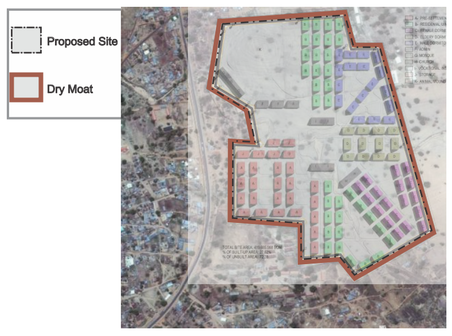
ACCESSIBILITY PLAN

The proposed site is bound by a major road, known as the Numan road. The IDP settlement will be accessed through this road.



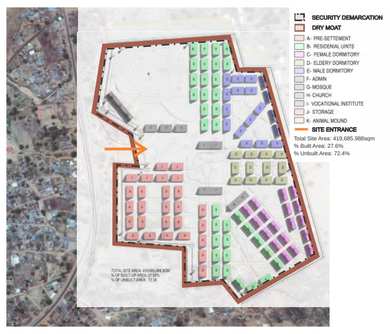
SITE CONDITION

The proposed sit is relatively flat as ust one contour line cuts across the site. The site is sparsely covered with vegation.



WATER DRAINAGE

A trench, also known as a dry moat will be dug around the boundary of the site at a slope to aid in site drainage in times of flood. The excavated sand will then be used to build the cow mound for the protection of the cows in times of flood. The water in the moat will also be channeled for irrigation of the cow grazing area. The dug out trench will also provide additional protection to the site.



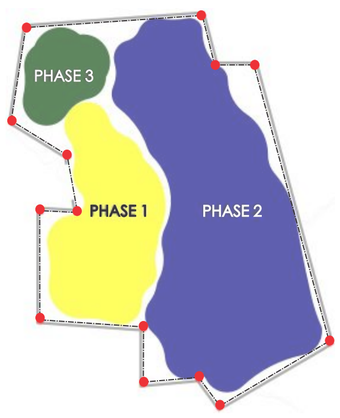
SITE CONCEPT

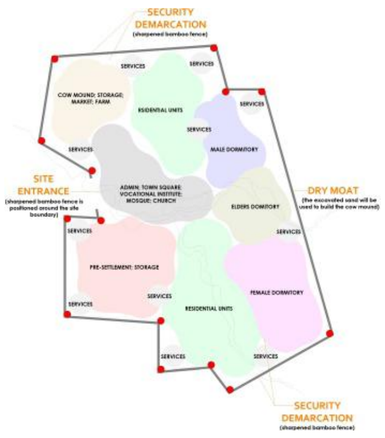
The site was planned such that the elderly dormitories and the residential units sort of surround the female dormitories thereby protecting them from external danger due to the high rate of rape by the soldiers in the present camps. The boundry of the site is surrounded by a fence made of sharpened bamboo poles, held together for additional security. The site layout is divided into four parts namely; Administrative, Pre-settlement, residential and food area.

MODULARITY

The design was done to align with the cultural, traditional and religious norms and values of the region selected.

SITE PHASE DEVELOPMENT





PHASE 1

The administration and Pre- settlement facilities will be built first because they are the immediat needs of the internally displaced persons.

PHASE 2

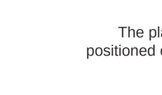
The residential units which comprises of the incremental bedroom units; junior dormitories(age 3 months - 10 years); senior dormitories (11 -25 years); elderly dormitories (singles >26 years, widows and widowers) will be built at this phase. Female dormitories are secured to prevent female children and youth assault.

PHASE 3

Support facilities such as the vocational centre, classrooms, clinic and cafeteria would be constructed at this stage.

ADAPTABLE PLATFORM LAYOUT

Mosque | Cafeteria/Clinic | Family units

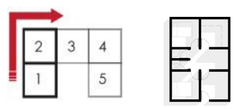


The platform upon which the buildings are positioned can adapt to suit various functions on the settlement.

Church | Elders Dormitory | Dormitories

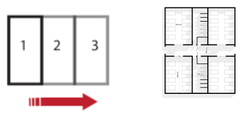
INCREMENTAL FLOOR PLAN LAYOUT

Typical layout of family units



The floor plan layout of the bedroom units increases in a clockwise direction with the addition of more rooms. The addition of more rooms is due to the polygamous nature of the *Fulani's*.

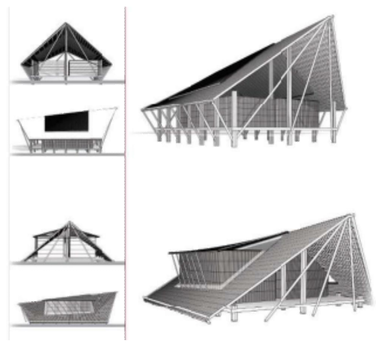
Typical layout of dormitory



The dormitory layout and support facilities such as the vocational institute and classrooms have a typical floor layout which is developed in phases 64 person (phase 1) and 128 person (phase 2).

INNOVATIVE DESIGN

BUKARU CONCEPT

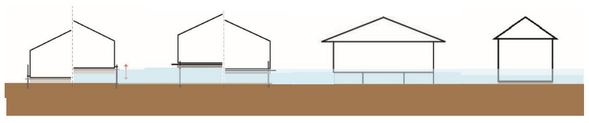


The design concept was inspired by the *fulani* native term for their home known as *bukaru*, which means grass house. It is practicalised to help them appreciate their culture and to help lessen the pain of being displaced by providing a structure for the that strongly resembles their home.

AMPHIBIOUS STRUCTURES

Amphibious structures utilise a form of floating foundation that allows the building to be built on land but it is able to move vertically upwards when affected by flood.

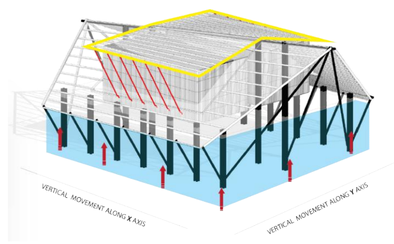
This structure is able to lift the building through the use of buoyancy blocks or any similar material such as plastic barrels, below the building. These are then connected to the sub-frame and guideposts are installed at intervals to keep the building in place along the horizontal axis while simultaneously allowing it to lift during the flood and settle vertically after the flood.



Amphibious Structure | Floating Structure | Elevated on piles | Normal Structure

ROOF DORMER

The type of roof dormer used is called a shed dormer. It is sloped in the same direction as the principal roof and at the same angle. The roof dormer is triggered as the platform moves vertically upward and comes in contact with it.



HUMUS TOILET

The humus toilet would be employed in the design. The toilet comprises of a manuallly constructed platform with a removeable compartment for disposing the waste.It utilises sawdust, ash or soil to aid decomposition. It is an ingenious way of ensuring that in time of flood, human activities can still be maintained. Also, the waste material turns to gardening soil after about a month.

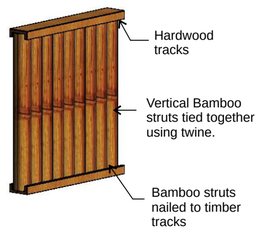
ECO-COOLER

This is the system used to cool the building, due to high temperature of the geographical region of Girei. The thermodynamics principle used here is called the Joule - Thomson Effect and the process is known as throttling. It uses plastic bottles with different diametres as means to reduce indoor temperature. This occurs because ss hot air rushes into the larger diameter of the plasticbottles, it comes out through the bottleneck with a higher pressure and improves the thermal - comfort of the people. From research, this method drops indoor temperature 10 degrees.

MATERIALS

BAMBOO

Bamboo is the main construction material and would be used for the construction of the walls, roof, structural posts and supports.100mm Gadua bamboo would be used due to its peculiar strength and availabilty in Nigeria.



Roof arrangement of bamboo

A readily available waterproof membrane, such as used cement or sand bags would be placed under the roof arrangement to prevent water seepage from rainfall.

WHY BAMBOO?

- Bamboo is light in weight.
- It can be readily found locally in Nigeria
- It is a renewable material as it takes only 4 years to mature and can last for up to 30 years.
- It is quite durable.
- It is easy to use with manual tools.
- it does not require external finishes.

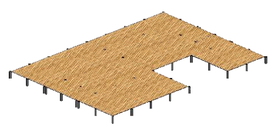
PLASTIC BARRELS

Plastic barrels are used as the buoyancy blocks that enable the building to float when it interacts with water. They are positioned beneath the floor of the building, and are held in place with timber members. They are also readily available in Nigeria.

RAFFIA

Raffia is a fiber obtained from the leaves of the raffia palm, used for tying plants and other objects and for making mats, baskets, hats, and the like. Woven raffia is used for the doors, windows and ceiling of the buildings. It was selected because it is lightweight, locally sourced and locally made in the region.

woven raffia sliding window



woven raffia ceiling

HARDWOOD

Hardwood planks are used for the floor of the platform, which are then enclosed with an impermeble material such as a large monolithic piece of tarpaulin to prevent water seepage which may cause the wood to decay over time.
Hardwood floor was selected because of it's lightweight, ease and speed of construction.

Process of constructing timber flooring

INDIGENOUS DESIGN

CONTEXT

The design was done to align with the cultural, traditional and religious norms and values of the region selected.

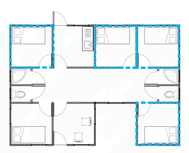
THE FULANI TRIBE

The main tribe which can be found in Adamawa state is he *Fulani* tribe. The *Fulani's* have various aspects of their tribe which are paramount to them.
CULTURE: The attitudes and behaviours that are characteristic to them, such as the *Ba-shiga*, regular gatherings and meetings hence the proviion of the town square.
TRADITION: These are long standing specific practices of the people eg, early marriage, polygamy and certain hygiene rules.
RELIGION: The spritual practices and beliefs that are unique to a people. They are predominantly muslims.

SITE PLANNING

TOWN SQUARE: The Fulani culture encourages communal living among the tribe. The design incorprated this aspect of their culture by including a town square area for town gatherings and meetings .
COW-GRAZING AREA: One of the major traditions distinct to the fulani's is the rearing and hearding of cows. This aspect of their culture was included in the settlement by providing a grazing area for their cattles and cows .
MOSQUE AND CHURCH: An incremental mosque facing Mecca (North) was provided for this purpose, but for the minority, a church was also provided and situated away from the mosque.
BA-SHIGA (No entry): The culture of the Fulanis dictates that there should be a separation between the male areas and female areas. this was incorporated in the settlement planning, by locating the female residences far away from the male residences .

PLANNING THE FAMILY UNITS

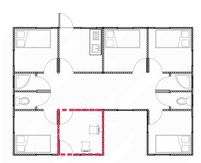


POLYGAMOUS

The *Fulani* culture encourages the men marrying more than 1 wife. The bedroom units can easily adapt to the instance of the displaced persons having more than 1 wife.

HYGIENE

The *Fulani* tradition frowns on the location of the toilet and shower in the same space. The design ensured that these two spaces were properly segregated.



BA - SHIGA (No entry)

The culture of the *Fulani's* involve the women being placed in a secluded area, with the main entry to the space being through the mens area, thereby protecting the women from any assault .