Primary Focus

Breck Small
PRIMARY FOCUS

DESIGNING A NEW METHOD OF ADAPTABLE CONSTRUCTION
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DESIGNING A NEW METHOD OF ADAPTABLE CONSTRUCTION

Request for approval of thesis research project is presented to:

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Thesis proposal is presented to the faculty of the Department of Architecture, College of Architecture and Construction Management by

BRECK SMALL

In partial fulfillment of the requirements for the degree of

BACHELOR OF ARCHITECTURE

Kennesaw State University
Marietta, Georgia

May 1, 2023
DEDICATION

I would like to dedicate this thesis to all those who have helped, supported, and encouraged throughout the duration of my architecture degree.

To my classmates and travel companions, thank you for making the long hours in studio some of my dearest memories. I look forward to our next adventure.

To my parents, Beth and Corey Small. You supported me in more ways than I can count. Thank you for raising me the way you did and for becoming more than parents but friends to me.

Lastly, I would like to thank my church for their continued support, community, and prayers.

ACKNOWLEDGMENT

This project would not be possible without the advisement of Giovanni Loreto. Your insight was invaluable. Thank you for continually pushing me to be my best and expecting the highest quality of work.

I would also like to acknowledge Liz Martin. You are fast to encourage and eager to call your students into more. Thank you for providing opportunities to share my work with other professionals.

To the rest of the faculty, I would not have made it here without you.
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Ugandan architecture exposes a large gap between modern building technology and preserving traditional building methods and materials. This opens up the opportunity to research and implement new building strategies and methods to enhance the building's construction and establishing a new precedent for future projects in the area.
Christina Martinez first visited Uganda’s capital city of Kampala in the early two-thousands. She was there to visit a friend who returned home to Uganda after completing school in the U.S. While here, Christina was shocked to see a city with dirt roads lined with concrete buildings that had only a fraction of the windows that she was accustomed to in Atlanta. People crowded the streets during the day begging for money as cars passed by with the rare hand out. All this didn’t seem to phase her friend as she had grown to find all of this normal.

They stayed in a small village outside the city limits. The town was composed of mostly residential structures with civic buildings scattered throughout the small single family homes. The closest school was miles away in the neighboring village, leaving the children with little access to a formal education. But all this did not compare to the shock of the high volume of children that had been orphaned in the area due to political unrest, migration of people into the city in search of employment, and the high volume of unplanned pregnancies. Many of these children are left with little to no support from government aid. Few adults in the region have been trained in vernacular construction techniques which leaves a large gap that could be filled by an architectural understanding.

In the years that followed her initial visit, Christina funded the construction of a small orphanage that would soon be home to twenty-three people ranging from infant to eighteen years old. While her hope was to give this kids an opportunity for a brighter future, she has found that without access to a primary education, her sphere of influence is small compared to the need outside the main city center. Much of the architecture remains primitive in its design, material use, and construction. The main challenges to consider when seeking to create a new construction is the cost of construction materials and the transportation or access to the site. Many of the new construction builds use materials that are cheap but may not be the most appropriate for the climate or program needs. The need for architecture that is sensitive to the needs of the users while being smart enough to respond to the needs of the climate grows with the increased number of minors in these rural towns. This led to the question - can we design for the people of rural communities in a way that utilizes available materials, integrates the use of passive systems, engages the user to be trained in new techniques while the building is under construction, all while being respectful to the surrounding community?

This thesis proposes a new construction method that looks beyond the physical needs of a community to train and equip unskilled laborers to continue expanding their own build environment. In areas where electricity along with running water are sparse and construction materials are expensive in contrast to average income, this method of construction will look at the manipulation of indigenous materials, climate, and passive systems to design a project that is both respectful to the surrounding community and innovative in its final design. This method could be realized in cities with similar context, training unskilled laborers to build structures in a way that benefits the community as whole and maintains the integrity of the people inhabiting the space.

This work will look at the needs of a small Ugandan community outside the city of Kampala, Uganda. Due to the political climate of the nation, many people travel to larger cities seeking employment, leaving many children in the care of others or alone. The testing ground for this method will be a primary school and housing courters for the children who have been orphaned in the area and surrounding communities. Applying this method to two separate programmatic typologies will produce challenges that will test the feasibility of the construct and allow it to morph to the needs of other program types.

The goal is to shift the focus away from providing monetary solutions and instead direct our focus to building a structural system that teaches as it is being built. Leaving behind both a completed structure, but more importantly, the tools needed to continue developing their own build environment. Although the method may look different in contrasting climates, the primary focus remains the same.
Statistics produced by the Trading Economics, Africa Database, reveals that more than thirty percent of primary school-age children do not enter the education system at the intended time. This percentage of students grows the more rural the settlement is, this can be linked to less government funding provided schools in these remote areas; the migration of working adults leaving children to be self-reliant lowers the incentive for an education, or the simple lack of infrastructure. The unique education situation accompanied by the increasing need for housing to support students and young families, creates an architectural gap that currently does not a definite solution.

This thesis works to study the needs of villages outside the city limits of Kampala. The research consists of indigenous material study and the study of traditional building technique to create a construction method that can achieve the goals established in the thesis abstract. There are five major design consideration that help establish the framework for the proposed research. These elements will act as guardrails when researching successful precedents studies, climatic, and site selection.
METHOD OF RESEARCH

The design-build construction model proves beneficial for projects that do not have access to the traditional resources. In addition, the research and design of the project can be achieved through exploration of materials along conventional research methods.
Design-build refers to a method that produces a project in which the design and the construction of the project are completed by the same group, person, or company. This process removes several phases from the traditional owner-designer-contractor relationship such as bidding and integrating cost estimation into the initial design phase. This restructuring reduces the time spent between project phases and the overall cost.

Along with lowering the cost of the project, design-build projects offer benefits to both the owner and the designer/contractor that surpasses that of traditional building methods. The owner often has more say in the initial design project, while the contractor is able to directly speak to the cost and construction of the project as it is still in the design phase. The intent of this structure is to streamline the phases of an architectural project by engaging all the participants at the same time, which often leads to projects that are smaller in square-footage and have a smaller amount of sub-contractors. This method offers solutions to many hurdles that designers encounter with the owner, contractor, and sub-contractor. This raises the question, is there a way to design a new design-build method that further streamlines the process and integrates the user into design/construction of the project?

Research through the exploration of construction devices creates a form-work for other methods to be explored based on the success of the existing methods. These devices or rather the factors that influence the devices are studied by its material properties and use of vernacular techniques. The cultural context, programmatic needs, and labor are of equal value as they refer to the social conditions in which these projects exist. This understanding comes from the research of current projects and historical references.

This two areas of exploration will work in tandem to understand the needs of the users and to create a new design construction that can be replicated through the same process of understanding these two main design factors.

**SECTION 2.1**

**RESEARCH THROUGH DESIGN**

Developing a new method of construction through a design-build approach cannot be achieved without first understanding the conditions in which this method can be explored. Research through the exploration of construction devices creates a form-work for other methods to be explored based on the success of the existing methods. These devices or rather the factors that influence the devices are studied by its material properties and use of vernacular techniques.

The cultural context, programmatic needs, and labor are of equal value as they refer to the social conditions in which these projects exist. This understanding comes from the research of current projects and historical references.

This two areas of exploration will work in tandem to understand the needs of the users and to create a new design construction that can be replicated through the same process of understanding these two main design factors.
HISTORICAL CONTEXT

AREAS OF STUDY | Population

Uganda’s social and political climate has produced cities that operate uniquely to the East African region. Many towns produced data recorded from six countries on the East Coast of Africa shows the spikes in income and cost of living in dense urban cities and the lack of infrastructure in the rural areas that sustain them. The implementation of architectural strategies that are affordable to the native people offers an alternative to the migration of people into the city in order to find employment and housing.

Studying the existing conditions and why people are leaving these small towns creates a foundation of understanding, since these areas are identified, the space for architectural intervention can be filled.
SITE STUDY

CLIMATE

The site region is located in the tropical zone of Africa under the northern desert lands. Uganda, as a whole, has a more temperate, tropical climate with mild winters. Although the temperature is relatively consistent for the majority of the year, there is great potential to design passive systems that can enhance the thermal comfort of the project for maximum amount of time.

Although the temperature of the potential site is, on average, above the thermal comfort zone, the low relative humidity rate does not increase the standing temperate but allows the ground to cool in the afternoons and evenings, this along with the average winds of four miles per hour assists with the heating and cooling of projects in the area.
The migration of people into cities for employment has resulted in many families being separated for extended periods of time. Community leaders and western organization have begun to establish homes for children and teens that no longer have parents in the area, while these homes offer short-term living conditions, it does not offer any permanent solutions.

Living conditions actually have little to do with the school attendance of the children between the ages of seven and fourteen. More than ninety percent of orphaned children in the region attend primary school (Site source). The number of orphaned children attending school reduces when the child reaches adolescent age. This is partly to with the inconsistencies in the living conditions.

The need for education increases as these children enter into their adolescent years. This creates need for educational facilities along with housing. The programmatic qualities of both housing and education typologies differ in square footages, egress, and passive system implementation; these qualities influence the site strategies of the project along with the construction approach. By developing a construction method that addresses the needs of both of these programs, the method will be more adaptable to multiple functions rather than just one.

**NEEDS**

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**SECTION 2.4**

**TYPICAL VILLAGE ORGANIZATION**

- Major Roadways
- Minor Streets
- Commercial
- Education
- Civic
- Residential (Multi-Family)
- Residential (Single-Family)
CONSTRUCTION DEVICES

MATERIAL ANALYSIS
Stone, wood and mud bricks make up the three basic construction types for the region of study. Each performs uniquely in reference to its structural assembly, building form, and site strategy. These materials differ in their price, accessibility, and workability, allowing the materials to influence the site organization through three primary orders:
- Courtyard
- Cluster
- Linear

These traditional methods are now influenced by the road system that passes through the community, forcing towns that are not in close proximity to a large city but the major roads not directly through the settlement. Now they begin to cluster around the road, losing key spatial elements that were once large parts of the site's development.

STONE | COMPRESSION | COURTYARD

The nature of the African Climate yields a brief annual rains season and a long, dry season during which wind blows down from the Sahara. While temperate rarely drop below freezing during these months, the temperature difference can be as high as thirty degrees in one day. Roundhouses, or rondavels, became a common solution as the isolation walls capture and store heat during the day and release the heat at night. The circular form allows for the optimal use of the interior space, proving more effective than traditional rectangular structures. The round forms also help to filter light by removing the harsh shadow edges that are created by sharp corners and are replaced with a shift gradient of light and shadow.

The circular form created by the stacking of stone and sediment pieces acts as the mortar. Traditional applications of this building material produce small, single-use structures such as housing courters. The large chunks of stone lean on one another as the gradual form to create an enclosed space—acting much like a Roman arch. The compression of the stone creates the structural integrity of the rundavel while the sediment or mud filling acts as an aesthetic finish while capturing the heat during the daylight hours. The buildings are traditionally laid out in a frame on a central outdoor space, creating a courtyard where the footprint of each individual structure is small. Site planning creates ample space for the programs that are not housed in the interior space.

MATERIAL DISTRIBUTION

Approximate Introduction Dates

<table>
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<th>Material</th>
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<tr>
<td>Stone</td>
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<td>Concrete</td>
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<td>Timber</td>
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<td>Steel</td>
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<tr>
<td>Dried Brick</td>
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<tr>
<td>Woven Cloth</td>
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</tr>
<tr>
<td>Fired Bricks</td>
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<tr>
<td>Wood and Textiles</td>
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</tr>
<tr>
<td>Mud Bricks</td>
<td>5000 BC</td>
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Figure 2.5.1

STONE || COMPRESSION || COURTYARD

SECTION 2.5

MATERIAL DISTRIBUTION

APPROXIMATE INTRODUCTION DATES

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As one moves down from the Sahara and into the more dense tree canopy of the Congo and East African nations, the tree access becomes more abundant. In areas where the temperature differential is not as dramatic, timber construction becomes more prevalent. Once were nomadic tents but has gradually evolved into more permanent settlements. The number of harvested timber has to an absolute minimum in order to reduce the amount of harvested timber. Leather is stretched over the wooden frame to enclose the space. While the endpoints of the structure are a rectangle, the tensioned textiles create softer edges that perform more efficiently against the desert wind brought down during the dry season. These structures provide little thermal insulation compared to stones or mud constructions. To accommodate for the loss of radiate heat, the single use buildings are cluster together on the site. The standard footprint of the tensile structure can shift with the needs of the occupant, reducing the need for exterior space on the site. The small alleys between the structures create walkways but do not center around a social space.

Commonly used wood: Pine, Biligom, Eucalyptus, Pearwood, Beli, Limba

Commonly used textiles: Leather from cow or Ostrich

MUD | COMPRESSION | LINEAR

result in compacted materials in areas with a sparse tree canopy or there is a lack of soil useful for mining stone. The traditional method of mud construction in Eastern Africa is called banco, which is very similar to the process of coil pottery where layers of circular mud tubing are stacked on top of one another then smoothed to create a flush exterior finish. Due to the continuous form of the coil, the structures have few openings. Banco construction continues to be used for extremely rural housing but has gradually shifted in use to mud brick rather than continuous coils. Results packed into rectangular molds and dried in the sun. The dried bricks are then stacked in an offsetting pattern resembling a running bond. The now rectangular bricks yield structures in more orthogonal patterns rather than circular ones. With this, the small buildings can now share a structure wall rather than having to be its own stand alone building. The single use program still draws on the site planning to create larger communal space for community gatherings. With the form of the brick structure, two rows of the smaller buildings line a linear exterior space. Much like the circular stone structures, the organization of the houses produce a unique spatial experience based on the material use as well rather than formal planning.
MATERIAL SYNTHESIS

RELATIVE BENEFITS

Each of the three building materials display advantages that affect the building form, organization, and site planning of structures using these materials. These techniques were analyzed by use in Uganda and its surrounding countries over the last three hundred and fifty years, qualities were pulled from each study that proved advantages for the projected regional development in the North-East region of Uganda.

The three main building materials offer differentiations in cost, workability, and accessibility that vary in usability for particular program types. Along with the study of the physical material qualities, the site planning reveals opportunity for exterior use. These findings are paired with pragmatic needs to help influence material use of the final design.

### Construction Material Qualities

- **Cost Per Unit**
- **Accessibility by Region**
- **Workability**
- **Construction Time**
- **Transportation Effort**
- **Structural Span**
- **Opening Span**
- **Passive Systems**

### Courtyard Site Planning
- **Central Courtyard**
- **Minimal Interior Space**
- **Stone Wood Brick**

### Cluster Site Planning
- **Bono-Perminate Structures**
- **Flexible Building Footprint**

### Linear Site Planning
- **Shared Structural Wall**

### Figure 2.6.1

- **Stone**
- **Wood**
- **Brick**

### Figure 2.6.2

- **Courtyard Site Planning**
- **Central Courtyard**
- **Minimal Interior Space**
- **Cluster Site Planning**
- **Bono-Perminate Structures**
- **Flexible Building Footprint**
- **Linear Site Planning**
- **Shared Structural Wall**
The area where Uganda and its surrounding countries reside offers climatic conditions that are consistent year-round. This promotes the implementation of passive systems in addition to the strategic use of materials. The study of successful projects in this area helps guide the project as it enters site analysis and schematic design.
KACHUMBALA MATURENITY UNIT  
Location: Kachumbala, Uganda  
Architect: HKS  
Healthcare

CONSTRUCTION DEVICES
The exterior facade system creates an open-air corridor that pushes the circulation of the project to the exterior of the building. This facade allows air and light to pass through the project while securing the exterior envelope. The architects used locally sourced materials to reduce the cost of imported materials.

SOCIAL ENGAGEMENT
The program directly addresses the needs of the community while the construction of the facade trains unskilled laborers to be able to repeat the technique in other projects.

DESIGN ADVANTAGES
The architects use the building masses and site strategy to create exterior spaces for community use along with involving local labor in the construction of the project. In addition to the passive lighting and cooling that comes from the open-air corridor along the exterior, the roof runs water to one side of the pitched side lets in light to the patient rooms.

SECTION 3.1

Image 3.1.1

Image 3.1.2

Image 3.1.3

Image 3.1.4

Pour-in-place Concrete
Post and Lintel System
Circular Clay Bricks Baked in the Sun
Brick Form Allows for Air Flow into Patient Rooms

VERTICAL LOAD

Four-in-place Concrete Post and Lintel System
Circular Clay Bricks Baked in the Sun
Brick Form Allows for Air Flow into Patient Rooms

Brick Form Allows for Air Flow into Patient Rooms

Figure 3.1.5
CONSTRUCTION DEVICES

The college was designed in a series of single room structures with multiple entry points. Mud bricks create the exterior walls while lightweight wood trusses form the roof structure. While the tin roof may heat up in the hotter months, the operable wall opening help passively ventilate the structure.

SOCIAL ENGAGEMENT

The majority of the materials can be locally sourced and the workability of these resources promotes the training of the labors during the construction process. The flexible space allows for different types of program to take place in the space while the classrooms are not in use.

DESIGN ADVANTAGES

Thinner wood planks shade the openings during the hottest parts of the day, while allowing light to enter the space in the evenings, maximizing the flow of daylight and air, reducing the need for active systems.

Clay bricks baked in the sun, wood planks from indigous timber.

Wooden Trusses Set on Brick Sheer Walls

Wooden Planks Shade Exterior Corridor

-clay bricks baked in the sun, wood planks from indigous timber-

VERTICAL LOAD

Summer
Winter
The hospital takes an innovative approach to the program organization and circulation of a healthcare center. Pushing the circulation to the exterior, the project reduces the amount of enclosed space that needs to be heated and cooled while using the form of the structure to create an exterior public space.

This project uses both indigenous materials (stone) and imported products (temperate glazing), and the use of some vernacular materials and construction techniques to bring down the overall cost while hiring and training local labor.

While this project does utilize active heating/cooling, it also is strategically placed on the site to enhance the amount of daylight that enters the space. The shallow-floor plates help in reducing the need for artificial lighting.
SEDHIOU CULTURAL CENTER

location: Senegal, Sedhiou || architect: AMKNA, Dubai-based Studio || Education

CONSTRUCTION DEVICES
the building functions as a gathering space, teaching area, and water collection device due to the remote location and lack of new constructions, the building must have multiple functions in order to have the greatest impact on the community.

SOCIAL ENGAGEMENT
the architects embraced the patterns of locally made textiles when designing the openings of the cultural center. The use of vernacular materials reduces the maintenance for the project along with the construction cost.

DESIGN ADVANTAGES
the butterfly roof allows light into the main gathering space while collecting water at the center fold of the roof. Air can freely enter and leave the cultural center while catching the mist of the center water collection system.

Wooden Trusses Set on Brick Sheer Walls
Clay Bricks Baked in the Sun for Load Bearing Walls
Light Filled through Opening Above Exterior Doors
While each of the four projects exhibits a unique typology, they are similar in their application of indigenous materials, emphasis on passive systems, and strategic site planning. This helps them operate with little assistance from grid-generated electricity and other active techniques; the climate of the anticipated site varies a small percentage but still yields similar site conditions.

Five major design advantages are proposed for the further schematic design consideration:

- **Form through Materials**
- **Passive Systems**
- **Shaded Enclosure**
- **Workable Materials**
- **Enclosure by Form**

**PROGRAM SYNTHESES**

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<tr>
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<td><strong>Figure 3.5.2</strong> Schematic Design</td>
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**PROGRAM TYPE INFLUENCE ON SITE PLAN**

- Prioritizes Student Needs
- Short Term Use

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<tr>
<th>Educational Center</th>
<th>Medical Center</th>
<th>Cultural Center</th>
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<td>Prioritizes Patient Needs</td>
<td>Short Term Stays</td>
<td>No Programed Exterior Space</td>
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<tr>
<td>Large Teaching Area(s)</td>
<td>Courtyard</td>
<td>Varies Ages</td>
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<td>Smaller Exterior Areas</td>
<td>Doctor Housing</td>
<td>Short Term Use</td>
</tr>
<tr>
<td>Linear Path</td>
<td>Exterior Visitor Space</td>
<td>Flexible Open Program</td>
</tr>
</tbody>
</table>

**KACHUMBALA MATERNITY UNIT**

**MITYANA COLLEGE**

**BUTARO DISTRICT HOSPITAL**

**SEDHIOU CULTURAL CENTER**

**Prioritizes Student Needs**

**Year Round Use**

**Large Teaching Area(s)**

**Exterior Circulation**

**Common Exterior Connections**

**Prioritize Patient Needs**

**Short Term Stays**

**Exterior Visitor Space**

**Doctor Housing**

**Linear Path**

**No Programed Exterior Space**

**Flexible Open Program**

**Varies Ages**

**Short Term Use**

**Prioritizes Student Needs**

**Short Term Use**

**Exterior Circulation**

**Common Exterior Connections**

**Prioritize Patient Needs**

**Short Term Stays**

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**Varies Ages**

**Short Term Use**

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**Short Term Use**

**Exterior Circulation**

**Common Exterior Connections**

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**Short Term Use**

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**Varies Ages**

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**Varies Ages**

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**Short Term Stays**

**Exterior Visitor Space**

**Doctor Housing**

**Linear Path**

**No Programed Exterior Space**

**Flexible Open Program**

**Varies Ages**

**Short Term Use**
The "bush" of Uganda’s Northern region operates differently to its urban capital in terms of material sourcing, government assistance, and construction labor. Kewinda is no exception, composed of small village settlement between the Gayaza-Zirobwe Road and the Luwajjali River. The hillside site offers both timber resources and clay deposits.
Existing site analysis
An analyzing the current site conditions and climatic factors will inform the material selection choice. In conjunction with the results known from traditional material use, four key factors will be studied in relation to the chosen site:
- Site study (physical conditions)
- Climatic information
- Settlement structure
- Urban growth

Exploring the site at both a micro and macro scale will provide a more holistic insight into the needs of the community, thus informing the formal site strategy of the project.

Key Influencers That Effect Current Site Conditions
- Sun
- Wind
- Temperature

Effects on Final Design
- Orientation
- Openings
- Landscape
- Site Planning
- Program
- Building Form
- Building Layout
- Water Supply
- Zoning
- Transportation
- Future Needs
- Adaptation
- Future Growth

Figure 4.1.1
Kewinda is located fifteen miles northeast of the country’s capital of Kampala. Village settlements that are outside the dense urban fabric of larger cities operate differently than the larger neighbors. Western suburbia has created a precedent that supports the independent single-family structure and, although this model supports the growth of sprawling American cities, outliers in Ugandan communities show a different response. A unique approach has to be created in order to address the needs of this particular people. Many laboring-age people travel into denser areas seeking employment due to the lack of industry development outside the city. This creates a cycle of migration of people to urban areas while the population continues to increase in rural settlements without the increase of employment opportunity from industry development. The lack of government funding to public schooling in the area only increases the need for a structural system that can be localized to Kewinda and its imitate needs.
SECTION 4.3

SITE ANALYSIS

CURRENT SITE CONDITIONS

Site Circulation
- Major roads (cars per day)
- Minor roads (cars per day)
- Residential traffic only (cars per day)

Building Typology
- Residential
- Commercial
- Retail
- Civic (church, community spaces, etc.)
- Education

District Zoning
- Districted for farming
- Residential

Concentration of Civic and Commercial Structures

Undeveloped Foliage

0mi 1mi 15 2mi 4mi
River
Major Highway Connector
Township Centers
Miles Northeast of Kampala

Residential Traffic Only (Cars per Day)

< 20

> 100

< 100

> 100

29

5

0

Minor Roads (Cars per Day)

Major Roads (Cars per Day)

Figure 4.3.1

Figure 4.3.2

Figure 4.3.3

Figure 4.3.4

Figure 4.3.5
ANTICIPATED NEEDS

The village has shown steady population growth over the past fifty years but lacks in public amenities and educational facilities. The closest primary school is outside the town limits, more than eight miles away in the neighboring community. More than half of the students that attend the school walk more than an hour everyday in order to attend class. This is less than half the time that students from Kewinda will walk to the nearest school.

The need for education centers in the rural areas of Uganda increases every year as eighty-six percent of the population lives in the “bush”. We see western organizations, often partnered with missionary organization, assist in the construction and management of schools in the Northern regions. While the facilities are much needed, they do not offer any type of expansion plan as the student body grows. Therefore growing the schools dependence on outside sources.

Material selection in reference to the site’s resources will help prepare the school for future growth as the population increases.

SITE STUDIES

The proposed site resides between two minor roads that connect the residents of Kewinda to the major road. The terrain of this bush town is relatively mild compared to the mountain region of more Northern African countries with a one hundred and ten foot grade change along that cut through the middle of the village. The southern side of the sloped land is underveloped with large amounts of native vegetation and rock. The access to natural resources are beneficial to the material selection and construction of the project; however it often challenges when clearing and preparing the land for construction. The site strategy determines the proper amount of timber that needs to be removed to avoid overdeveloping the site.

The prevailing Eastern winds funnel across the proposed site. This can be utilized in the design of the primary school to utilize passive cooling during the day. The average wind speed is between three and four miles per hour year-round, but increases as it breaks and funnels around the hill to a maximum of eight miles per hour. The relative temperature remains within twenty degree differential year-round supporting the need for passive systems in the daytime to help cool the structure.
EXISTING CONDITIONS

COMMON SECURITY MEASURES
Due to the political climate of the region, home security is the responsibility of the user rather than a governing body. Windows are often reinforced with steel bars and doors have boarding on the inside. While these are effective ways of securing the property, the architectural appeal is lacking.

“...In order to protect our home, we built a mud wall around the perimeter. It took almost a week to build the six and a half foot barrier but now allows the kids to play outside without the worry of strangers approaching them.”

We decided the best way prevent people from climbing over the wall was to top it with broken glass from bottles and old windows.

“...The need for architectural planning grows as the population of the nation has steadily increased over the past fifty years. This need is not isolated to urban areas but to villages that lack the access to civic structures.

“...Architecture is all the more important in fast-changing environments like Uganda, the country is currently urbanizing at a rate of more than five and three-quarters percent per year, according to a recent survey by the Commonwealth Association of Architects. Architects play a critical role in the design of cities, especially newer ones. Lack of proper planning often results in problems such as urban sprawl, car dependency and growing inequality.

When properly trained, architects and planners understand the importance of creating mixed-use, walkable neighborhoods together with the value of public open space, culture and heritage.”

BUILT CONDITIONS

The need for architectural planning grows as the population of the nation has steadily increased over the past fifty years. This need is not isolated to urban areas but to villages that lack the access to civic structures.

“...Architecture is all the more important in fast-changing environments like Uganda, the country is currently urbanizing at a rate of more than five point three percent per year, according to a recent survey by the Commonwealth Association of Architects. Architects play a critical role in the design of cities, especially newer ones. Lack of proper planning often results in problems such as urban sprawl, car dependency and growing inequality.

When properly trained, architects and planners understand the importance of creating mixed-use, walkable neighborhoods together with the value of public open space, culture and heritage.”

MAJOR ROAD CONDITIONS

The pavement of major roads across the northern half of the country have encouraged the transportation of goods and services to rural communities. This assets with the transportation of construction materials and the movement of tourist or daily workers. Currently, nineteen percent of recorded roads are paved with a three percent increase every year.

“We are constructing roads there because they lead to areas with lucrative tourism – parks and eco sites – and it is where the majority of food we eat in Kampala comes from and is a lot of cattle farming, leading to a big dairy output.”

“...The ministry gives priority to regional productivity, access to district headquarters, political roads and roads opening up regional corridors to the border points.”

MATERIAL SELECTION

CLAY BRICK

The quantity and value of round wood produced in Uganda has increased for the last five years. In 2016, Uganda produced 50.2 million tonnes of round wood worth about Shs 972 billion, registering an increment of 10.8 percent in value, (bib. 14). The accessibility to round wood has proven plentiful as the forest covers nearly 60,000 square kilometers of brush land. The soft wood is often chosen for construction use over its counterparts due to the workability of the timber.

This timber along with clay will be harvested from the site as the main two construction materials for the project. While the southern hillside of the site has a dense tree coverage, the Northern peak is home to large deposits of clay that are typically used for bricks in residential construction.

Using clay bricks in alternating patterns and sizes will increase the design potential during schematic design.

<table>
<thead>
<tr>
<th>Quantity (tones)</th>
<th>Year</th>
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<tbody>
<tr>
<td>40k</td>
<td>2011</td>
</tr>
<tr>
<td>42k</td>
<td>2012</td>
</tr>
<tr>
<td>44k</td>
<td>2013</td>
</tr>
<tr>
<td>46k</td>
<td>2014</td>
</tr>
<tr>
<td>48k</td>
<td>2015</td>
</tr>
<tr>
<td>50k</td>
<td>2016</td>
</tr>
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</table>

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TRADITIONAL BRICK PATTERNS

- RUNNING BOND
- RUNNING AND STACK BOND
- HERRINBONE
- SPANISH BOND
- FLEMISH BOND
- DOUBLE BASKET WAVE

SECTION 4.6

Figure 4.6.1
MODIFIED TO ALLOW VENTILATION

RUNNING BOND
RUNNING AND STACK BOND
HERRINBONE
SPANISH BOND
FLEMISH BOND
DOUBLE BASKET WAVE

Figure 4.6.2
MODIFIED RUNNING BOND

MODIFIED RUNNING AND STACK BOND

MODIFIED HERRINBONE

MODIFIED SPANISH BOND

MODIFIED FLEMISH BOND

MODIFIED DOUBLE BASKET WAVE

LOAD DISTRIBUTION

LOAD DISTRIBUTION

LOAD DISTRIBUTION

LOAD DISTRIBUTION

LOAD DISTRIBUTION

LOAD DISTRIBUTION
PATTERN ANALYSIS AND SELECTION

CLAY BRICKS

The modified brick patterns offer differing load capacities. The selection of the brick pattern is based on the load the programmatic application of the wall - the load that the wall will carry from the roof - and the orientation of wall.

Potential program applications are:

- Security wall
- Housing exterior walls
- Education exterior walls
- Education interior partition walls
- Administration exterior walls
- Programed exterior space, partition walls

The two highlighted brick patterns will be used for the security wall along the site boundaries. These patterns allow light to transmit through the small openings but limit the visual sight line to the interior of the site.

MODIFIED RUNNING BOND

MODIFIED RUNNING AND STACK BOND

MODIFIED HERRINBONE

MODIFIED SPANISH BOND

MODIFIED FLEMISH BOND

MODIFIED DOUBLE BASKET WAVE

Figure 4.6.5

Figure 4.6.6

MODIFIED SPANISH BOND

Exterior walls of Classrooms
Exterior walls of Housing Courters
One layer for Interior Portals

MODIFIED FLEMISH BOND

Exterior Security Walls
Exterior Functioning walls
One layer for Exterior Program Separation
The initial site strategy set up perimeters for the design development and final design of the project. The application of the wall study to different program types is the main focus of the design along with the human interaction within the space.
There are three primary design considerations that are indicated in the models - centered around program distinction and placement, the models show major site design choices, while the intent of the models is design inspiration, the following qualities were considered:

- Circulation
- Security
- Program relations
- Building masses
- Overhead coverage
- Topography
- Visual connections
- Program orientation

Figure [5.1.1]
SECONDARY CONCEPT MODELS

Figure 5.1.3
The program of the project is separated into three general program clusters to assist with designing the site strategy and laying out the building masses on the site. The first program cluster acts as a threshold, welcoming occupants onto the site while creating a security barrier with the mass of the building itself. The second cluster holds the majority of education spaces and exterior gathering areas. This cluster acts as a connector between the entry space and the living quarters.

**Site Clusters**

- **Program Cluster 1**: Main Point of Egress
  - Support Space
  - Public
  - Street Access
  - Community Space
  - Cafeteria

- **Program Cluster 2**: Central Gathering
  - Private to User(s)
  - Monitored Access
  - Classrooms
  - Exterior Meeting
  - Garden
  - Athletic Field

- **Program Cluster 3**: Living Quarters
  - Private
  - Restricted Access
  - Dorms
  - Teacher Houses
  - Exterior Living
  - Communal Lounge

**Program Distribution**

- Education
- Housing
- Support Space

**Figure 5.2.1**

**Figure 5.2.2**
SITE STRATEGY

PROGRAM PLACEMENT

The three clusters of program are organized so the support space is the main point of egress for vehicular and pedestrian traffic. The education cluster follows, then the housing structures. The progression of space becomes increasingly private for the security of the users. A monitored secondary egress point is provided for emergency use but not intended for continuous use.

Figure 5.3.1
Figure 5.3.2
Figure 5.3.3
Figure 5.3.4
Figure 5.3.5
Figure 5.3.6
Figure 5.3.7
Figure 5.3.8
Figure 5.3.9
Figure 5.3.10
Figure 5.3.11
Figure 5.3.12
Figure 5.3.13
DESIGN DEVELOPMENT
Preliminary Schematic Sketches
Good quality clay is an ongoing challenge for brick makers, as they do not have access to heavy mining equipment or access to financing to purchase the necessary equipment. In some countries, especially Zimbabwe, large termite mounds are used as clay brick raw material, although these clay bricks are normally produced by owner-builders. Lack of transport was mentioned as a major stumbling block in getting bricks produced in the informal sector to the more lucrative formal sector markets.

In addition providing products for home building, the informal clay brick makers play an important role in economic sustainability for many communities as they provide regular employment. There are thousands of informal clay brick producers in the SADC countries, and each employs at least a few people who would otherwise have no income.

<table>
<thead>
<tr>
<th>Laborer Age</th>
<th>Formal Training</th>
<th>Mold Bick</th>
<th>Minutes Between</th>
<th>Bricks a Day</th>
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<tr>
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<td>6-9 days</td>
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<table>
<thead>
<tr>
<th>Gender</th>
<th>Brick Production, NationWide ( K units )</th>
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<tr>
<td>Male</td>
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<th>May</th>
<th>June</th>
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<td>700</td>
<td>800</td>
<td>900</td>
<td>1000</td>
<td>1100</td>
<td>1200</td>
</tr>
</tbody>
</table>

Catering Raw Clay
Softened with Water
Press Clay into Wooden Mold [8” x 4” x 3”]
Release Brick from Mold on to Flat Ground
Line Wet Bricks a Few Inches Apart
Set in Direct Sun Light to Dry
Stack and Store for Use

<table>
<thead>
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<th>Let Sit For</th>
<th>Days</th>
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<tbody>
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<table>
<thead>
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<td>14-24 years</td>
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<tr>
<td>80k</td>
<td>120k</td>
</tr>
<tr>
<td>200k</td>
<td>25-60 years</td>
</tr>
<tr>
<td>61+ years</td>
<td>89%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Production Processes Takes Between</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5.4.7

Figure 5.4.8

Figure 5.4.9

BRICK DEVELOPMENT
Integration of the Wall by Production

Gender
Male 59%
Female 41%

- Clay Brick Association of South Africa
Scalloped Texture to Hold Mortar
Wood for Lateral Bracing
Mortar to Set Bricks Horizontally
Air Gap
Alternating Brick Overhangs
Alternating Brick Orientations

SECTION 5.5

PROJECT DRAWINGS

Figure 5.5.1
Figure 5.5.2
Figure 5.5.3
Figure 5.5.4
Figure 5.5.5

Entrance // Southern Facing Exterior Wall // Eastern Facing Wall
FINAL CONCLUSIONS

PERSONAL REFLECTION

As my knowledge and fascination of Western architecture grew, I began to see the gaps in rural developments. When I was four, I remember watching my dad draw on a large tilted white tablet and when I was five, I remember moving into our new home. My dad used his knowledge of building technology, his desire have a home that was large enough to house four wild kids, and his overall handy manliness that came from growing up on farm, to build him and my mom’s dream home.

I have never known a life where the simple pleasures of the built environment were not accessible to me. If we needed something, anything, my cowboy of a father knew how to build it. Through conversations with a friend who owns a small orphan house in rural Uganda I realized that not everyone had access to these same simple luxuries.

I began to study how the built environment is developed in countries that don’t have government housing, or well fair, or to an architectural education as I do. What shape their built environment? Current construction devices, the cultural context, programmatic needs, or is it just their accessibility to construction materials? All these inquiries and first accounts from people who live and work in Uganda led to my initial question.

Can we design for the people of rural communities in a way that is utilizes available materials, integrates the use of passive systems, engages the user to be trained in new techniques while the buildings are under construction, all while being respectful to the surrounding community? The value of this question lies in its ability to target a construction goal without the implementation and pre-conceived notions of Western architecture that would frame my mind from my architectural education. This produced a theory that not only looks at the site and climate but the understanding of material choices and labor acts that form so many African communities.

My research reveals that stone, locust wood, and clay bricks stand as some of the most economical construction materials for the rural Ugandan community but they can be modified by simple substantially techniques to increase the performance of the building with minimal labor intensive actions. These techniques can be taught and replicated on countless building types by implementing these methods into areas that are driven by the labor of the building owner and the available labor. The community holistically can take steps to more adaptable architecture.
This Thesis is presented in both a book format and eight 24” x 60” presentation style boards. While the scale and organization of the figures vary from the two formats, the content of the drawings is the same. The information in this thesis was used for the 3-Minute Thesis Competition at Kennesaw State University and the Final Thesis Competition by the College of Architecture and Construction Management.
SECTION 6.1

FINAL PRESENTATION BOARDS

Awarded {Honorable Mention} in Final Thesis Competition, Kennesaw State University

Awarded {Runner-Up} in 3-Minute Thesis Competition, Kennesaw State University

Figure [6.1.1]
**REFERENCES**

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