Regionalism and Necessity: A Proposal for Community Buildings in Rural Uganda

STAN GUIDERA
Bowling Green State University

CHRISTOPHER HILL
Linedota Architects, London, UK

> *"The meanings of places may be rooted in the physical setting and objects and activities, but they are not the property of them – rather, they are a property of human intentions and experiences"*
> E. Phelps, Place and Placelessness [1]

INTRODUCTION

The proliferation of western influences across the developing world has resulted in profound cultural shifts for many societies. As noted by Paul Ricour, "mankind is on the brink of a single world civilization representing at once a gigantic progress for everyone and an overwhelming task of survival and adopting our cultural heritage to the new setting"[2]. Architecture's complicity with globalization is evidenced by the export of the international style and related ideologies throughout the developing world during much of the 20th century. The contradiction between the universality of modernist ideology and the specificity of location and culture was not lost on the international style's advocates. Le Corbusier recognized the significance of site and location as indicated in his statement that "there will be no confusion of regions; for climatic, geographic, topographic …. will always guide towards forms conditioned by them" [3]. However, while Colquhoun proposed that this was indicative of Le Corbusier's growing interest in vernacular and regional influences that characterized his career after the late 1920's [4], he also suggested that Le Corbusier was at least to some extent contradictory in his position that "problems, and the scientific means to solve them, are universal". According to Colquhoun these contradictory positions, first "that modern architecture is conditioned by a universal technology" and secondly that "modern architecture is conditioned by local customs" are "independent absolutes whose relationship to each other remains a total mystery" [5].

Regionalism has evolved as a counter-argument to the universalism associated with globalization. Proponents of regionalism argue that "architecture should be firmly based on specific regional practices based on climate, geography, local materials, and local traditions" [6]. This approach emphasizes the value of place and culture. However, situations involving crisis interventions in developing countries, the decision to depart from regional influences and local customs can be driven more by the economic and physical constraints of region than by any aesthetic ideology proclivity. Rather, in such cases the introduction of an alternative technology and aesthetic is driven by the necessity of regional conditions.

Inevitably, in non-western countries the introduction of non-native form and materiality can run the risk of being perceived as an imposition of western culture, particularly in regions with a history of cultural repression associated with colonialism. However, the introduction of an alternative architectural form does not inherently preclude regionalist principles. Aalto's work is often cited as an example of "new regionalism" which responded to context in a non-literal way [7]. However, the conditions in developing countries suggest that a process which engages the local stakeholders can enable architects to identify the regional characteristics of greatest value to the community. According to Boussora, regionalism should “begin by identifying relevant elements and then proceed by understanding the relationship between them”, and provided specific recommendations regarding the required research that must be conducted in assessing the possibilities within a specific region [8].

Equally relevant to projects in the developing world is what Barbara Allen identifies as “performative regionalism” and its potential for creating connections between architecture and community. According to Allen, regionalism is a socially constructed concept performatively produced by practices of regional coherence. It is a locale in which people share identities, and identity can be understood by actions and behaviors which in turn are influenced by places and cultures [9]. This inherently de-emphasizes the physical and emphasizes the social character of a region. According to Allen, “this allows architects a degree of interpretive freedom with regard to regional design ‘style’; once the spatial dimensions of human activities are satisfied, the visual appearance of the built environment is open” [10].

This paper documents a project which was undertaken to provide assistance to a village in a remote area of rural Uganda, with the intention of developing a proposal that could be replicated in multiple locations. The direction of the project was influenced by these multiple dimensions of regionalism, and the priority the project architects placed on developing a culturally responsive solution while accommodating extensive economic and technical constraints. This on-going project has evolved into a collaborative effort among faculty and students in both the UK and the US. Christopher Hill, principal with Linedota Architects in London, UK, has been the project director and lead designer. Architecture students under his direction at the University of Nottingham were responsible for the fabrication and assembly of the project prototype of the structural system. The project has been further supported by architecture students at Bowling Green State University in the United States who have been involved in design development, computer modeling, and design visualization.

PROJECT BACKGROUND AND FIELD ASSESSMENT

The project was initiated in 2007 by the Kyomya East Sponsorship Project (KESP), a community organization in rural Uganda seeking to improve their village. KESP secured the services of the London architecture firm Linedota Architects, who agreed to volunteer to provide design services for a much needed new village school and a health facility.

The project began with a 12-day field visit to Uganda by Christopher Hill and a representative from a partnering charity. From the outset, consultation with the local authorities, politicians, personalization of the school and clinic by the building users, and development of a master plan for the village, which will be developed with the local community were perceived as critical aspects of the project.

The field visit to Kyomya East Village found a close and active community, despite living conditions that would be described as precarious and nearly pre-industrial. The village was found in need of basic infrastructure, lacking electricity, access to potable water, and paved roads, problems which are common in many rural areas of the country.

The field research activities, which closely paralleled the recommendations proposed by Boussora [11], began with interviews of the members of the village community which included interviews with local teachers, medics, nurses, and religious and community leaders. Activities included community focus group and mapping sessions. Children’s drawing workshops were also conducted with the intention of integrating the children’s artwork into the project design. While the physical output of these activities was important, gaining an understanding of the social interactions (i.e. identity and social “performances”) was deemed critical to developing a proposal that was responsive to the needs of the community. Investigations were also conducted into local archetypes, construction methodologies and materials, economic considerations, local construction skills and capabilities, and climactic, geological and environmental conditions.

Informed by the site observations, performance targets for the project were developed by Christopher Hill in an attempt to define the theoretical envelope of possibilities that could be achieved for such a project. These were identified as follows:

- To build for 30% of the cost of conventional construction in rural Uganda.

• To build in 30% of the time required with conventional construction in rural Uganda.

• To be carbon neutral or negative, and environmentally sustainable with potential to reuse or recycle 100% of the materials.

• To be safer than common construction practices in rural Uganda under earthquake and wind load conditions.

Inherent in these targets were several material and design constraints. The proposed structures must be constructed of locally available materials to minimize costs. Additionally, the structures would need to be built with local skill sets and technologies. Lastly, the structures would be built without formal site supervision from the architects. Therefore, assessment of the regions' physical, material, and labor resources was critical as these constraints would have a substantial influence on the design process.

INITIAL FIELD ASSESSMENT

Investigations of local construction materials:

Documentation of locally available materials was an important activity. There were seven categories of locally available materials. Quality and cost were documented as follows:

Locally made mud and clay brick were of variable quality. Inconsistent firing techniques at the local brickworks resulted in many bricks being weak or brittle. The shape, color, and dimension of the bricks were also inconsistent. Clay pan tiles and clay fired brick were available but were relatively expensive and scarce in poorer rural areas. Their use was typically limited to the most prestigious private houses and commercial buildings. Cement is imported into Uganda and is considered an expensive material. Gravel and aggregates are dredged by hand from the Nile River and graded using hand sieves. Concrete was hand mixed, and therefore there was no way to ensure consistent quality. Profiled metal sheet is widely available and is one of the most common roofing materials. Several sheet thicknesses are available. Steel tubing and other steel section are available in standard lengths. Sizes were typically limited to smaller metalworking sizes. Larger structural steel section sizes could be ordered but were expensive.

Timber has been a scarce resource in Uganda in recent history due to the widespread deforestation of the rainforests in colonial times. Eucalyptus plantations were established several decades ago but these produce a limited supply of lumber. Therefore, more indigenous construction practices were found to rely on the use of branches and smaller tree trunks. Unprocessed eucalyptus logs, commonly used for telephone and electrical service poles, were available in varying lengths and diameters. Other wood products were imported and therefore more expensive, but there is a supply of internal grade ply produced locally.

Assessment of local construction skills and capabilities:

Labor costs in Uganda were found to be low compared to western standards due to an abundance of unskilled workers. As a result, material costs and transport costs represented a much higher proportion of the cost of construction than in more developed countries.

Availability and skill levels of local labor varied with trade. Brick layers were widely available and well-skilled at basic brickwork. Concrete workers were skilled in basic applications such as laying foundations and floors, but any complex concrete work in the area appeared to be undertaken by larger construction companies. Due to the limited supply of lumber, skills related to wood construction and associated standards of carpentry in the country were found to be relatively under-developed. Metalworking was also limited and the quality of work was not precise. Similarly, while welding was widely available, the quality of welding work varied extensively and was inconsistent. Workers with plumbing and electrical skills were found to be scarce.

Local construction methodologies:

Two basic construction methods common to rural Uganda were found to be, adobe and mud-brick. Unlike the more indigenous form associated with adobe construction, the rectilinear form of the buildings typically using mud-brick construction was imported into Uganda by the British during colonization.

Adobe construction was typically used for small structures and built using small diameter wood

Figure 1. Typical hut built with adobe construction and. typical mud-brick construction

branches set vertically in the earth and woven together with smaller branches to form a simple flexible frame with voids filled with hand-mixed mud. Mud slurry is typically applied to the walls and rendered smooth before being painted or whitewashed and decorated with traditional patterns. The roof was supported by a central pole supporting radiating sticks which were covered with dried grass for shading. A typical adobe structure required approximately two months to complete [Figure 1]. These structures were subject to several common failures, including wall and roof erosion, roof leakage, susceptibility to structural damage to roofs from high wind, and fire damage from cooking or lighting with an open flame.

Mud brick construction was typically used for larger structures. The walls were found to be constructed of locally-produced hand-made mud brick using wide steel-reinforced mortar bed joints in order to accommodate the large variations in brick size and shape, and the unpredictable strength of the brick. Roofs were constructed of machined timber which were through-pinned with bolts or bent over nails. Roof structures were typically connected to the walls with bendable steel ribbon that was wrapped around a wall plate and several courses of brick. The roofs were usually double-pitched, constructed with 3" profiled metal sheet nailed directly to the timber for roofing material. Window and door openings were typically minimal [Figure 1]. Common problems included internal overheating, wind damage to roofs, cracking of walls and floors from seismic activity as well as poor quality foundations, and wall erosion and cracking due to inconsistent quality of bricks.

Local archetypes for schools and health clinics:

Three schools and three health care clinics in the region were visited and analyzed. Both the schools and health clinics were mud brick structures organized with a linear scheme. The size varied and type of school varied with the needs of the local population and the range of students that were served, with classrooms accommodating around 40 children per class. To create a larger school, classroom buildings were added. A similar scheme was followed with clinics.

Building failures associated with mud-brick structures were due to similar conditions as that found in adobe construction, and were therefore commonly found in schools and clinics in rural Uganda. Additionally, the maintenance level of such facilities was found to be low, further contributing to material and structural problems.

SUMMARY OF SITE RESEARCH

Of the two basic construction methods widely used in rural areas only mud brick construction was determined to be capable of being employed for buildings such as a school or health facility. However, the quality of materials used in this construction method, as well as the seismic and climatic conditions of the region, suggested that this construction method was not an acceptable option from a western perspective and that an alternative to common rural Ugandan construction methods would be required.

The project parameters mandated that the use of any non-regional building technology would require integrating simplified construction processes so that local construction skills are readily transferable to the local community. This yielded several preliminary material-selection decisions: First, given the low maintenance scenario, the life of the materials with which the buildings are constructed will be an important consideration. Therefore, the technical parameters of the project suggested the use of profiled sheet metal as the most feasible building material of those locally available. This material would be supplemented by other locally materials where appropriate and available. Profiled metal was durable, recyclable, and readily available and relatively inexpensive, and its widespread use made it a material which was familiar to local laborers and the general population.

Secondly, the transportation considerations suggested developing a proposal that could be configured as a kit of parts that would be field assembled. This would support the project goal of developing a solution that could be reproduced in multiple locations.

EVOLUTION OF THE DESIGN

When considering the implications of proposing an alternative architectural solution, there was a local precedent for non-traditional form found in the rectilinear schools, clinics, and other government buildings. However, although such buildings are not traditional to pre-colonial Uganda, their construction processes embraced the traditional role of generations of local craftsmen who have learned to make and build with brick. Therefore, rejecting the use of brick, as well as other regional construction materials and techniques, broke an important link between the local people and the buildings they create and use.

Investigations into precedents considered a number of buildings that used profiled steel sheet in their construction. WWII air raid shelters were investigated for their use of metal skin as well as the structural efficiency of their arched form. A variation known as an Anderson Shelter was of particular interest in that it was mass produced in a factory and delivered as a kit of parts, which yielded significant cost and construction efficiencies. A second precedent studied was the Tropical House designed by Jean Prouvé, [Figure 2] which was of interest for its use of an exterior skin composed of two layers of metal. The void between the internal and external skins was used to control internal temperatures by shading the inner surface of the roof and allowing air-flow between the steel skins.

Both of these precedents influenced the direction of the project. The initial explorations were based on half-round arch schemes as found in the air-raid shelters. Utilizing a modular arched-bay system similar to those employed in the shelters would provide an extensible solution that could be expanded as required to accommodate diverse needs among the users. However, cross-section analysis found that up to 25% of the floor area was wasted due to low headroom at the building sides of the half round design. In response, it was replaced by a parabolic arch. Additionally, the direction of the profile of the metal skin in the shelters was parallel to the curve of the arch. This required the use of specialized machinery to bend and form the metal sheet. Since there would not be access to this equipment in rural Uganda, the profile of the

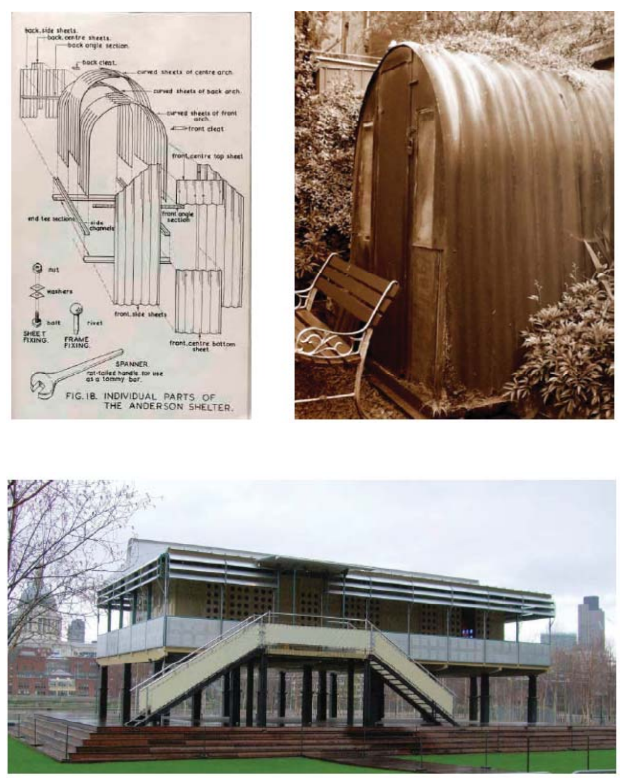

Figure 2. Anderson Shelter (above) and Tropical House by Jean Prouvé

sheet was configured in the opposite direction (i.e. perpendicular to the curvature) so that no bending machinery would be required. The architects also explored ways in which to optimize the double skin exterior including using earthen fill to stiffen the structure and provide a thermal mass for temperature control. However, this approach proved unfeasible due to the potential lack of locally available suitable fill material.

The design shifted to a truss system which would incorporate a semi-structural skin at both the interior and exterior, which could stand on its own as a single bay or module. The trusses were to be field-assembled from commonly available steel tube, using bolted connections to eliminate requirements for welding. The connections were detailed with the tubing flattened at the bolt locations to make bolting and assembly easier. The final engineered proposal reduced 80% of the structural steel required in the original scheme, which equated to a 75% reduction in cost. More importantly, the redesign was able to reduce the number of unique components in the structure from 65 to four, making it much simpler to build, a key consideration given the limited skill set of the local population.

CONSTRUCTING A PROTOTYPE

With the initial design finalized, it was decided that the construction of a physical prototype of a single arch-bay would provide critical insight into the viability of the design. This was intended to accomplish the following:

- Demonstrate that the architectural and structural principles were as predicted.
- Provide data to refine the design, and the fabrication and construction process.
- Identify potential health and safety issues.
- Identify cultural or sociological issues that may be relevant to the introduction of this technology within a rural community in Uganda or elsewhere.

Several parameters were established for the building prototype. First, as much as possible the prototype construction process would use equipment and machinery that would parallel that available in rural Uganda. Secondly, the project architects onsite would have limited input during the prototype fabrication and assembly.

The prototype was assembled in the UK by a team of 20 students and staff at the University of Nottingham with additional consultant participants observing the process. Building a 1 to 1 prototype of this size was an unusual event at the university. While it was estimated only two days would be needed, three days were scheduled in the event of unanticipated delays. As a condition of allowing the prototype to be constructed on campus, the university required the structure to be disassembled immediately after completion.

Several complications surfaced during the construction process. The original plan to use a vice to flatten the steel tubing at the connections proved unfeasible. As an alternative, the steel tubes were heat-softened prior to shaping the ends. This was successful, but required significantly more time than planned. The jigs used to form the steel sheet had been designed and built for an earlier draft of the design so did not function efficiently. This resulted in difficulties in bending the chords accurately, causing out of tolerance construction and additional delays. The improperly curved trusses lead to deviations between the pre-drilled sheet-holes and the chord positions requiring re-drilling of the sheets.

The arch-bay was assembled flat to facilitate construction, which required it to be raised into the final vertical position. To be consistent with anticipated field conditions, the arch was hand-lifted. This would provide some indication of how maneuverable the arch would be under actual conditions. This was further complicated by the lack of a foundation. Where on site the arch could be pinned onto the foundation providing a hinge around which the arch would rotate, raising the prototype required the ends of the arch to be allowed to sink into the earth, providing an impromptu hinge. Despite these complications the prototype was successfully raised and placed [Figure 3] with just over an hour remaining until the deadline.

While building the prototype served to verify that the project was technically feasible, the reactions of the team members were of equal interest to the architects. When the arch was ready to be lifted, a call went out for additional helpers to pull the arch into its vertical position, and a crowd of over 40 people materialized to observe the event. Immediately after the arch was lifted and secured in its vertical position, spontaneous celebrations erupted.

Figure 3. Completed prototype of structure.

It became evident that over the short period of three days, a small temporary community had formed around the specific task of creating a small building prototype. This community had come to know the building and had formed emotional attachments to it. The strength of the attachments varied from person to person and seemed to be related to the amount of time they had worked on the project. The attachments that were formed seemed to be independent of the nature or importance of work the person had contributed to the project. It is hoped that this unanticipated sense of community and connection to the project will be indicative of the potential for such a connection developing amongst the villagers who would build the structures in rural Uganda and other countries. Despite the requirement that the prototype be disassembled, students and staff petitioned the university to leave the prototype in place for six weeks so that the project could be included in the architecture school's end of year exhibition of student work.

POST PROTOTYPE PHASE

With the successful completion of the fabrication and assembly of the prototype, efforts were directed towards refining the design and resolving the remaining technical and design issues. A key change was reconfiguring the building section profile from a parabola to a pointed arch. This eliminated the section of the chords with the greatest curvature, thus simplify the tube bending and assembly operations while retaining the structural advantages of the arched truss.

Additionally, the truss-member connection details were revised to remove the flattened portions at the bolted connections of the truss struts in order to eliminate the need for on-site heat-softening. The foundation connections, floor structure, and end panels were also developed based on data from the prototype construction. Environmental analysis on the refined design demonstrated that the proposed design was superior to a structure built with commonly used methods in rural Uganda in terms of natural light, acoustic, and thermal performance.

Lastly, the building configurations to be used in the community master plan were finalized. Based on input from the village community, the master plans were developed to provide both school facilities and health service facilities on the same site.

Figure 4. Master plan rendering.

Using building configurations with five, seven, and nine bays, the plan created separate zones for the school and health functions, each with a public space that would serve as circulation and gathering areas. The plan also included a playground, parking area, and community gardening spaces.

Computer models were used to develop representations that would assist the community members in understanding the master plan [Figure 4]. Given the nontraditional form of the buildings, the computer models were used to familiarize the villagers with the structures. This approach relied heavily on photorealistic renderings using perspective matching with site photographs. The goal of this strategy was to enable the villagers to see the proposed structures located in the actual context of the site. Consistent with the community engagement priorities of the project, computer rendering enabled the project teams to develop representations that integrated the artwork developed in the workshops held during the initial site visit to Kyoma East Village as well as artwork from later drawing workshop with the children. [Figure 5]

Figure 5. Proposal with local artwork.

CONCLUSION

With many of the technical issues largely resolved, the emphasis has now shifted to refining the master-plan and related environmental and political/administrative issues. A second full-scale prototype will be required in order to verify the efficacy of the design revisions and to conduct additional fabrication tests. However, the concerns of the project team regarding the introduction and acceptance of non-traditional structures and construction methods remain a high priority. Proposals such as this which are engineered off site for on-site assembly to achieve cost and quality objectives must overcome additional barriers as several aspects associated with the interface between local craftsman and built work have been removed from the process. It is hoped that the community participation in the act of making the architecture, the personalization of the buildings, and the ongoing input of the local community that has occurred throughout the design process will generate a connection with the project among the villagers that transcends resistance to an unfamiliar architecture. It is hoped that these new bonds can be as strong as the traditional bonds that formerly existed.

There is, however, evidence that this may be possible. After the project leader for the village had shown other villagers images and photographs of the prototype, he reported that he received some encouraging and excited comments back. One of the comments was particularly significant:

> '…people will come from all over the world to Kyomya East Village to see these buildings…'

ENDNOTES

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