Initiative reCOVER: Building Schools for Tomorrow

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Figure 1. Site for new primary school in the village of Gita looking east

> Every child has the right to an education. Education transforms lives and breaks the cycle of poverty that so many children are caught in. And an educated child will make sure her own children receive an education.[1]

The people of Uganda are faced with considerable challenges when it comes to providing an education for their children. Poverty, HIV/Aids,[2] lack of access to basic healthcare, and an inadequate and deteriorating infrastructure are the most notable factors depriving a large portion of Ugandan children from a primary education; the fact that Uganda is the youngest country in the world with a population median age of 15.3 years[3] only exacerbates these problems. Although Ugandans place education at the top of what they value as a society, over one million children in Uganda, between the ages of 6 and 12, are not in school, [4] only 57% of Ugandan children will complete primary school, [5] and ultimately 35% of adult Ugandans are illiterate. [6]

This paper centers on a design/build project of a primary school for 320 young citizens of the village of Gita in the Wakiso district of Uganda. The Wakiso district, an area surrounding the country's capital city Kampala, was specifically identified because of the staggering statistic that it has a 1st grade drop-out rate of 80%.[7] Building Tomorrow, Inc. (BT), a US non-profit organization based in Indianapolis, Indiana, is responsible for directing this project and building a series of schools in the Wakiso district of Uganda. George Srour, BT's executive director along with Ugandan in-country director Joseph Bagambaki Kaliisa work closely with the beneficiary communities to realize new primary schools for the Wakiso district. Additionally, BT has an agreement with the Ugandan Ministry of Education which ensures teacher and headmaster assignments for the new schools. The University of Virginia, School of Architecture's Initiative reCOVER designed the new Gita primary school building in collaboration with UVA's School of Engineering and Applied Science as well as Arup engineers from the Cardiff office in the UK. This paper also describes the University of Virginia, School of Architecture program, Initiative reCOVER, founded in January, 2007 with a primary mission to work collaboratively with non-profit organizations and humanitarian relief agencies involved in building relief structures from transitional disaster relief shelters as well as more permanent buildings such as schools, health clinics, and community centers.

GENERAL BUILDING PROJECT INFORMATION AND LOGISTICS

The overall construction budget for this primary school (building size-6,300 sqft or 585 square meters) in the village of Gita is $48,000 (94,552,320 UGX Uganda Shillings as of December 12, 2008). The primary building material used is a handmade brick produced within a 10 kilometer radius of the building site.

Figure 2a/2b. Local handmade bricks

The building's structure is comprised of a concrete and brick foundation wall system, load bearing masonry wall construction and a wood truss system covered with corrugated metal for its roof structure. Approximately 90% of the labor force is made up of Gita community volunteers investing sweat equity – they are the parents, grandparents, aunts, uncles, and cousins of the children who will attend the school upon its completion. The community group is organized and led by three experienced and skilled Ugandan builders and a project manager employed by BT who is also Ugandan. Additionally, US student volunteers participate in the construction process in a limited capacity during periodic visits. The design team carefully considered how to effectively integrate local building materials and methods to reflect local building traditions, customs, and aesthetics. The construction budget of $48,000 along with limited access to materials and building components was a considerable challenge and could not have been managed successfully without the close working relationship between the reCOVER design team and the non-profit organization. BT has a well established Ugandan infrastructure and network including an in-country director, local fabricators and builders who have worked on previous school buildings, and a Kampala engineering firm responsible for processing building permit submissions and providing construction estimates in the form of 'bill of quantities' (b.o.q.) at critical junctures during the design process. Global communications via fax, mobile phones, (when service was available in Uganda) and the use of the internet-based free service Skype between the US, Europe, and East Africa have proven to be, in large part, effective. Future technical improvements are necessary for the design and construction process to continue more efficiently and in a timely manner.

Figure 3. Gita groundbreaking ceremony

PROJECT TIMELINE

Spring 2007: Organizational meetings and coordination with BT executive director George Srour, Ugandan in-country director Joseph Kaliisa, Engineering in Context (EiC) program director Dana Elzey with the UVA School of Engineering, and reCOVER director Anselmo Canfora

Fall 2007: Architecture and engineering research and development, pre-schematic design and engineering course (ENG 401 taught by Elzey) students focus on power and water systems

Spring 2008: Architecture design studio (reCOVER taught by Canfora) coordinated with UVA engineering course (ENG 402) to develop design BT and the A&E firm Arup

Summer 2008: Address value management revisions to design and construction documents in service of budgetary adjustments and material costs increases (cost increases largely due to the political unrest in Kenya where most of the building supplies originate)

October 14, 2008: Groundbreaking

Fall 2008: Building construction begins and BT finalizes teaching assignments with the Ugandan Ministry of Education

Spring 2009: School building to open for classes

SITE AND PROGRAM

Purchased in 2007 by Building Tomorrow, Inc., the school building will be built on a three-acre plot of land located approximately 15 kilometers from the city center of Kampala. The site has a gradual descending slope from east to west of approximately 16 feet (5 meters) aligning with the general direction of the prevailing winds. There are no paved roads in the area and access to the site is made possible by a number of foot paths and a small, dirt road which defines the bottom western edge of the site. Located at 0.3° N latitude and 32.6° E longitude, the regional climate is tropical with the hottest months being December to February reaching highs of 85 degree Fahrenheit (29 degrees Celsius.) The rainiest months of the year are March to May, October, and November with the highest average rain fall of 10.8 inches (275 mm) during the month of April and relative humidity of 79%. The modest primary school program includes seven classrooms for grades 1st through to 7th (each grade has approximately 40 to 45 students) a room dedicated as a small library, an administrative office for the headmaster, two detached water filtration pavilions, and a detached pit latrine.

PROJECT TEAM

The project team was made up of an academic interdisciplinary group of six undergraduate engineering students, one engineering professor, three recent architecture graduates, one architecture professor, one graduate architecture student, and a studio of 13 4th-year undergraduate architecture students. A series of coordination and planning meetings prior to the beginning of the fall semester 2007 between the architecture and engineering faculty and the non-profit partner organization directors established an effective working framework. The project design timeline spanned two academic semesters officially beginning in the fall term 2007 and ending the spring term 2008 and the architecture and engineering faculty and students worked collaboratively in the context of three courses. Additionally, the architecture and engineering firm Arup based in the UK joined the team during the spring term 2008 to assist with the design and analysis of the building's structural system.

RESPONSIBILITIES AND TASKS

Building Tomorrow's University of Virginia Chapter raised the majority of the funds necessary to build the primary school with the assistance of reCOVER architecture and EiC engineering students and staff. Working closely with the architecture design studio, the engineering students researched, designed, and specified the power and water systems. Studio reCOVER was responsible for the overall design of the school and auxiliary buildings and coordinated all efforts with the engineering team and Arup engineers. As part of Arup's internal public good program, *The Arup Cause*, all travel expenses, and fees were covered for their engineer, Ewan Smith, to visit our campus in Charlottesville, Virginia and meet with architecture and engineering students over a one week period to consult and help finalize the structural system.

DESIGN STRATEGIES

As the design of the school evolved, the design team and collaborators identified a series of critical design strategies supporting a set of values and necessities important to the community; these criteria were especially pertinent to how the building would help support the primary school's curriculum and the education of the children of Gita. Overall safety, performance, use, and life (maintenance) of the building were critically considered throughout the design process. At the outset of the design process and in consultation with our collaborators, the reCOVER team focused on the following important design questions: first, how could the building take advantage of the tropical climate of the region while ensuring optimal lighting, temperature, and ventilation of the classrooms and improve the overall ambient quality in comparison to existing school

classrooms; second, how could the three-acre site, rich vegetation of the landscape, and two annual harvest cycles be put into service as an instrument of learning while generating local, community-managed, agricultural revenue; and third, how could the alternative power and water systems be effectively integrated into the building design to provide potable water and modest artificial lighting without creating a considerable disturbance in the local daily life, habits, and customs of the community.

Figure 4. View of water filtration pavilion

MODEST MECHANICAL SYSTEMS

The primary purpose of the modest mechanical systems is to provide electricity and potable water for the primary school without reliance on a municipal infrastructure – which is nonexistent. While applying basic principles of sustainable and renewable energy practices, we were mindful of local Ugandan cultural and social values. Important design parameters of the systems were affordability, compatibility, transparency, and adaptability. The architecture and engineering team placed an emphasis on the adaptability of the water filtration and power systems to varying peak demands and seasonal rainfall. The systems were also designed to be compatible with the non-profit's economic model.

The energy and water systems are relatively simple and straight-forward to use and can be easily maintained and repaired with materials and components available locally. During the design process, it was very important to keep in mind that the school's headmaster, teachers, students, and community members would have complete access to the systems for daily use as well as periodic cleaning and maintenance. The water filtration system is comprised of slow sand filters and rain water harvesters to provide clean water for drinking and personal hygiene. Rainwater is collected from a single roof surface and redirected to two water collection basins on top of pavilions at the north and south ends of the school building. The filtered water is ultimately collected in a series of three 1,000 liter tanks with a fourth 1,000 liter overflow tank. A solar power system comprised of an array of six photovoltaic panels will provide enough power for ambient lighting in each of the 9 rooms (7 classrooms, 1 headmaster's office, and 1 library room) as well as some outdoor lights above the porches. A small electrical closet in the headmaster's office will house the converter and batteries which are part of the solar energy system.

Figure 5. View looking north of school entry ramp

SITE VISIT AND COORDINATION

In late February, 2008 and with BT's director, Srour, we were able to travel to Uganda to visit the future site of the school building. While in Uganda, we worked with the community, the in-country Ugandan director, the project manager, and the local engineering firm to determine and specify, first hand, the needs of their clients. We also met with local area masons and steel fabricators to determine availability and cost of materials and building components and to discuss the viability of altering building details to improve overall ease of construction and building performance. Over a 10 day period, our small group made multiple visits to the building site to survey the land with a local sur-

veyor and to meet with the parents and children of the community. In consultation with the community leaders, preliminary decisions were also made in regard to the clearing of the land of brush and preferable locations for the school building while carefully considering orientation to the sun, prevailing winds, and pedestrian accessibility. Visits to the school building site were challenging due to poor road conditions and traffic; a 15 kilometer trip from our hotel in Kampala to the village of Gita would take 1.5 hours, on average. On a number of occasions the trip time doubled due to traffic congestions exiting or entering the city or when our vehicle would encounter large mud holes along the unpaved roads. We were always very fortunate to receive assistance from Ugandans who would take time from their daily tasks to help us extract our car. The group also visited other local schools and met with students and teachers to discuss their experiences and what they considered to be necessary improvements to school buildings currently used in their communities. A second site visit has been scheduled from January 2nd, to January 12th, 2009 and will include George Srour, Anselmo Canfora, Jeff Ponitz (reCOVER project manager), and a small group of architecture students from the spring term 2008 architecture studio.

Figure 6. View from school building looking east

INITIATIVE reCOVER MISSION

Initiative reCOVER focuses on the research, design, and fabrication of relief structures. Domestic and international catastrophic events and the necessity for more responsive and collaborative involvement on the part of architects, landscape architects, designers, engineers, planners, policy makers, and humanitarian volunteers lead to the development of Initiative reCOVER. The problem of designing for a vulnerable population in an unstable environment is highly complex and requires a great deal of care, attention, rigor, inter-disciplinary collaboration, and entrepreneurship. Initiative reCOVER emphasizes the comprehensive study and design of relief structures from the scale of the detail, a room, a module, a building, a community, to the scale of systems of infrastructure, organizational logistics, and policy. Critical variables such as climate and weather, geography, culture and customs, local skills, resources, and building techniques, governmental policies and agencies, and health risks are rigorously researched, analyzed, and considered throughout the design and building process. The principal purpose for Initiative reCOVER is to contribute in a substantive way to the emerging network of *Open-Source Humanitarian Design.* Our impetus is to openly share our work with the general public, disaster relief agencies, the global design community, and – most importantly – with those who are in need of help. Ultimately, our collective purpose is to positively affect, promote, and contribute to the design and building of safe, healthy, and sustainable communities around the world. Our three principal goals are as follows: first, to positively affect the design and building of safe, healthy, and sustainable communities around the world through partnerships with non-profit and humanitarian aid organizations; second, to focus our attention on immediate, real-world, real-time design applications in service of a comprehensive

Figure 7. View of school building looking west

architectural design studio learning experience; and third, to work to advance translational research in the areas of building materials, methods, and technologies in developing countries.

INITIATIVE reCOVER FRAMEWORK AND CURRICULAR COMPONENTS

The most important academic component of Initiative reCOVER is an option studio (ARCH 402) offered in the spring term to undergraduate architecture students in their last semester of a four-year undergraduate architecture program. The students are presented with a design problem which recognizes and addresses the unrelenting domestic and international catastrophic events (natural and man-made) and the paramount necessity to study and develop innovative and entrepreneurial models of effective collaboration between architects, landscape architects, engineers, planners, policy makers, and humanitarian volunteers. An equally important pedagogical goal for the studio is to focus the students' attention on a design problem steeped in a current, culturally expansive, and interdisciplinary context. Studio reCOVER focuses on a very direct and critically important question in regard to the design of relief structures: *"How would you build it?"* This question is not only asked of the viability of each proposal's technical merits such as structural and cladding systems, construction sequence, alternative energy, passive heating and cooling strategies, and material applications, but it is, more judiciously, asked of how design proposals can be an argument to be made (figuratively and literally) in a highly charged and complex context. Our design context is one affected by global, socio-cultural, geopolitical, economic, institutional, interdisciplinary, and bureaucratic variables. The question *"How would you build it?"* is certainly not asked to influence or imply a more reductive, simplistic or utilitarian approach to the design problem. It is made clear that the problem of designing for a relief situation in an unstable environment is a difficult design problem fraught with bureaucratic and political processes and procedures defined by policies and unfortunately, occasionally, influenced by corruption. The approach to the problem is to embrace and incorporate this complexity into the design process rather than reject it, ignore it, or use it as a reason to render the design strategy generic or commonplace. It is a complex design problem that not only requires a great deal of care, attention, and rigor to ensure the design of safe, healthy, above-standard living, working and learning environments, but also demands particular attention to the intricate logistics of distribution, implementation, and evaluation. Studio reCOVER emphasizes the notion that well-informed and well-executed design strategies require critical vertical and lateral investigations through iterative developments at multiple scales; the need to be resourceful when considering new applications and re-allocation of modest but viable building components, commercial products, recycled materials, and alternative energy systems in a developing country is paramount. Working with non-profit organizations and community representatives, the design scope and overall construction budget is, under the best of circumstances, clearly defined at the outset of the semester. It is important for the site selection process to be concluded at the beginning of the semester in order for important variables including climate and weather, geography (topography), local resources, and building techniques are identified, studied and directly inform the overall design process. The design process also involves careful evaluation of local and regional customs and traditions and is intended to be facilitated by a non-profit's in-country personnel, network, and infrastructure also in place at the outset of the project.

DESIGN/BUILD AND RESEARCH & DEVELOPMENT

Initiative reCOVER is fundamentally conceived of as a program with the primary purpose of assisting humanitarian aid organizations currently addressing the problem of relief building. This effort also serves a second and important educational purpose as a design/build, research and development program in our School of Architecture curriculum. The essential didactic purpose of this design/build program is to foster the effective synthesis of pedagogical and professional frameworks for the design student to observe, experience, and affect directly. Pedagogically, the process involves the student in a critical manner of acquiring knowledge and skills while promoting the notion of reflection-in-action described by Donald Schön in his book *The Design Studio*. With the close supervision and assistance of the instructor, the design/build project affords the student numerous opportunities to be critical, to be decisive, and, in turn, to be reflective in the act of designing and making. Additionally, the

process involving reflection-in-action promotes responsiveness, on the part of the student, to skill development, new and established material sensibilities, and attention to methodological and technical aspects of fabrication and assembly methods and techniques.

As a design/build program, Initiative reCOVER engages processes of active feedback. The notion of active feedback, at the heart of all constructional processes, describes the constant cycling of information between idea as speculation and execution as enterprise. Active feedback also describes the exchange of information as the transference of 'know-how' (one source of knowledge) between teacher and student. Working side-by-side, a student and instructor establish and maintain a dialogue through the work and not outside the work as abstract speculation or hypothesis. The learning experience is tangibly immediate and concrete while being rooted in a thoughtful and comprehensive conceptual framework. A productive and instructive active feedback loop is most effective when clear instructions, consistent supervision, and timely demonstrations are provided. The student immediately experiences trial-and-error, negotiates margins of error, and becomes more aware of temporal, systemic, and material tolerances. The concept of active-feedback is of particular importance in the development of viable relief structures as it involves sustaining constant information loops between ideas, prototyping, production, implementation, distribution, and evaluation. Therefore from the scale and nuance of a detail to the scale and negotiation of policy, the student is asked to consider the implications of one decision based on subsequent decisions throughout the design/build process.

Initiative reCOVER is founded on the philosophy that design and building processes are dialectically interdependent. A building is not simply a result, outcome, or even a "product" of design, but an inextricable, investigative, collaboration well informed by thoughtful research, substantive interdisciplinary exchanges, and direct community involvement. Building Tomorrow's Gita primary school budget, logistics, and access to viable building materials challenged us to be more creative and judicious throughout the design process; architecture and engineering, academic and professional, non-profit, and governmental agency partnerships were essential to effectively address these challenges. Well-integrated, active, and passive environmental systems and making pragmatic use of local building materials and skill sets certainly mattered in the design of this project; its social significance and community value will only be measured in years to come and in terms of the transformative opportunities a place of education can offer.

Figure 8. Future student of Gita's primary school

ENDNOTES

1. UNICEF

2. UNAIDS, Nearly 90% of all children in the world infected with HIV live in sub-Saharan Africa

3. United Nations Population Division, "World Population Prospects: The 2006 Revision Population Database"

4. USAID

5. UN Statistics Division

6. USAID

7. Ugandan Ministry of Education