Journeyman International:
Bihongora Library in Rwanda, Africa

Sarah Nelson
California Polytechnic State University
San Luis Obispo, California

My senior project is an interdisciplinary effort between students from the College of Architecture and Environmental Design at California Polytechnic State University, San Luis Obispo and Journeyman International. Our team was given the task to design, engineer, and produce preconstruction services for a library in Bihongora, Rwanda. My main deliverables as the construction manager consist of a construction estimate with quantity take-offs, a construction schedule, and a project site plan. There is a great need for literacy in Rwanda, among both children and adults, so by building a library we are hoping to provide the locals in the community with a space that they can take ownership of and where they can be empowered to grow in all areas of life.

Keywords: Humanitarian Design, International Construction, Library, Community Development

How Project Came About

This project came about through the outreach of Journeyman International. After learning about this opportunity to pair up with a nonprofit that specializes in humanitarian design for my senior project, I immediately knew that that was something I wanted to be a part of. I wanted to put the construction skills I have gained throughout my undergraduate studies to use in a way that could impact the lives of people living in a developing nation. After expressing my interest to Journeyman International, I was assigned to a project team with three other Cal Poly College of Architecture students: Gabriela Ojalvo, the Architecture student; and Elyssa Adams and Nick Dekker, the two Architectural Engineering students. As a project team, we were selected to design a library for the Bihongora village in Rwanda, Africa.

Process

The process for me all began when our project team, amongst other Journeyman International groups, traveled to Rwanda to visit our proposed building site and to meet the locals of the community. After learning more about the culture of Rwanda, the building materials and processes used, and speaking with people that lived in villages JI has worked in before, the project came alive in my eyes. I became even more excited and motivated to come back to Cal Poly, take part in the design process, and figure out how we can best bring this community together with our design. Coming back into winter and spring quarters, the process looked a little different for all four of us students. The architect spearheaded the design, the architectural engineers worked with the design to establish the best structural system for the building, and I as the construction manager, put together a pre-construction package containing deliverables such as an estimate, schedule, and site logistics plan. A description of each deliverable is provided in the following pages. It is important to note, however, that from the very beginning, all four of us worked collaboratively, each bringing our suggestions to the table of what we thought would and would not work regarding
our respective majors and knowledge. For instance, an important aspect of our design that we all desired to incorporate came from learning the source of drinking water in the community. Currently, the people of Bihongora receive water from the nearby river, which is composed of dirt, mud, and other contaminants. This new knowledge sparked the idea to install a butterfly roof and rainwater catchment system into our design to allow for access to filtered potable water. This would become one of many design attributes that all of our work would be based around.

**Deliverables**

As the construction manager on the project, my responsibilities primarily included offering constructability advice when discussing materials and processes to be used for design, researching local materials and costs, and completing many deliverables discussed below. Some of these deliverables I have had experience completing in my classes and internship; however, by doing them for my senior project I have gained an even greater amount of skills that I know will prepare me for my future career.

**Estimates**

Both a conceptual estimate and a full construction estimates were completed as part of my senior project. First, I created the conceptual estimate by discussing with the founder of Journeyman International, Daniel Wiens. This consisted of the U.S. target price per square foot for the building and calculations regarding how much of the budget would be allocated to the 16 CSI divisions. Then, as our project team progressed into design and created structural drawings, I calculated costs for each minor component of the 16 CSI divisions by using the quantity take offs of the building. My conceptual estimate totaled $188,591 USD while my final construction estimate had a lower result of $122,357 USD. The costs were derived from a material sheet used for Sunzu Yacu, another Journeyman International project located in Rwanda. In addition, for the prices that I was not able to find on this sheet, I researched prices in China and concluded that it would be comparable to the price for that same material in Rwanda.

**Schedule & Phasing Plan**

I created my overall project schedule using Primavera P6. I accounted for preconstruction, which was based off of a tentative start date and is subject to change depending on the local codes, regulations, and permitting process. I then broke up construction into two phases: sitework and building construction. I decided to only do two phases because the proposed library is only one building at a total of 458 square meters (4,927 sq. ft). However, there are three areas of the building that have a slab at varying elevations, which was also accounted for with three different pours during the building construction.

**Quantity Take Offs**

My quantity take offs included the main building components such as concrete, formwork, rebar, brick and mortar, steel trusses, doors and windows, metal roof, and a couple of interior finishes. These are the quantities that I was able to estimate, while the other building components required an allowance in the final estimate and should be subject to change. These quantities were all found and estimated from the structural drawings and the architect’s floor plan.
Hazard & Risk Mitigation Plan

The Hazard & Risk Mitigation Plan was developed in research of the site to inform the investors of the project of possible risks on the job. I found that, due to Bihongora being on a slight floodplain and Rwanda’s frequent rainfall throughout the year, the site can be prone to flooding, landslides, and earthquakes.

Site Logistics Plan

I created my Site Logistics Plan using Sketchup. I was able to import the geolocation of the proposed construction site and develop appropriate locations for items such as a main entrance, laydown area, portable restrooms, storage, temporary power, and more. I then imported the site plan to Synchro, along with the schedule I created in P6, to create a 4D animation of the construction process. This will allow investors to see the proposed building go vertical month by month before construction begins.

Stormwater Pollution Prevention Plan

The Stormwater Pollution Prevention Plan contains suggestions and recommendations to implement before and during construction. Since the building is located in between river channels, and is on a slope and a slight flood plain, SWPPP is something that needs to be taken seriously. I included possible SWPPP measures in my plan such as silt fencing, French drains around the building foundation, and straw wattles. I also included these items to my site plan to show a 3D representation of where I suggest they be placed as the construction manager on the job.

Utilities Analysis

At the moment, the building site does not have access to any utility lines. The utility analysis is comprised of information regarding the future construction of a hydropower plant that will be able to feed into the village of Bihongora, Rwanda. This hydropower plant will generate 5 mW of electricity and will be able to supply energy to not only the library, but the existing and future buildings in the community as well. The hydropower plant is set to undergo construction in late 2019. This plan also describes the function of the rainwater catchment system as well as the proposed compostable toilet partitions for the restrooms.

Lessons Learned

Throughout my time working on my senior project, I have learned the importance of communication. Working on an interdisciplinary team can be challenging at times because there are moments where, in order for one of us to begin working, information needs to completed and transferred by another. This aspect of the interdisciplinary process also made the project that more rewarding in the end as I got to learn more about the construction process and how it is going to work in the industry. In addition, the fact that a group of individuals who specialize in different concentrations were able to come together and create something that will make an impact on the community of Bihongora, made it a worthwhile end to my undergraduate career. I was also able to expand my technical skills while working on this project. Prior to beginning the project, I had never had the opportunity to complete a full estimate for an entire building by myself, let alone serve as the only person on the job in charge of creating the estimate. This experience compelled me to be more detail-oriented when completing quantity take offs and associating them with costs.
Future Applications

I have learned so much by partnering with Journeyman International for my senior project. I am confident that I will be able to apply this experience to my future career as a construction professional. I have learned a lot about scheduling, estimating, and building in itself. I am especially grateful to have learned about the difficulties of building in a new location that I am not used to. These skills will allow me to be more adaptable, more of a critical thinker, and to never want to stop learning about the built environment. In addition, combining my love for humanitarian work with construction offered me an enriching experience that I want to incorporate into my future work. Building for a greater purpose is an invaluable opportunity and I am grateful to be a part of that for my senior project.
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