

Journeyman International – Rubagabaga EVC and ACE – Rwanda, Africa

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Rubagabaga EVC and ACE, or Empowering Villages Center and Agricultural Center of Excellence, is an interdisciplinary project based senior project completed by California Polytechnic State University, San Luis Obispo students. College of Architecture and Environmental Design students Jake Stom, Mackenzie Diaz, Julia De Hart, and Jenna Williams completed the design and pre-construction services with the help of non-profit humanitarian organization, Journeyman International. The deliverable aims to serve the client, Empowering Villages, by providing the complete design of a community center and agricultural training facility near Kaseke Village in Rwanda. The goal is to provide the local community with development efforts in order to establish long-term socio-economic success throughout the region. The group of students intended to create a space that is functional and sustainable. Through research and design development, various preconstruction services were completed. The paper will briefly describe the estimate, material quantity take offs, schedule, hazard and risk analysis, phasing plan, site logistics, and utilities and material analysis.

Key Words: Humanitarian, Rwanda, Interdisciplinary, Non-Profit, Design

Introduction

The Rubagabaga EVC and ACE project is a joint effort between Empowering Villages, Journeyman International, and students from the College of Architecture and Environmental Design. As part of the overall socio-economic development efforts by Empowering Villages in the Rubagabaga region of Rwanda, Africa, preconstruction design deliverables were formulated. The project includes a community center, agricultural training facility with administration offices and storage, an outdoor patio, detached bathrooms, and a rainwater collection feature. The overall budget for the project is \$100,000 USD or \$89,412,000 RwF, and construction is planned to begin in August of 2019. The following will discuss the design process and preconstruction deliverables of the project.

Process

In the fall of 2018, Journeyman International formulated the design team composed of four students. Architecture student Mackenzie Dias, Architectural Engineer students Julia De Hart and Jenna Williams, and Construction Management student Jake Stom were tasked to design EVC and ACE. Fall quarter consisted of researching everything about Rwanda; history, language, climate, wildlife, traditions, etc. Additionally, building materials, methods, and styles were also researched to deliver a sustainable and functional building. Once the group was knowledgeable about the region, design began. Meetings took place weekly throughout winter quarter of 2019 to discuss design and make changes. The main floor plan design changed only once. Originally, EVC and ACE were two separate buildings, but were then joined together for the purpose of increased collaboration of the spaces. Concrete columns and tie-beams with milled eucalyptus trusses were decided upon as the frame of the building. Brick in-fill walls and metal sheet decking were then selected to enclose the structure. After design was complete, production commenced. Construction drawings and preconstruction deliverables were the focus in spring quarter of 2019. Together, the group satisfied all deliverables and produced a design package for Journeyman International and Empowering Villages.

Deliverables

Multiple Construction Management deliverables were produced in order to satisfy both clients. Production of the deliverables required constant communication between the design team. Information was gathered from the clients and past projects in order to come up with a realistic plan to execute Rubagabaga EVC and ACE.

Estimates

The two estimates produced for EVC and ACE are a conceptual estimate and a final construction estimate. The conceptual estimate was completed when design was 85% complete and is based off estimated allotted percentages of construction line items. The percentages are tied to square footage of the building and a price per square foot of \$40 was used to calculate prices. \$40 per square foot was derived from historical data of past projects in Rwanda. The final construction estimate was completed after drawings were produced and cost information was researched. Most prices come from information given by Journeyman International. The final estimated construction cost came out to \$108,342.57 USD. This number is \$8,342.57 over the given \$100,000 budget and is primarily due to the heavy use of concrete. It is recommended to use milled eucalyptus columns to reduce the cost.

Schedules

Two schedules were produced for the project, an overall project schedule completed in Microsoft Project, and a final construction schedule completed in Primavera6. The project schedule includes the research, design, fundraising, and construction of the project. From the final schedule, an overall construction duration of 10 months is estimated to completion. 10 months proves to be reasonable, as the building scope is simplified, and labor is plentiful. Past projects have utilized compensated local village labor to complete construction, and it is forecasted to also occur on Rubagabaga EVC and ACE.

Material Quantity Take Offs

The material quantity take offs were completed with a given Microsoft Excel template from Journeyman International. The take offs break down each phase and give quantities in both metric and imperial units. Major line items include concrete, rebar, brick, wood, steel, paint, plaster, and other finishes. The take offs were completed by using Bluebeam Revu.

Hazard and Risk Analysis

Hazards and risks were evaluated through research and past construction projects in Rwanda. Local hazards include wildlife, funding, flashfloods, and volcanoes. Mitigating these risks can be challenging, but best action was recommended in the analysis. Safety risks were also identified in the construction safety plan.

Phasing Plan

Rubagabaga EVC and ACE will be composed of three phases. Phase one is EVC, phase two is ACE, and phase three is the outdoor patio, bathrooms, landscaping, and water feature. Phase one and two will be constructed simultaneously but will be offset in construction activities to benefit from the learning curve and allow proper concrete curing times. The scope of the project is not large, so simultaneous construction has been identified as feasible. Phase three will take place after EVC and ACE are completed. The plan was produced in Trimble SketchUp.

Site Logistics

The site logistics plan was created by using a PDF of the Architect's site drawing and marked-up in Bluebeam Revu. The plan covers the placement of material, concrete wash-out, temporary toilets, break areas, PPE locations, and

more. No change will be needed in the site logistics plan throughout construction, since both EVC and ACE will be constructed at the same time.

Utilities and Materials Analysis

The utilities and materials analysis served to provide the client with knowledge of the existing site, proposed improvements, and local building capabilities. Since the project location is rural, no existing utility infrastructure was present. Gas and telecom are not needed nor feasible. Electricity will be tied-in from the new hydropower plant mini-grid. Water will be collected from the roof during rainy seasons, and compostable toilets will be used to treat waste. Mud brick, eucalyptus, volcanic stone, and bamboo are the main local building materials.

Lessons Learned

The year-long project was both frustrating and rewarding. Many lessons were learned in respect to interdisciplinary approach and project success. First, communication and coordination are the most important factors when completing the design of a project. With so many moving parts, clarification and certainty are necessary to deliver a well-rounded design. Interdisciplinary work relies on team member trust to adequately communicate intention. Second, organization is also an important factor in any work. Staying organized in a cloud-based system where all team members can share documents and information at the same time is vital. Without it, design projects take more time and become less synthesized.

With respect to delivering a service to a client, the most rewarding feeling is to satisfy. Throughout the many hours of a project, the result is hard to imagine. Delivering the preconstruction services for Rubagabaga EVC and ACE will serve countless people around the world and satisfy the people who will use the building.