JI: Zimbabwe Rural School Development Program

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Adjusting to the construction codes and processes of a foreign country is a very complex and involved process. There are considerations for different materials, procedures, costs, requirements, potential tribal or cultural conflict, corruption, and many other potential obstacles and challenges to overcome. While this project was seemingly simple, inexpensive, and straightforward, there was a significant amount of obstruction from the government concerning a coup that limited the team's ability to apply for permission to begin construction. Additionally, there were significant changes in the design and budget as the project progressed, delaying our start date. Ultimately, this project should serve as a case study to assist future projects in funding, design, and development.
Key Words: Confined Masonry, Collaboration, Passive Ventilation, Schematics

Introduction

Journeyman International (JI) is a humanitarian design and construction company started by a Cal Poly alumnus, Daniel Weins. Having designed over 42 projects worldwide to date, this company specializes in partnering with international organizations to provide young construction professionals the opportunities to volunteer their knowledge and skills to provide designs and logistical planning for future projects. In 2017, Journeyman International boasted a total of 48 volunteers and employees, currently working on more than 30 projects.

The Zimbabwe Rural Schools Development Program (ZRSDP) exists to improve educational opportunities in rural Zimbabwe and to provide new facilities and resource by working in partnership with the governing body, schools, and other institutions. Founded by James Easen after teaching in Zimbabwe and returning to the UK, the organization was ultimately created in 2001. To date, this charity has raised over £250,000 and remained entirely political and non-religious.

ZRSDP originally reached out to JI in the hopes that the two organizations could work together to develop and expand a much needed secondary education structure in rural Zimbabwe. After minor field surveying, fundraising, and some budget reconciliation from a previous, but similar project, the two organizations began to move forward with a preliminary design and contacted Peace and Good Hope, a local school in the Bulawayo and Chidamoyo district. The inspiration for the design is taken directly from the country blocks standards, and will be adapted to introduce a familiar, but unique design to address ventilation and insulation issues that currently exist with the primary school structure.

Site Analysis

The original project site is located at 20°11'59.2"S 28°03'05.0"E, near a rural settlement just outside Bulawayo, Zimbabwe. The land was graciously donated by the local government, with an additional donation expected from the existing primary school. The area resides in a warm, semi-arid climate, with average temperatures around 66 degrees Fahrenheit year round, and receiving about 22 inches of rain per year, with the rain season between November and March. The site is not easily accessible, but there are sand paths acting as roads. (ClimaTemps,

2017). From Satellite photos and preliminary information, the site is very flat, with minimal brush. The site is not located to any nearby manufacturing facilities, and requires that a majority of the concrete elements of the project be produced by locals.

A challenge unique to this project that didn't become apparent until 4 months into the planning process was the current political climate in Zimbabwe. Elected in 1980, Robert Mugabe has maintained his leadership status in the country through deception, political genocide, and constitutional amendments to gather him a significant amount of power. In November, the Zimbabwe military overthrew Mugabe in an attempt to ultimately remove him from power and reintroduce a democratic and fair election process. This put a significant portion of the government's operations on hold, including the country's federal education commission. This commission must approve all new construction for education, and cannot currently do this effectively. This paired with the dangerous climate has pushed. back construction at least a year and a half, and may put a halt to the project altogether. (Falconer, Connor, Nov 16, 2017).

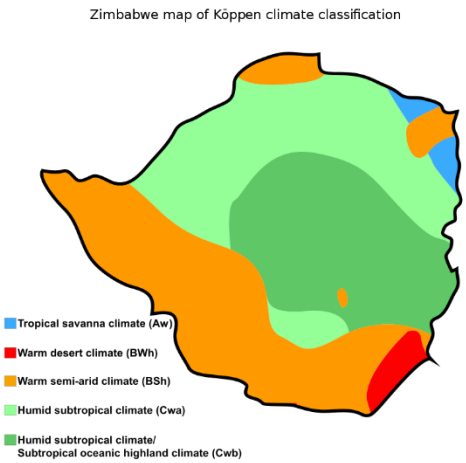

Figure 1: Zimbabwe map of Köppen climate *Source: Ali Zifan*

Design

The design for the project was heavily dictated by the standards establish by the government. Referred to as the "Santar Blocks," this design features a fully concrete block structure with air vents, wooden trusses, two store rooms, and class rooms. Our lead designer, Leah Zaldumbide, with assistance from our Structural Engineer, Serina Zepeda, designed a split roof student block to allow for active ventilation. To create a more dynamic and integrated space, the student block classrooms were separated by a covered courtyard. After review by ZRSDP, the courtyard design was scrapped for fear of it being rejected, and a simpler design with adjacent class rooms and shed roof was settled on.

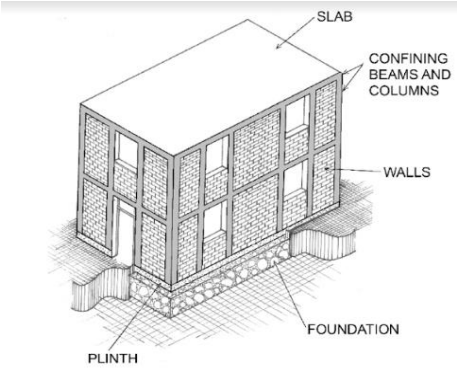

Figure 2: A typical confined masonry Building. *Source: Journeyman International*

The government requires that concrete be used as the main structural element in construction. JI recommended that we utilized a confining masonry system. This system utilizes non-reinforced clay bricks for a majority of the structure to cut costs, supporting them with horizontal and vertical reinforced clay brick columns built on all four sides of a masonry wall panel, generally separated by corners, windows, or doors. These masonry walls are able to effectively transmit gravity loads while also resisting horizontal lateral loads from earthquakes, winds, etc.

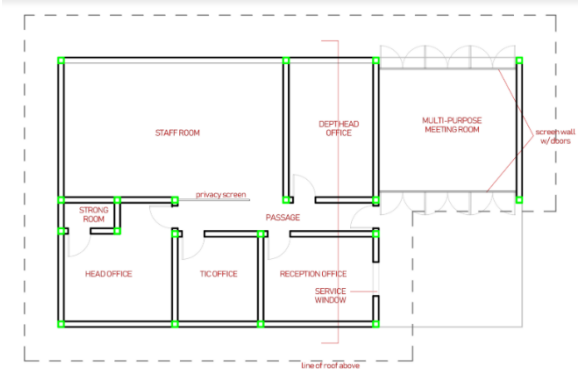

Figure 3: Floor Map of the Admin Block. *Source: Journeyman International*

While this final design would have likely been accepted, due to budget constraints and the current political climate, the project focused was altered to prioritize the addition of admin blocks for additional teachers and faculty. Utilizing the previous designs as inspiration, an admin block with the

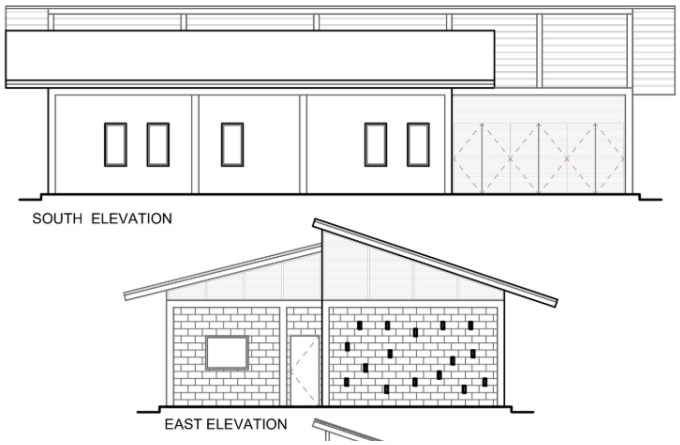

Figure 4: South and East Elevations of the Admin Block. *Source: Journeyman International*

shed roof design and confined masonry system was drafted with rooms for staff, office use, and a multi-purpose meeting room accented by a screen wall.

Budget

Construction for this project is very primitive when considering the tools and equipment available for use, and the lack of any plumbing, mechanical, or electrical system. Thus, given the material rates by ZRSDP and JI, the total price of the Admin Block came out to just over $30,000. Estimating the amount of material for this project was difficult given the lack of details and specifications concerning concrete mixes and unit rates. The provided mix details were difficult to read, cut off, non-specific, and didn't address all structural aspects of the project. Some of these missing pieces were addressed as suggestions by our Structural Engineer, however many assumptions and allowances had to be applied.

Additionally, it was very difficult to acquire detailed unit pricing for many materials. Although there was communication between the local labor force and access to previous construction estimates, the design varied enough to complicate the previous unit rates, and require recalculation. The major prices missing were of aggregate, water, rebar, and metal for the trusses, roof sheathing, and beams. This resulted in the final estimate being very rough, and potentially inaccurate.

Schedule

Scheduling this project was not very precise due to the little knowledge available concerning productivity rates. I was advised to utilize average productivity rates in the United States, and half them to account for the areas lack of skilled laborers and equipment. I utilized these rates, as well as the previous School Block's estimate of a two-month duration to calculate a duration of just over 61 days of construction. To avoid weather and rain delays, the construction was started at the beginning of May, 2019, and expected to end on July 8th. Unfortunately, this start date is likely to be pushed back at least another year, however it's crucial that construction start during the dry season, with ample time for construction to be completed before the next rainy season.

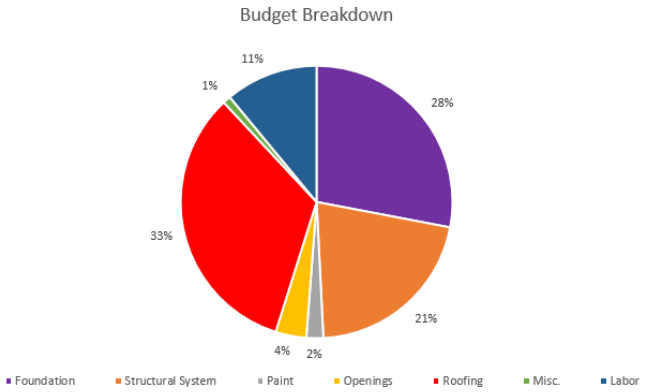

Figure 5: Budget Breakdown by Percentage. *Source: Journeyman International*

Lessons Learned

One of the largest challenges associated with this project was expecting obstacles associated with construction in a mildly unstable third-world country in a remote, rural location. Although JI provided our group with warnings of how an unstable political climate, cultural differences, and lack of resources could affect a construction project, it was difficult to truly understand or anticipate their potential effects. Working with such strict guidelines for design caused many revisions, delaying the Structural Engineer's ability to provide adequate structural drawings, thus delaying my ability to estimate and schedule the project. At first, the design process was accelerated and productive,

with minimal obstacles, giving the impression that the design would be finalized within two months, and allow ZRSDP to fundraise quickly and effectively. However, after the political environment flared, most progress was halted as ZRSDP evaluated if the funding would be available and construction would be feasible. This ultimately resulted in a changed scope, design, schedule, and location. Instead of having months to produce a final project, we were left with just over a month to produce a final design, develop a structural system, and deliver a budget and schedule. This shows how much the design process can be impacted by external factors and last minute changes, and how this can cause work to fluctuate significantly.

Another important lesson is how difficult it is to stay in contact with so many involved parties in a long distance project. We were in constant communication with the JI team, ZRSDP, Peace and Good Hope, as well as several local contacts that had experience in construction. Besides the language barrier, which was bridged rather well, sharing all relevant documents, organizing them efficiently, and awaiting responses was very time consuming and difficult to manage. Towards the end of the project we focused on having more weekly phone calls, rather than just emailing, which helped solve many of the miscommunication issues. Ultimately, this proves how important face to face conversations can be to stay up to date.

Conclusion

Ultimately, this project has increased my interest in pursuing similar opportunities either with JI, other similar non-profits, or potential founding my own with a slightly different focus. While the feasibility for this project is seemingly low given the current climate, developing a design and preliminary budget and schedule will give ZRSDP a portfolio to utilize in their future financing endeavors. Before all future projects in such unstable countries, I recommend that a full risk analysis be performed to understand the potential risks associated with fundraising, designing, and constructing a structure.

Resources

ClimaTemps. (2017) Bulawayo Ariport Climate & Temperature. *ClimaTemps.com*. Retrieved June 3, 2018 from: http://www.bulawayo.climatemps.com/

Falconor, Rebecca. O'Connor, Lydia. (Nov 16, 2017) A Look Back At Zimbabwe President Robert Mugabe's Rise To Power. *Huffpost*. Retreived June 1, 2018 from https://www.huffingtonpost.com/entry/robert-mugabe-zimbabwe-profile_us_5a0b84e5e4b0bc648a0eaf39

Zimbabe Rural Schools Development Programme. (2016) Peace and Good Hope. *ZRSDP*. Retrieved June 1, 2018 from: http://www.zrsdp.org/ZRSDP/Projects/Projects.html