Medical Clinic at Mission TwentyFive35 Vocational Village – Dominican Republic

Sarah C. De Los Reyes
California Polytechnic State University
San Luis Obispo, California

This community medical clinic will be the first of its kind in the rural town of Villa Tapia, Dominican Republic. It is Phase II of a five-phase master plan drafted by religious organization Mission Twenty-Five35, founded by the Romano family. The team consists of Cal Poly undergraduate students: Griffin Chierici (Architecture), Erica Croft and Tommy Sidebottom (Architectural Engineering), and Sarah De Los Reyes (Construction Management), backed by the guidance and support of non-profit organization Journeyman International and A/E firm Smith Group JJR. The task was to design a clinic that would serve as a pediatric and urgent care center but also a place for education. The main goal is sustainability, using solar panels and passive heating and cooling just to name a few. Concrete masonry, steal, and brick make up most of the building elements, with an emphasis of recycled material through the design of a gabion wall. In a location that is prone to earthquakes and hurricanes, it is just as important that this building can withstand great lateral forces too. Overall, the clinic will provide much needed help in the region where currently the ill need to travel to the island's capital for care.

Key Words: Clinic, Dominican Republic, Sustainability, Gabion Wall, Photovoltaic

Introduction

Mission Twenty-Five 35 has been helping out in the Dominican Republic for about six years now. Originally, JI had made a team during the 15-16 school year that made their own architectural drawings and structural analysis of the medical clinic but the project was not able to be funded. This was called El Cibao Regional Collective Impact Project that called for seven phases of a recycling factory, aquaponics, vocational technical training school, community center, medical clinic, housing, and market. The purpose is following the vision to help those in need and make a difference in the region by educating anyone who comes upon the vocational village. Now with a new design and the help of national architect Smith Group JJR, we have designed a new medical clinic that will feature four patient rooms, two negative pressure rooms, two restrooms, a reception desk, two office rooms, and an atrium. The building is not fully enclosed and it is positioned optimally so that air flow is constantly cooling the building down. The shade structure located at the buildings main entrance is also a rooftop garden.

General Information

On the island of Dominican Republic, our site is within the municipality of Villa Tapia, approximately three miles outside the center. It is officially incorporated within the Hermanas Mirabal Province but sits on the border between La Vega and this province. Being that it is mostly located within La Vega, we have decided to conduct our research based on the La Vega Province. La Vega rests in Cibao Valley, which is nestled by two of the largest mountain ranges in the North portion of the island spanning from northwest to southeast. This is a relatively flat region of the island. Dominican Republic has a mild tropical climate, and Villa Tapia has an average temperature of 78 degrees Fahrenheit and an average rainfall of 54 inches. The population of La Vega is about 30,021 people. The property that the clinic is being built on will potentially be a vocational village. The Master Plan drafted by Mission Twenty-Five 35 calls for the site to eventually have: group stay housing, a community center, market, library, classrooms, and new chicken coops and aquaponics farm. As of right now however, the clinic will be the first main structure to be built on the land.

Project Process

Journeyman International has established a system to streamline the process of submitting deliverables and establishing open communication. I was placed with a team soon after applying. Luckily enough, two of the team members, Architectural Engineering students Tommy and Erica, I had known throughout my undergraduate career. This was reassuring because I knew these two students could produce quality work. The design process began in Fall with a couple of conference calls with all of the project team, Smith Group, Rick, and Daniel from JI. In December, the team flew out to Dominican Republic to meet the Romano family and analyze the site. My portion of the work did not begin until the start of spring quarter, as I finally got enough information and design from the architect to begin the analysis and plan reading portions of the work. This is when I began to open dialogue with Rick personally so that I could ask a few questions about the site since I did not get to visit personally back in December. Winter quarter we had a personal team meeting with Daniel and then spring quarter there was a "all hands" meeting with every JI team doing a project this school year.

Deliverables

The deliverables requested by Journeyman International are meant to mimic a general construction project that an onboarding project manager would need to complete in order to be prepared for groundbreaking onsite. All work will be turned into JI and Rick Romano will use the schedule and estimate in order to fund the project. These include a soils analysis, utilities analysis, a storm water pollution prevention plan, hazard and risk mitigation strategies, safety plan, site logistics map, quantity takeoff, project schedule, conceptual estimate, and lastly a feasibility analysis. These were known as the CM deliverables. Below is a more in depth explanation of each.

Soils Analysis

The purpose of this deliverable was to provide a historical and geographical context of the surrounding region and its soil conditions and properties for which the medical clinic is to be built on. It is not a formal soils report and should not be used as such. Cibao Valley is designated as a cropland being that is it a humid and fertile region. It is fed by two main river systems: Yaque del Norte and Camu-Yuna. This means the soil here is very fertile, alluvial soil. It consists of sandy, clayey organic material that is relatively weak in bearing pressure. It is common for sugarcane to be grown on some of the largest farms. As of now, the site of the clinic produces plantains and yucca. Based on a Structural Calculations Report made by architectural engineer student Erika Dileva on our site in December of 2017, it was discovered that the soil type is clayey sand (SC) with an allowable bearing pressure of 2,000 pounds per square foot. These are soils derived from pre-Quaternary marine and fresh water sediments.

Utilities Analysis

Villa Tapia is located about five minutes from the center of La Vega. La Vega itself is located about 45 minutes from Santo Domingo, the island's capital. With that said, this is a remote and rural site. The land is not connected to a city grid, whether electrical or water/sanitary. In rural areas, only 25 percent of the population is connected to public water supply systems. To begin, La Vega is dependent on surface water and currently water is being accessed through a well onsite and dominantly used for irrigation purposes to feed crops and aquaponics pond. Power is temporary and is gathered from a generator housed inside a factory building. The clinic must be capable to providing potable water for sinks and non-potable water for both public and staff restrooms. JI's recommendation would be to install a submersible well pump with a water line running to the clinic to provide the potable water. A rainwater catchment system will further provide the greywater for both staff and public restrooms. All utility power for the clinic will come from solar photovoltaic panels located on the building's slanted roof. This system will also include an inverter, a charge controller, and several batteries for power storage to be used as backup when weather is less than fair. Only 20 percent of the island is connected to a public sewage system. For the toilets and sink basins, it is recommended that a private septic system with is installed underground with an adjacent leach field on the property.

SWPPP

This report is an informal Storm Water Pollution Prevention Plan that will aid in effort to maintain little to no pollution of construction storm water discharge into adjacent cropland or tilapia pond. The site that the new clinic will rest on is located in the humid, fertile region of La Vega within the Cibao Valley. The water is mainly fed from the Camu-Yuna River system, one of the two largest rivers of the country. Flooding is not common in this valley however; hurricanes are the exception. Rain averages about six inches during the months of September through December. Humidity averages just under seventy-five percent per year. Luckily, a relatively flat terrain and soil type are positive factors when determining an erosion control plan. First, it is important to stabilize the soil onsite and as soon as possible. This means getting the site to final grade and establishing haul routes early. The haul route into and out of the site should be compacted and watered so that no dust or debris are kicked up and spread as a result. Moreover, water infiltration can be stopped on the site by installing a silt fence around the downslope portions of the perimeter of the working space while still allowing for traffic and equipment around the building footprint. Installing straw wattle (fiber roll) or sandbags along the perimeter of the fence will also help reduce polluting sediments and debris from leaving the site. The implementations of these BMPs are only successful with the right maintenance and care. Frequent inspections of the chosen BMPs should be done in order to determine what is working properly and what could be fixed or changed.

Hazards and Risk Mitigation

Disasters, whether man-made or natural, are bound to occur during any point in the construction timeline. With knowledge of the inevitable, one can prepare and mitigate any negative effects that may result due to these unfortunate instances. This document will address the main hazards and risks that this project location possesses and ways to thwart or minimize detrimental effects to the progress and life of the construction process. The hurricane season runs from June 1st until end of November, where historically up to six hurricanes can hit during one season and the peak of the season is in late September or early August. Earthquakes are a common occurrence in DR just as they are in California. Most of these earthquakes are a magnitude of 3 or less but can become fatal as the 1964 Dominican Republic earthquake that generated a tsunami and killed almost three thousand lives. All earthquakes in this region are generated by the Enriquillo fault that torment Haiti and the DR and is still active. Similar to California, is the chance for “the big one” to hit. Although not as severe as hurricanes per say, it is important to be aware of the fact that severe rainfall, thunder and wind could cause tremendous delays to schedule and even permanent damage to the structure is bad enough.

Safety Plan

Falls pose a moderate risk on this site. Although the building is only one-story, it does reach a height of above 10 feet, and as a safe practice, fall protection should be required. Struck-by accidents can occur in many ways but most common is overhead. This could be from tools if someone were working on scaffolding or the roof above a workspace. Hard hats should be worn until the building becomes fully enclosed and signs warning of a hard hat area are recommended. As equipment is maneuvering around the site, it is possible to strike a worker or pedestrian due to the many blind spots associated with these vehicles. A flagger should accompany such equipment so that there is a timely warning before a stuck-by occurs. Electrocution risk is also of moderate severity. Shock, burns, and possible death are all negative risks associated with electrical work. Electrical gloves and non-conductive clothing should be worn when running wire, and a fire extinguisher should be close by in case of fire. To ensure the safety of all workers, PPE should be worn at all times during the activities mentioned above until the building’s hard lid is installed. Typical PPE includes safety vest, hard hat, gloves, and safety glasses. Sturdy work boots, pants, and shirts with a minimum of seven-inch sleeves are also good recommendations. Safety harnesses should be worn by those doing work on the roof or scaffold and should be good quality to ensure they will not break when in use.

Site Logistics

A Site Logistics Plan is a well-formulated thought process on where certain temporary site structures and items should be. The building has a north/south orientation and the site slopes towards the east direction, so most straw wattle will be placed on the eastern side to prevent sediment pollution. Trucks will also enter through this eastern side where currently a dirt parking lot is already in place, material laydown will also be located here so that trucks

can offload in a timely manner. Dumpsters will be located next to the parking lot so that the off haul is easier. There will be two gates, one will be used more so for deliveries and heavy equipment access on the northeast side of the site while the south entrance gate will be for personnel. The jobsite trailer will also be located at this entrance so that it does not interfere with construction operations as well as be a main meeting point for any visitors on site. The exact location of the silt fence will be established onsite but should give ample room to move around the building footprint. Portable toilets are located on the northwest corner, away from construction and away from wind path.

Quantity Takeoff

The quantity takeoff was done by taking the completed Revit model, made by architect Griffin mostly, and then imported into Assemble, which is a cloud-based, collaborative takeoff software. I was able to do this through the help of BIM TA's David Acosta and Trey Garcia. Assemble was the clear choice in doing takeoffs because of its accuracy. There was a small learning curve when using Assemble, but once commands were figured out, it was easy to navigate. I began by toggling off miscellaneous structures that were not needed for the purpose of the takeoff. This also included topography and quite a large amount of concrete flatwork. Next, I was able to export an excel spreadsheet sorted in terms of category items, that listed quantity, unit, square footage, and volume. I then converted all square footages and volumes into square meters and cubic meters respectively.

Schedule

Two schedules were made for the purposes of this project. One is the overall project schedule and the other is the construction schedule. The schedules were completed using Microsoft Project. Originally, the building was meant to be constructed in two phases, with the break being at the gabion wall. This was decided by the architect because at the time it was unclear if there would be enough funding to include the negative pressure rooms. I advised against doing this, as it would be easier in the long run to construct everything as one building, and later retrofitting the rooms to become negative pressure should Mission Twenty-Five35 decide they want to procede with it. This is because the connections with the gabion wall are quite complex, and since the building is only one story, it would not make much of a difference in cost to build those rooms.

Conceptual Estimate

The Estimate was done with the help of Daniel with JI. A cost per square foot to build internationally was established at $40 per square foot. The estimate and schedule were by far the hardest parst of this project. A big factor in the cost estimate was finding cost conversions that could translate to the Dominican Republic. Not surprisingly, materials are much more expensive to procure in the DR, and this is probably the main hurdle when building anything in the region.

Feasibility Analysis

A feasibility analysis was the last delieverable I decided to work on since I wanted a completed estimate beforehand so that I could truly analysis whether the project would be feasibile or not. It was determined that the project would not be feasible as is. The project is simply too expensive so such a rural area that the project is based in. A clinic at this time is not feasible. I believe that continuing with the master plan would be the best option in this case.

Conclusion

What drew me to do my senior project with Journeyman International was the crave to go abroad and get a small taste of what it would be like to work on an international project. The interdisciplinary approach was also something I felt I was missing throughout my time here at Cal Poly. The workload was pretty moderate for being a senior project. The workload is very much dependent on your own personal work flow and very much leaves you responsible to yourself to uphold your own schedules and deadlines. Looking back, I do not think I would have applied to do a JI project as my senior project. Research based projects are more up to par with the workflow and subject matter that I am more comfortable doing. This project was definitely a step out of my comfort zone so that is a positive. Overall, this project helped my independence in doing project deliverables for preconstruction.

References

"Climate-Data.org." *Climate Taiga: Temperature, Climograph, Climate Table for Taiga - Climate-Data.org*, 9 Aug. 2015, en.climate-data.org/location/710182/.

"Dominican Republic Maps - Perry-Castañeda Map Collection - UT Library Online." *University of Texas Libraries*, legacy.lib.utexas.edu/maps/dominican_republic.html.

Guerra, Ari. "Hurricane Season and the Dominican Republic." *IHeartDR*, 4 Mar. 2018, www.iheartdr.com/hurricane-season-dominican-republic/.

Flowers, Jane. "Earthquakes; Could the Dominican Republic Be under Threat by a Massive Quake?" *Blasting News*, Blasting Sagl, 27 Feb. 2017, us.blastingnews.com/world/2017/02/earthquakes-could-the-dominican-republic-be-under-threat-by-a-massive-quake-001505517.html.