STRUCTURAL ENGINEERING- INFRASTRUCTURE DESIGN (CAD) OF COMMUNITY WATER SYSTEMS IN NICARAGUA

Implement structural engineering concepts to design and select materials for water projects such as water tanks, cisterns, control booths, and underground pump stations in Nicaragua.

PROGRAM DESCRIPTION

Our bilingual on-the-ground engineers guide students and local leaders in the mechanics of a sustainable development project: community selection, local buy-in, needs/assets mapping, project scoping, and ultimately design. The final deliverable includes a presentation to community leaders of a proposed design and budget for the infrastructure project. In addition to our skill-based learning objectives, building cultural competence is integrated into the course to increase the quality of services and improve outcomes with community partners.

LEARNING OUTCOMES

- Discuss issues impacting the access to clean water and sanitation in rural communities in a developing country.
- Analyze and assess the community's water and sanitation needs that impact the community's health and wellbeing.
- Learn to resolve technical engineering challenges related to water system design and implementation in a different cultural context.
- Use CAD design software to prepare a sketch of a water tank for a water system.
- Develop a budget and proposal for the water system plan.
- Prepare and present a water system plan to the community water committee.

PROGRAM OVERVIEW

MODULE 1: Introductions and Organization Overview

Our Facilitator provides an overview of Squads Abroad (SA), our parent organization, Global Brigades (GB), and its Water, Sanitation & Hygiene (WASH) program. A facilitated discussion on the country of Honduras or Nicaragua and how public infrastructure improvements fit within the holistic model and UN Sustainable Development goals. **Self-paced activity:** Group reviews presentation on the WASH programs (water, sanitation, and hygiene).

MODULE 2: Community Context, Current Infrastructure Challenges, and Opportunities

Introduction to the community including profile, region, and map coordinates. The facilitator describes the major infrastructure challenge (i.e. a broken bridge) and the opportunities created by a repair. **Self-paced activity:** Students research the recent hurricanes and their effect on infrastructure in rural communities in Honduras and Nicaragua.

MODULE 3: Meeting Community Leaders

Facilitator leads a video introduction with Community Leaders to introduce themselves and learn about the challenge directly from community members. **Self-paced activity:** Students review the infrastructure challenge in their selected community, testimonials from community members, and results of previous visits.

MODULE 4: Technician Site Visit 1: Assessing Infrastructure Site

Virtual field visit: recording of a technician in the community showing the details for the current location of the infrastructure challenges within the context of the community. **Self-paced activity:** analyzing the situation of each community's condition and assess potential solutions for each case.

MODULE 5: Technical Training: GPS Mapping

Facilitator demonstrates GPS Mapping software so that students will be able to use it as a resource for their project. **Self-paced activity:** identify the nearest town from the households in order to deliver construction materials and feasibility of each project. Reading about how maps can empower people, communities and help NGOs: https://www.giscloud.com/blog/improving-non-governmental-and-non-profit-organizations-through-smart-mapping-solutions/

MODULE 6: Construction Material Assessment

Local engineer discusses various building materials unique to the region weighing the pros and cons of the options as it relates to price, durability, and ease of construction. **Self-paced activity:** Students begin considering proposals of the best material options to use on each construction project.

MODULE 7: Technical Training: Design Software

Facilitator demonstrates design software (AutoCAD) so that students will be able to knowledgeably use it as a resource for their project. **Self-paced activity:** Students continue familiarizing themselves with AutoCAD on their own.

MODULE 8: Technician Site Visit 2: Preliminary Charting

Group begins charting where they plan to replace any infrastructure and analyze the data to start the design phase. **Self-paced activity:** Students split up into teams of 4-6 volunteers to begin planning the remodel.

MODULE 9: Working Session with Engineer 1: Project Design

Group has a working session with the engineer to provide feedback and guidance on their project. **Self-paced activity:** Based on the engineer's feedback, volunteers edit the remodel design and begin working on their presentation for the community leaders.

MODULE 10: Working Session with Engineer 2: Budget Anlaysis

Working session with our Engineer to discuss the budget of the project and the community's financing options. Findings to be assembled in a Spanish PowerPoint presentation of the project to be shown by the SA team to the Community Leaders. **Self-paced activity:** Based on the engineer's feedback, volunteers edit designs and prepare the final presentation for the community with a script to be translated by the SA facilitator.

MODULE 11: Infrastructure Design and Budget Review

Teams submit the video presentation along with designs to the SA facilitator for translation and final review. **Self-paced activity:** Based on the engineer's feedback, volunteers edit designs and prepare the final presentation for the community with a script to be translated by the SA facilitator.

MODULE 12: Practice Presentation to the Engineer

The presentation is presented to our Engineer to receive feedback. SA facilitator provides feedback on any proposed edits or additionsl. **Self-paced activity:** Group makes any changes to the design based on feedback from our Engineer.

MODULE 13: Presentation to the Community

The presentation is delivered to the community to receive feedback. SA facilitator provides an overview of the project's next steps toward construction and the cost recovery model. **Self-paced activity:** Group makes any changes to the design based on feedback from the community.

MODULE 14: Data Impact Reporting, Post-Project Follow Up and Reflections

Facilitator explains ongoing follow-up with the project and presents the impact of the project. SA facilitator guides a reflection with the group and a Q & A about the usefulness of the project. The group is encouraged to advocate and help raise funds to implement the project. **Self-paced activity:**Receive a certificate of completion.