

## Villanova University Capstone Design Course

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Undergraduate civil engineering programs at many universities across the United States incorporate within their curricula a senior year Capstone design course. In most cases, the course involves a design project that is based on a real-world engineering problem. Typically, however, students do not get the opportunity to participate in the construction of their designs. Recently, civil engineering students in a senior Capstone design course at Villanova University had an opportunity to travel to a third-world country and build their design while being exposed to a culture and society far different from their own. The students designed and constructed a reinforced concrete cross for a Catholic orphanage in Honduras.

Amigos de Jesus, a Catholic orphanage located in Posas Verdas, Honduras, offers a refuge for abandoned and abused boys. Under construction since early 1999, the orphanage currently houses seven boys of ages five to twelve. Once completed, the orphanage will have the capacity to house more than 30 boys.

In December 1999, Anthony Granese, a Villanova alumnus, approached the College of Engineering with the idea of having students build a concrete cross for the orphanage. At that time, Drs. Dinehart and Gross saw the possibility of incorporating the cross design into the senior level Capstone design project. Plans were quickly made to focus the Capstone course around the design and construction of the 25-ft tall reinforced concrete cross. Over the next two months, Villanova civil engineering students would design the cross using real world constraints, travel to Honduras to participate in the construction of the cross, and prepare project reports and oral presentations to culminate the experience within the context of the course.

Students were required to design both the cross and its foundation, and prepared detailed design drawings for each. The project featured several unique design aspects. The concrete was made using local aggregates and mixed by hand on site by Honduran workers as opposed to by concrete mixer. Because of poor mineralogical characteristics and the process used, the concrete strength was found to be extremely low (2 ksi). Early in the course, students tested concrete cylinders and steel reinforcement samples that had been shipped from the orphanage site to determine the material properties for design. Throughout the design process, students used American building and design codes such as ACI 318 and BOCA for their design methodologies, but adapted certain provisions to the local conditions in Honduras. Students also had to account for the location of the site in determining loads for the cross and foundation; the area in Western Honduras is in an active seismic region and despite being well inland, the potential for strong winds from hurricanes and tropical storms also exists.

Over spring break, a group of four students from the senior Capstone course, four students from the junior level Struc-

tural Design course, and Drs. Dinehart and Gross made the trip to Honduras. Three other students were involved in the Capstone design, but were unable to make the trip. Over a one week period, the group partnered with local Honduran workers in building and erecting formwork and scaffolding for the construction of the cross. (The foundation had been constructed the week before the group arrived.) Forms for the cross were constructed in the on-site shop using sheet metal, and scaffolding was constructed from lumber cut by hand from trees. Students and local workers also hauled all of the aggregates and portland cement required for construction to the cross site, which was located at the top of a 75-ft high hill overlooking the orphanage. On the final day of the effort, the entire cross was poured using the hand-mixed concrete. Over the course of the week, the students had the invaluable opportunity to see their design come to life, and to better understand the correlation between the engineering design and construction processes.

Service-oriented learning is at the core of the mission of Villanova University, but rarely can it be combined with a technical-learning experience as was possible in this project. Aside from the chance to see their design constructed, the students making the trip also had the opportunity to travel to a third-world country. Students were able to interact with the children of the orphanage and with the local workers, and learn about the local culture. The group was also able to better understand the impact that civil engineering projects, however large or small, can have on people.

Because of the success of the project, Drs. Dinehart and Gross plan to continue incorporating third-world service projects into the senior Capstone design course. Currently, there are plans to return to Honduras in 2001 to build a small reinforced concrete structure that would function as a chapel and guest house. These projects provide a unique set of circumstances that must be considered during both the design and construction phases, and give students a unique opportunity to see their Capstone design become reality. Furthermore, these projects offer a valuable chance for students to learn more about themselves and others, while providing an opportunity to better themselves through a service-oriented experience in a third-world country.

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## Scalzi Research Award Nominations being Accepted

The Masonry Society (TMS) is accepting nominations for the Scalzi Research Award. This award, named after Dr. John B. Scalzi of the National Science Foundation, is presented annually by The Masonry Society to honor an individual who has made an outstanding, lifetime contribution to masonry research.

To nominate someone for the award, a brief statement of why the candidate should be considered for the award should be sent to The Masonry Society (3970 Broadway, Suite 201-D, Boulder, CO 80304-1135) along with the candidate's resume summarizing their life-long contributions to masonry research. Applications must be submitted to TMS no later than July 1, 2001. Awards will be made at the TMS Annual Meeting in October of 2001 in St. Louis, MO.