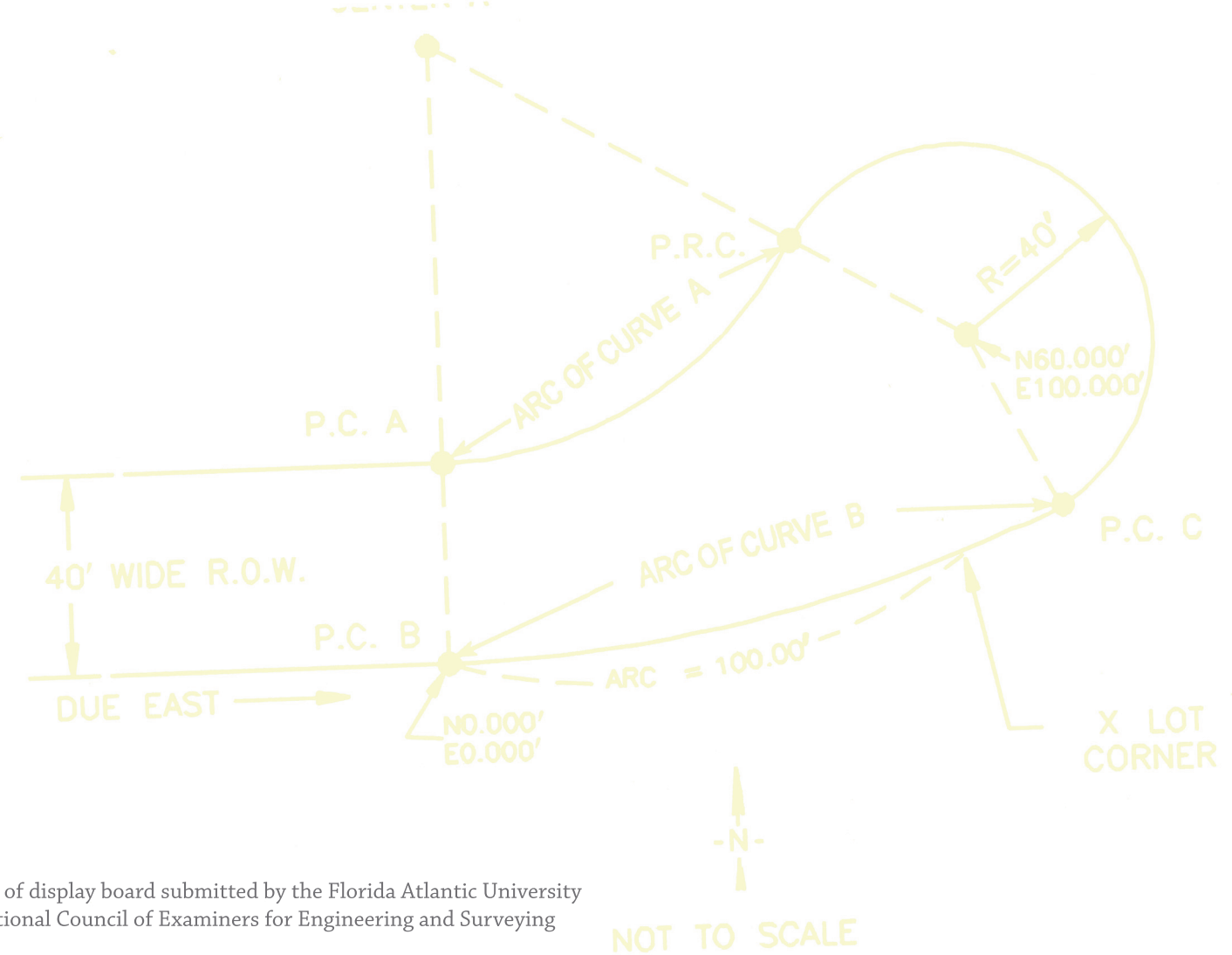
Engage. Enrich. Inspire.

NCEES Engineering Award 2012

Connecting Professional Practice and Education

NCEES

advancing licensure for engineers and surveyors



Cover art: Details of display board submitted by the Florida Atlantic University

2012 NCEES ENGINEERING AWARD

Engage. Enrich. Inspire.

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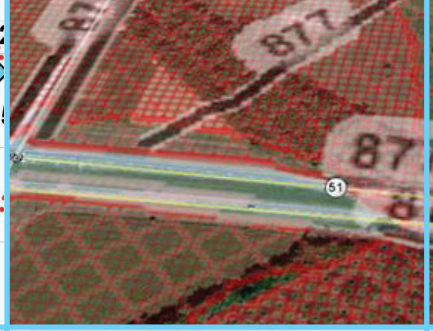
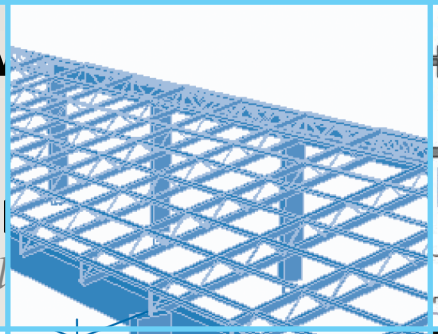
$25,000 GRAND PRIZE

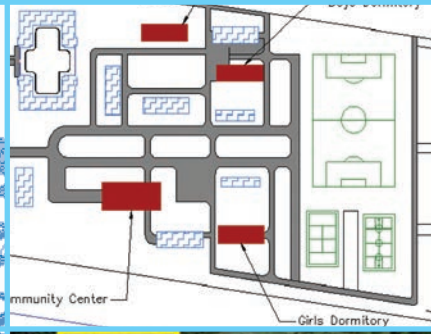
$7,500 AWARDS

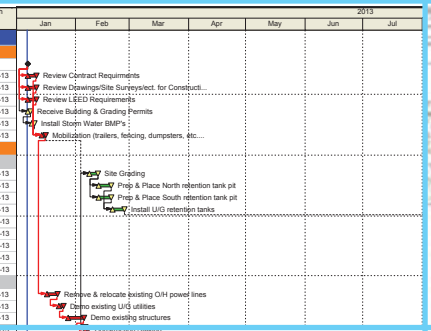


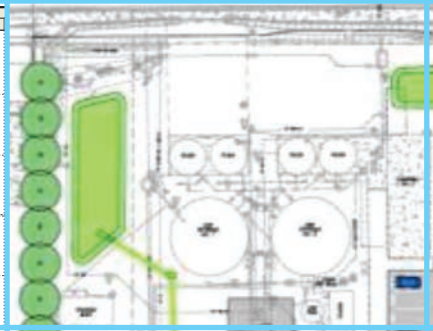
Florida Atlantic Univ
the City of Dania Be

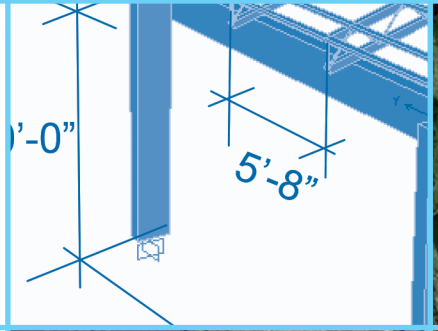
Fred Bloetscher, Ph.D., P.E. ,
Department of Civil, Environmental

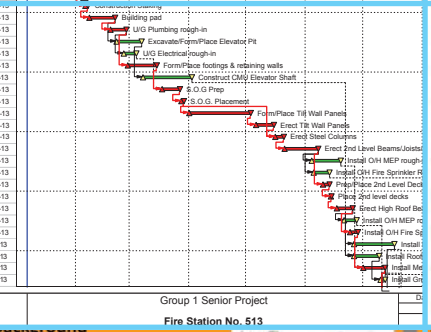


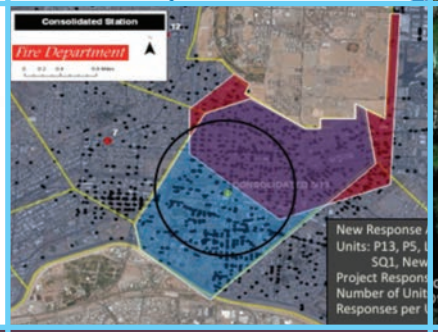


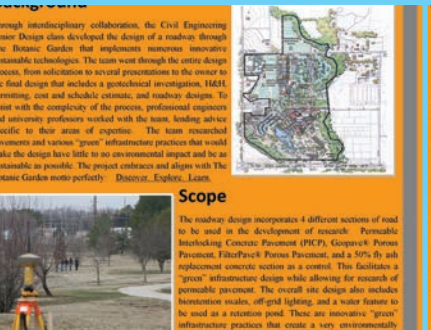


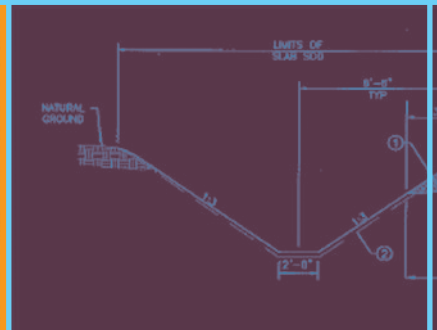


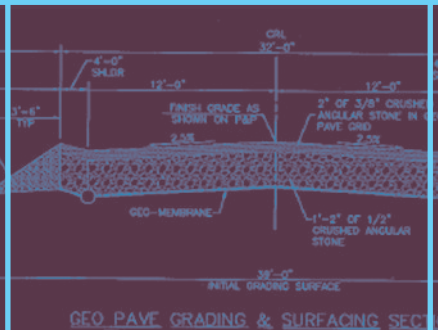


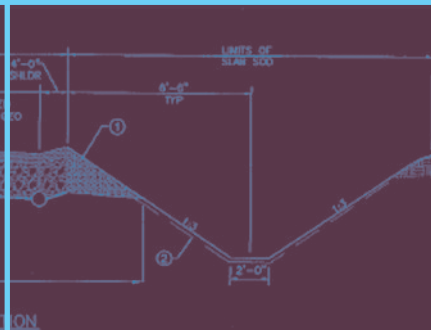












PRESIDENT'S MESSAGE

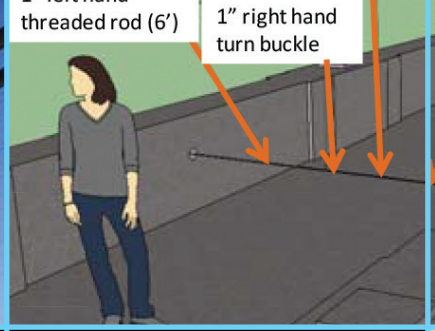
The NCEES Engineering Award was launched in 2009 to recognize projects that engage students in collaborative activities with professional engineers. Advancing licensure for engineers is a key part of the NCEES mission, and working with professional engineers helps students understand how licensure—with its emphasis on technical competency and ethical practice—can impact their individual careers and, more importantly, protect the American public.

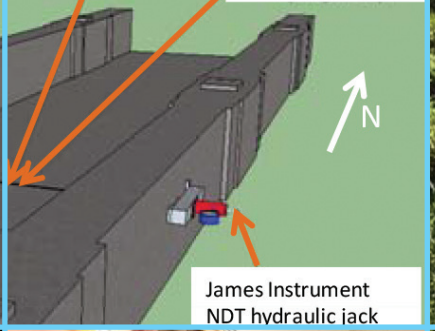
We at NCEES thank the students, faculty, and practitioners who took part in this year's projects, and we applaud their efforts to connect professional practice and education. The entries covered a wide range of engineering disciplines—from civil and mechanical to chemical and fire protection engineering—and it's great to see so many different branches of engineering focusing on inspiring the next generation of professional engineers. Our special thanks, also, to the jury members for giving their time and expertise to support this initiative.

NCEES has published this book to recognize the 2012 winners, and we hope these projects will serve as models for other engineering programs to develop collaborations with the professional engineering community.

Gene Dinkins

Gene Dinkins, P.E., P.L.S.
2012–13 NCEES President


threaded rod (6')
1" right hand
turn buckle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James Instrument
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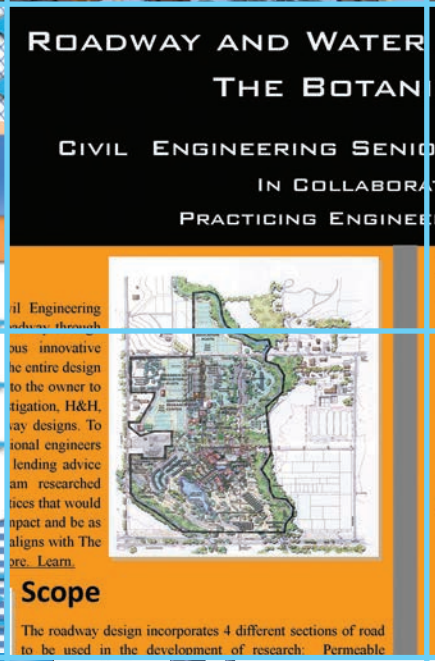
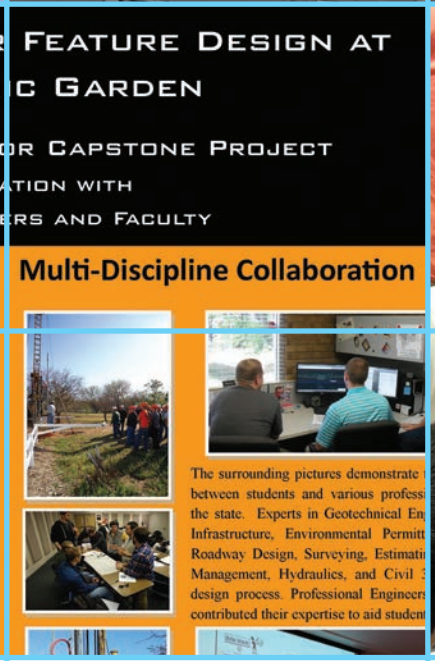
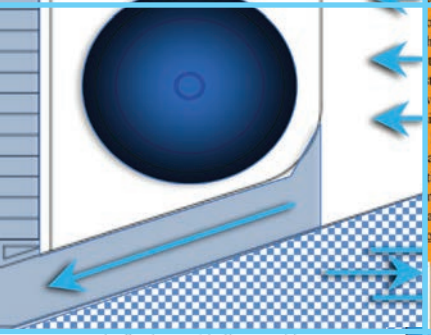
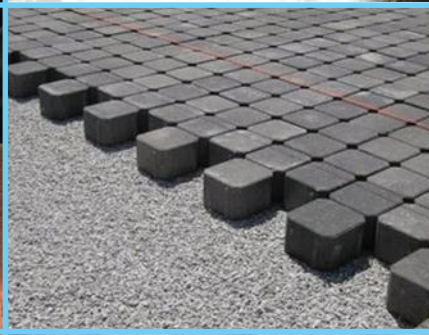
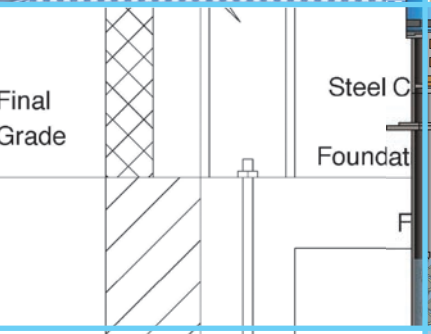

ROADWAY AND WATER FEATURE DESIGN AT
THE BOTANIC GARDEN
CIVIL ENGINEERING SENIOR CAPSTONE PROJECT
IN COLLABORATION WITH
PRACTICING ENGINEERS AND FACULTY
Scope
The roadway design incorporates 4 different sections of road


Multi-Discipline Collaboration
The surrounding pictures demonstrate
between students and various profess
the state. Experts in Geotechnical En
Infrastructure, Environmental Permitt
Roadway Design, Surveying, Estimati
Management, Hydraulics, and Civil
design process. Professional Engineers
contributed their expertise to aid student



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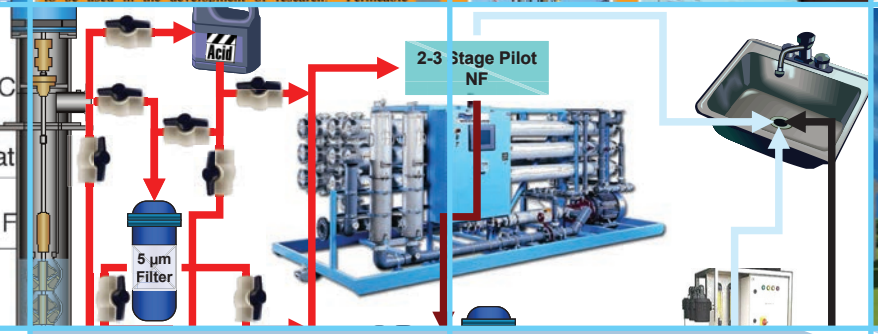
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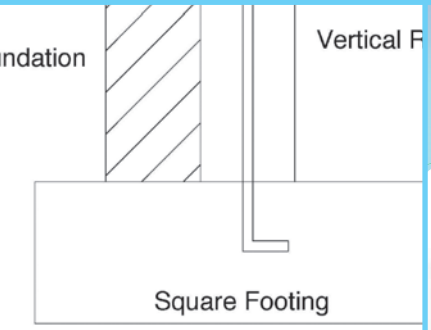
2-3 Stage Pilot
NF
5 µm
Filter


ndation
Vertical F
Square Footing


MAJI FOR MASAERA
REHABILITATION
MADE IRRIGATION
Background
Junction 1 Repair

ABOUT THE AWARD

The NCEES Engineering Award was established to promote understanding of the value of licensure and to encourage collaboration between the engineering profession and education.

Academic programs accredited by the Engineering Accreditation Commission of ABET were invited to submit projects that demonstrate a meaningful partnership between professional practice and education. The competition was open to programs from all engineering disciplines.

Projects did not have to offer academic credit, but they were required to meet other eligibility requirements. The projects had to be in progress or completed by March 15, 2012. If a project had been entered in a previous award cycle, the engineering program was required to explain how the project had been further developed since the previous submission.

The NCEES Engineering Award jury met in Clemson, South Carolina, on May 31, 2012, to conduct a blind judging of the 30 entries. Each submission consisted of a display board, abstract, and project description. These materials were sent electronically for the jury to review prior to the judging and were also available at the judging.

The jury considered the following criteria in its deliberations:

- Successful collaboration of faculty, students, and licensed professional engineers
- Benefit to public health, safety, and welfare
- Knowledge or skills gained
- Multidiscipline and/or allied profession participation
- Effectiveness of abstract, project description, and display board

The jury selected Florida Atlantic University Department of Civil, Environmental, and Geomatics Engineering to receive the $25,000 grand prize. The jury chose five additional winners to each receive $7,500 awards.


Erosion and Sediment Transport in
Calcasieu Ship Channel
Abstract
Sources

2012 NCEES ENGINEERING AWARD JURY

Norma Jean Mattei, Ph.D., P.E., Jury Chair
Interim Dean of the College of Engineering
University of New Orleans

Roger Helgoth, P.E.
Nebraska Board of Engineers and Architects

James Purcell, P.E.
New Jersey State Board of Professional Engineers and Land Surveyors

Robert Zahl, P.E.
Oklahoma State Board of Licensure for Professional Engineers and Land Surveyors

John English, Ph.D., P.E.
Dean of the College of Engineering
Kansas State University

Sunil Saigal, Ph.D., P.E.
Dean of the Newark College of Engineering
New Jersey Institute of Technology

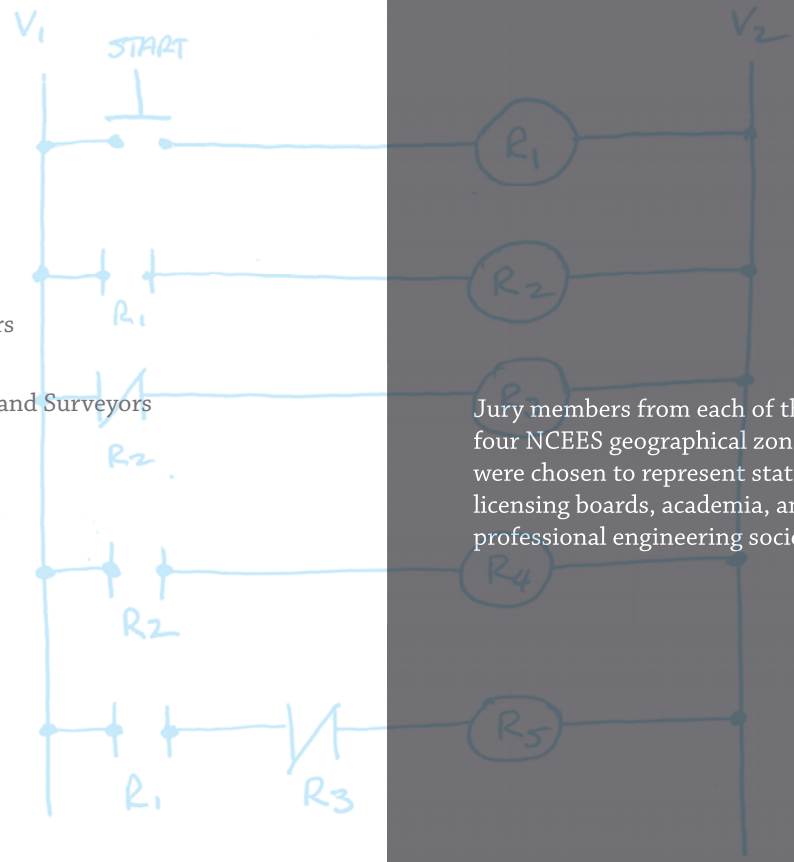
Indira Chatterjee, Ph.D.
Associate Dean of the College of Engineering
University of Nevada, Reno

Nadim Aziz, Ph.D.
Member
American Society for Engineering Education

Bernard Berson, P.E., L.S.
Past President
National Society of Professional Engineers

Lance Hoboy, MBA, CAE
Managing Director for Planning and Operations, Chief Financial Officer
ABET

Richard Wright, Ph.D., P.E.
Member
National Academy of Engineering



Jury members from each of the four NCEES geographical zones were chosen to represent state licensing boards, academia, and professional engineering societies.


PLAN SPECIFICATIONS
PARKING LOT
LANDSCAPING
PICNIC AREA
GAZEBO
IRRIGATION
LIGHTING

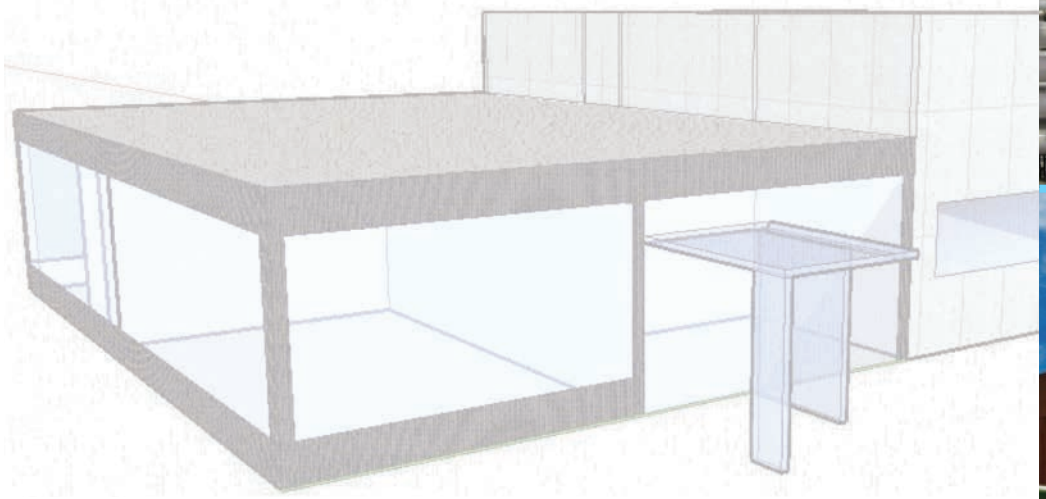
2012 NCEES Engineering Award

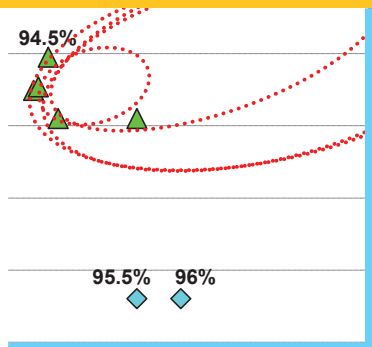
$25,000 GRAND PRIZE WINNER

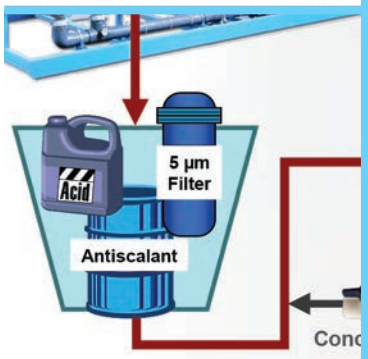
Florida Atlantic University

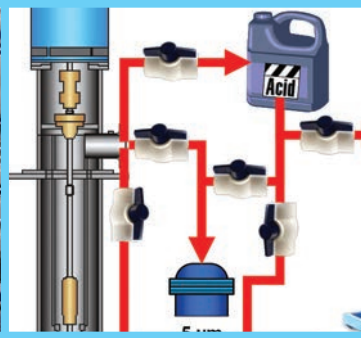
Department of Civil, Environmental, and Geomatics Engineering

Dania Beach Nanofiltration Plant Expansion









$25,000 GRAND PRIZE

PARTICIPANTS

Students
George Beck
Troy Bishop
Cory Blake
Lina Comacho
Paula Fonseca
Linda Hess
Luis Itturalde
Chris Masters
Adrianna Toro

Faculty
Frederick Bloetscher, Ph.D., P.E.
Daniel Meeroff, Ph.D., E.I.
Albert Muniz, P.E.

Professional Engineers
CDM Smith
Jonathan Goldman, P.E.
Curt Keifer, P.E.
Tim O'Neil, P.E.

City of Dania Beach
Dominic Orlando, P.E.

Additional Participants
CDM Smith
Michael Alford, AIA, LEED AP
Ron Dare
Tom Hempstead
Dave Urquart

City of Dania Beach
James Baker

Florida Atlantic University

Department of Civil, Environmental, and Geomatics Engineering

Dania Beach Nanofiltration Plant Expansion

ABSTRACT

Faced with continuing growth and redevelopment, increased water demand, an aging lime softening plant, and issues meeting the disinfection by-product standard, the city of Dania Beach, Florida, needed to upgrade its water treatment plant.

Through an industry partnership, the university and the city's engineer collaborated with the city of Dania Beach to create the design for a new 2.0 mgd nanofiltration process to complement the city's existing 3.0 MGD conventional lime softening water treatment plant. This was no ordinary design. The students at the university asked the question, why can't we design a LEED certified "green" water treatment plant? Then, the city got excited about the prospect, too. So the students developed an innovative membrane treatment plant concept that would be a high-performance facility in terms of energy efficiency, indoor air quality, solid waste management, and water use conservation.

At the same time, the plant was designed to maximize system recovery while providing a high degree of operating flexibility. This was accomplished with a two-stage nanofiltration unit followed by a convertible third- and fourth-stage reverse osmosis unit to provide the city with the flexibility to meet its concentrate discharge limits when operating at industry-leading recoveries of up to 95 percent by operating in a four-stage configuration. The ability to operate at this previously unattainable higher recovery was tested by faculty and students. The senior civil engineering undergraduate students also provided preliminary design concepts that were used by the design professionals to actually construct this project, including LEED certification documents and specifications.

On March 27, 2012, the new City of Dania Beach Nanofiltration Plant officially opened, and the project team submitted documentation to become the first LEED Gold certified water treatment plant in the world.

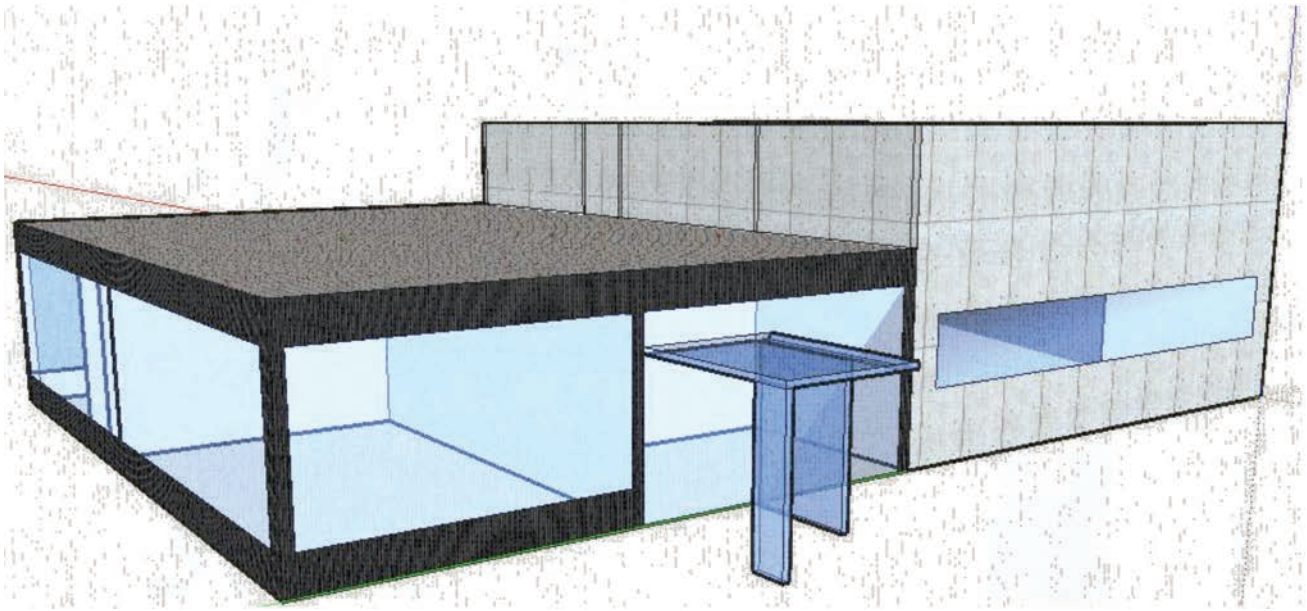
JURY COMMENTS

"This was a great project because the students took it from concept through construction and obtaining LEED Gold certification."

"Awesome project. The health and safety of the public were really enhanced by the project results."

"The involvement of students with professional engineers from concept to project completion were an excellent learning experience for students."

PERSPECTIVES ON



The benefit to the health, safety, and welfare of the public

The basis of the project was to develop higher quality water for the residents of the city of Dania Beach using a sustainable and cost effective approach. Safe drinking water is a public health, safety, and welfare issue and is a basic service required for its customers. The city was relying heavily on Broward County water supplies, which could not be adequately treated with the current lime softening system. A new treatment process was needed.

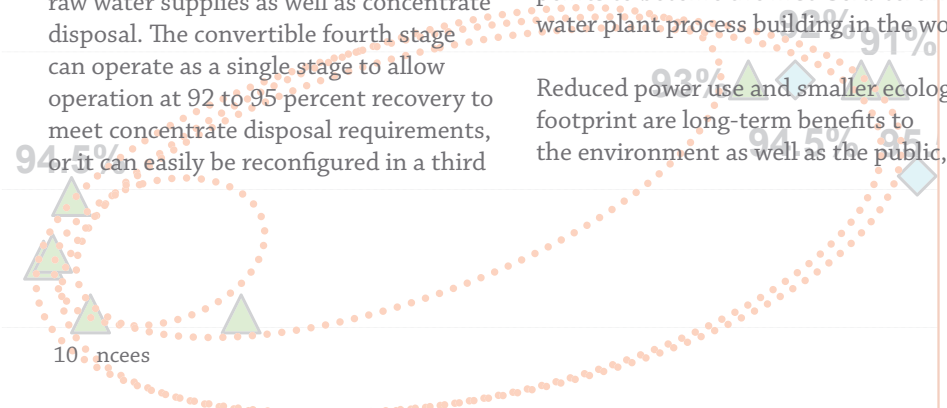
A hybrid nanofiltration with existing lime softening designed by a unique partnership of students and professionals resolved the troublesome water quality and cost concerns. The novel approach also reduced the chemical costs for both processes (less lime for hardness removal, less chemicals for stabilization of nanofiltered product water). An innovative membrane system design consisting of a three-stage nanofiltration membrane system with a convertible fourth stage reverse osmosis unit was developed by the students and engineering team to provide the city with the flexibility to operate at higher system recoveries to minimize costs for raw water supplies as well as concentrate disposal. The convertible fourth stage can operate as a single stage to allow operation at 92 to 95 percent recovery to meet concentrate disposal requirements, or it can easily be reconfigured in a third and fourth stage 2:1 array to maximize system recovery to reduce operating costs—something never done before. This protects limited water supplies for the public and future benefit.

The students showed the pathway to LEED certification; the design and construction process involving the engineer and the university students submitted documentation for enough points to become the first Gold-certified water plant process building in the world.

Reduced power use and smaller ecological footprint are long-term benefits to the environment as well as the public, and the facility is set up to educate the community on water consumption and energy efficiency.

Multidiscipline or allied profession participation

Many parties were instrumental in the design and construction of the new water treatment facility for the city of Dania Beach. The university included three faculty members (two professional engineers and one engineer intern) and nine students in the process. The engineering firm included four professional engineers, plus construction personnel. The city team included one professional engineer and operations staff. Each brought a particular perspective and skill set to the project. Solving the pilot testing, concentrate minimization, and LEED issues are all problems that the students provided significant input to. The interaction between parties was positive, and the student concepts were by-and-large incorporated in the final result, leading to the success of the facility, which has won both the U.S. EPA award for sustainable infrastructure and a Florida Institute of Consulting Engineers design award.



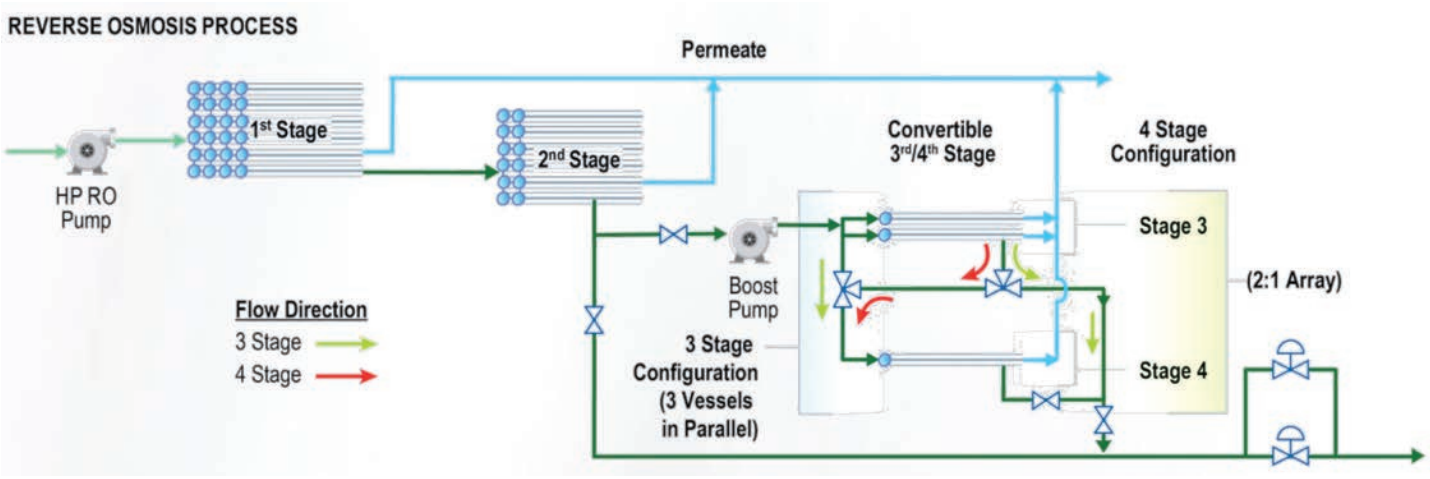
Frederick Bloetscher, Ph.D., P.E.
Daniel Meeroff, Ph.D., E.I.
Associate professors, FAU Department of Civil, Environmental, and Geomatics Engineering

This project was part of a capstone design course. What do real-world projects bring to the course?
Bloetscher: Our objective with the capstone design class is to expose students to a real-world problem for which they need to acquire the information necessary to complete the project. Having a real-world project means the students must talk to the real-world client, figure out what they want, visit the proposed sites, establish goals, and plan the work. The students learn a lot from these interactions.

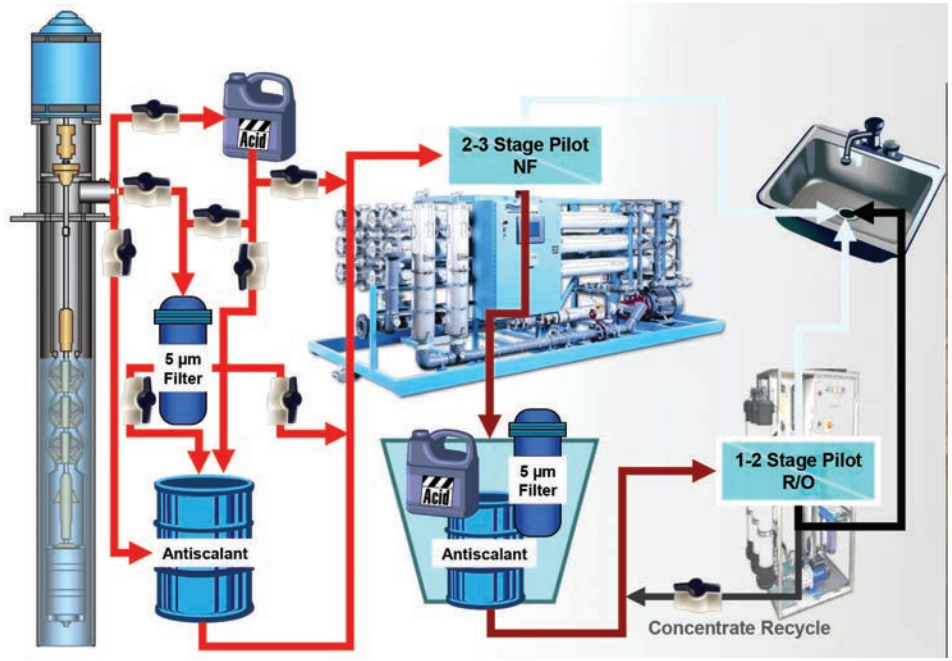
Our class is very intensive: students apply all prior classwork but advance it to a real application. This includes meeting codes and zoning (they must talk to the local regulatory agencies). They must acquire data for an environmental assessment, understand green buildings, and search for appropriate construction techniques. None of this is class-based learning, but it is all required for the real world. The opportunity allows our students to gain experience while learning.

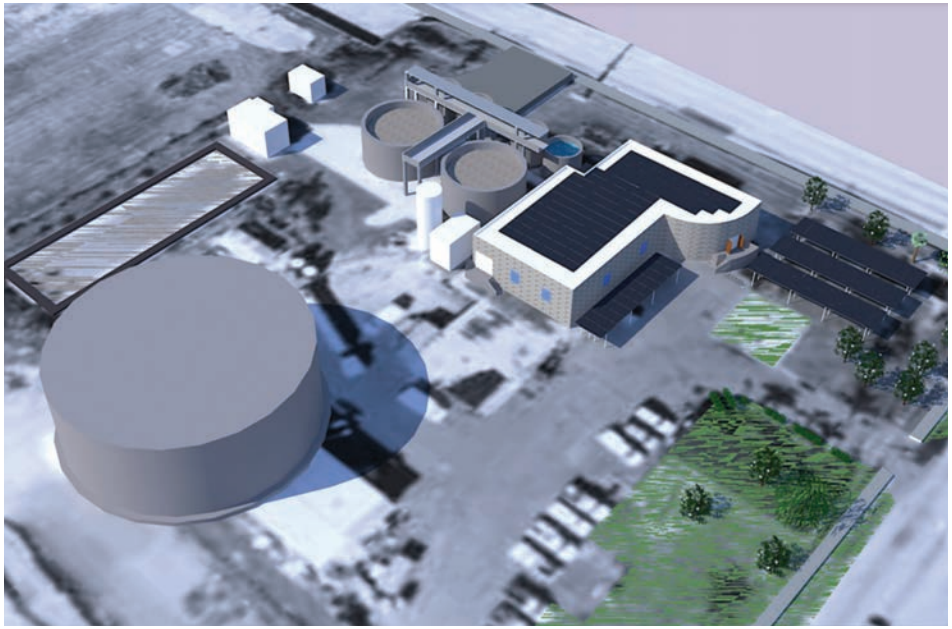
Meeroff: As a two-semester design class, the capstone design course has the goal of encouraging students to use creativity and teamwork to solve complex, real-world problems in the local community. Included are elements of fundamental coursework taken prior to the senior year: structural analysis, steel and concrete design, surveying, geotechnical, foundations, environmental, transportation, and drainage. The class typically involves the design of a building, with ancillary issues such as environmental impacts, transportation needs, hurricane resiliency, historical preservation, and multiple uses. All buildings designed during this course are required to emphasize green features and minimize environmental impacts.

Civil Design I requires students to perform a needs assessment for the project, develop a scope of work, perform site reconnaissance, and develop a floor plan and site plan. In Civil Design II, the students are required to have their plans approved by a professional engineer and then must take their project from a conceptual stage to a set of preliminary design drawings with all the calculations and support documents. Students make 12–13 presentations on the progress of the design, culminating with presentations to the department advisory committee, invited professionals, and interested stakeholders.



Florida Atlantic University





The intent is to allow students to transition from purely academic work to solving actual problems in a more real-world setting. Students thus become active participants in developing a healthy environment for our future by learning how to practice responsible environmental stewardship in design of long-lasting structures. This way, they will be better prepared to deal with a world with a doubling human population, increasing political conflict, mass species extinction, global climate change, and increasing economic and social inequities.

How do you decide which projects to work on?

Bloetscher: It varies, depending on available options. The projects must be fairly complex on some level, but that complexity varies: transportation, historical districts, architectural limitations, environmental issues, limitations on power, etc. No two projects are the same, but two teams will do the same project for contrast and comparison purposes. In this case, the city had planned the water plant for some time. There were some interesting aspects that needed to be studied. It seemed like the city/FAU/CDM Smith teaming to have the university study concentrate maximization, power options, and LEED certification were apt uses of student time but required integration with the larger design aspects. The more innovative the solutions are, the more likely the students can contribute because they are not encumbered with the "Standards."

Meeroff: The real world is an incredibly rich source of engineering design projects. The class is offered twice per year and tries to address both local community and campus issues of a civil engineering nature. In order to use a community project for the class, the following items are required:

1. Building program (square footage of various required functions for the building); buildings for the class must be multistory
2. AutoCAD file (location of existing utilities, existing building footprints, site location boundaries, etc.)
3. Soil analysis (site-specific water table levels, soil bearing capacity, soil types, depth of rock, number of blows, etc., probably to 40 ft. deep)

Typically, the projects come from city and county planning departments, community redevelopment agencies, and industry contacts. The projects tend to involve some complex design aspects such as hurricane resiliency, historical preservation, high performance energy efficiency, zoning restrictions, stormwater discharge limitations, and innovative design. In the case of the Dania Beach water treatment plant, Dr. Bloetscher and I worked on several small water quality studies at the facility. Then, we conducted a graduate research project at the site. Finally, we became involved in the future planning for an expansion of the facility, and then we created the project for our students to design the first LEED-certified water treatment plant in the world.

How did this project prepare students for professional practice?

Meeroff: First, the course itself allows the students to explore the real-world aspects of engineering design from the

perspective of a consulting engineer. They learn to be creative, to conduct site evaluations, to write engineering proposals, to present their work, to be ethical, and to be professional. Moreover, membrane filtration is becoming a mainstream technology for potable water treatment, particularly in Florida, so students got exposed to the design process and pilot testing for this type of technology, which they will deal with in their careers. Also, the aspects of LEED for designing a high performance facility with innovations for energy efficiency allowed the students to stretch the boundaries of their creative imaginations for solving complex problems.

Bloetscher: Nanofiltration plants are being built around south Florida. Students do not get exposed to this type of technology in the classroom, as there simply is not enough time to spend on in. However, if students were looking at careers with power, green buildings, or water treatment, which most of the students involved were, this was a great opportunity to get into the details of a very innovative project. The students contributed heavily to the innovation. They showed the professionals the way to Gold.

What was the biggest challenge on this project?

Bloetscher: Getting the students to talk to the client or consultants. They are not used to doing this. They prefer email and people they are comfortable with. The team on site was old school. But once communication happened, it was great.

Meeroff: Working together in a team setting and involving the outside professionals like the client and the consulting engineers and vendors. The other difficult part for students is the realization that there is no "correct answer" in projects like these.

What advice do you have for other programs wanting to add similar collaborative projects to their curriculum?

Bloetscher: Two things. First, set the bar high. Students will achieve the solutions if the expectations are clear. Simple projects do not challenge students. Hard projects make them learn, but it is subjects they are interested in. They spend time and learn a lot. Our capstone class is consistently the class all of the graduates say is the best class they take. It's setting the expectations high and demanding the students meet those expectations. This takes time and some dedication. It cannot be done part-time.

Second, make use of contacts in the community. Cultivate them. Find engineers and owners who may be interested in the perspective of students. We have graduated students for eight years, and we have people asking us if we can help them with their projects. Interface of faculty to the community is required.

Meeroff: Don't be afraid, but be ready to work. Managing this class is extremely time consuming, but the rewards are fantastic. Whenever you can involve the outside design professionals with students, the results are nothing less than amazing. This is why the course is consistently ranked as the students' favorite since Dr. Bloetscher and I took over the capstone class in 2005.

How does FAU plan to use its $25,000 prize?

Bloetscher: Our department chair suggests we reinvest the money in tools for the capstone class.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2012 NCEES Engineering Award

$7,500 WINNERS

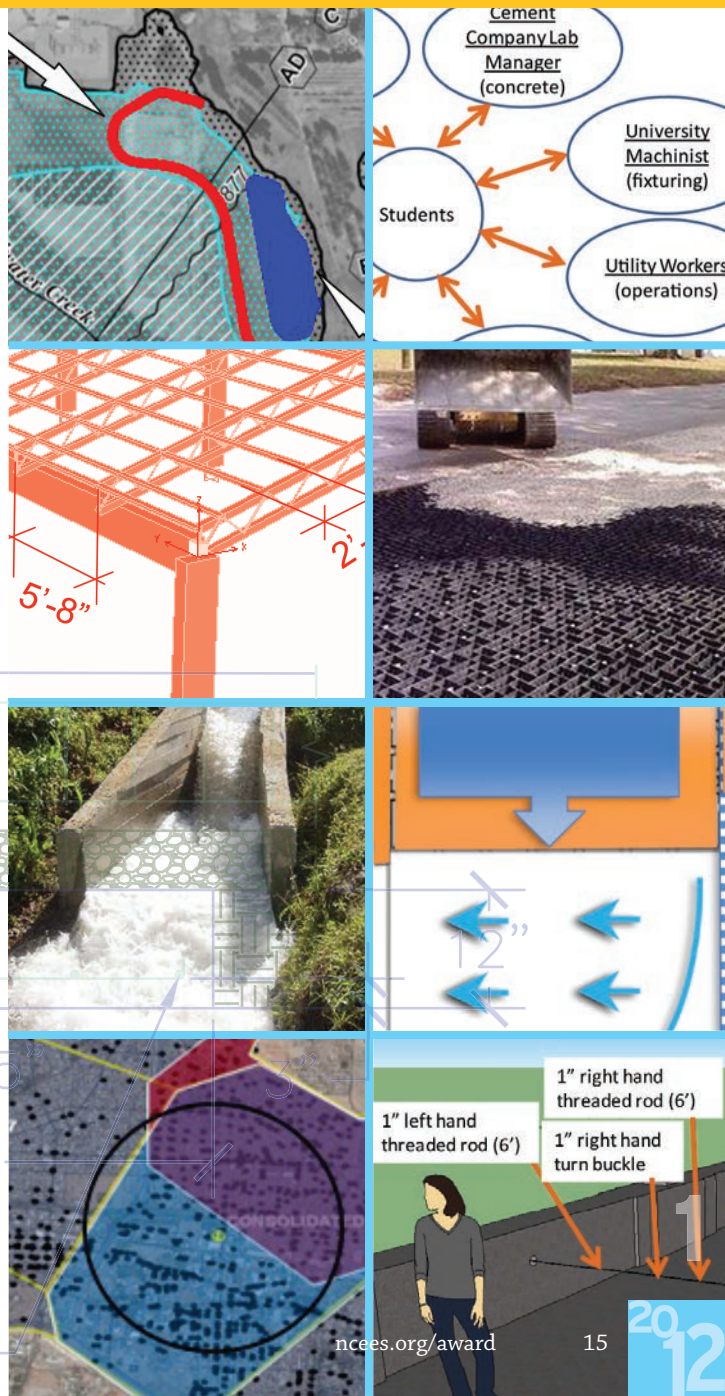
Oklahoma State University
School of Civil and Environmental Engineering
Roadway and Water Feature Design at the Botanic Garden

Seattle University
Department of Civil and Environmental Engineering
Design of an Orphanage, Learning and Community Center in Ethiopia

Seattle University
Department of Civil and Environmental Engineering
Historic Dam Guardrail and Vehicle Barrier Retrofit for Public Safety

University of Texas at El Paso
Department of Civil Engineering
Multidisciplinary Smart Design of Fire Station 513

Valparaiso University
College of Engineering
Maji for Masaera: Rehabilitation of a Man-Made Irrigation Canal



$7,500 AWARD

PARTICIPANTS

Students
Olugbemi Agbetunsin
Colby Bachman
Jacob Burton
Daniel Cook
Josh Griffin
Zach Keith
Matt Kennedy
Bobby Painter
Eric Scott
Richmond Slocombe

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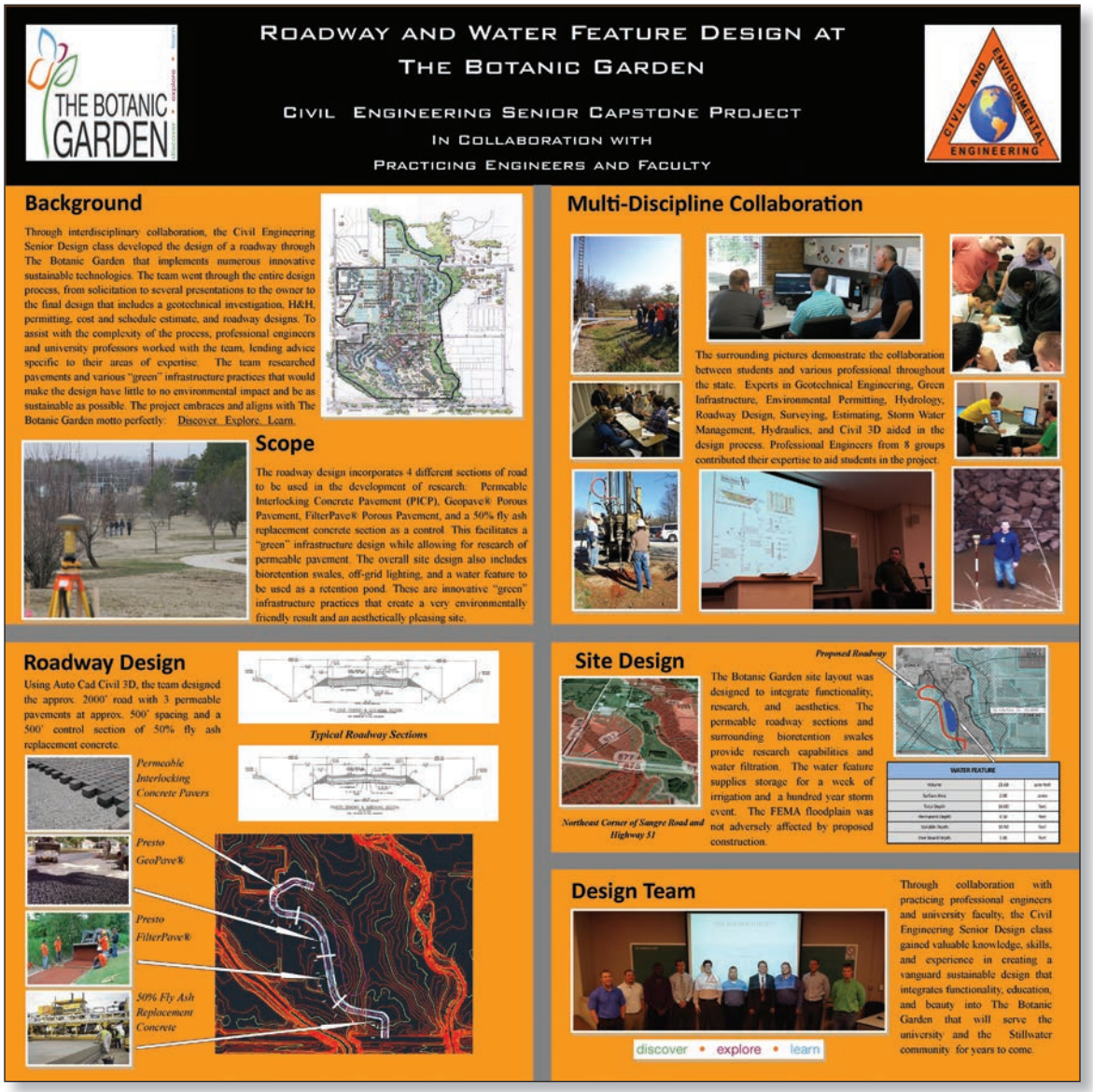
Joseph Echelle, P.E.
Garry Gregory, Ph.D., P.E.
Phil Lewis, Ph.D., P.E.
Dale Maronek, Ph.D.
Nick Nelson, ASLA, LEED AP

Professional Engineers and Engineer Interns
Michelle Barnett, P.E.
John Blickensderfer, P.E.
Brandon Claborn, P.E.
David Cross, P.E.
Pete Ellis, E.I.
Conrad Koehler, P.E.
Michael Mason, P.E.
Ellen Stevens, Ph.D., P.E.

Other Participants
Rebecca Carroll
Eric Loggins



Oklahoma State University

School of Civil and Environmental Engineering

Roadway and Water Feature Design at the Botanic Garden

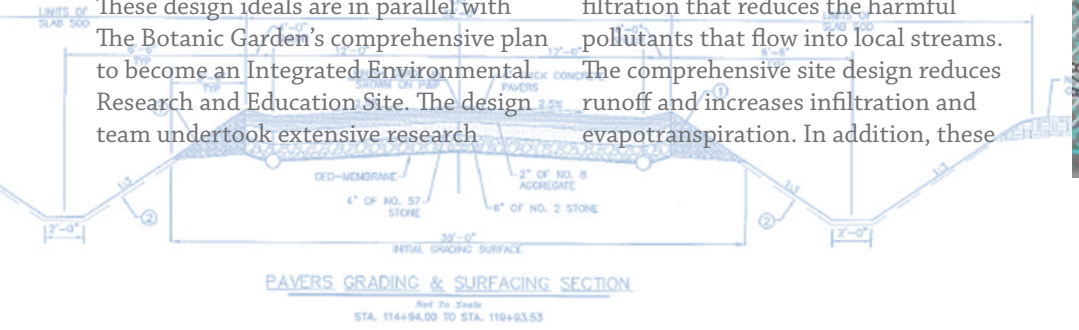
ABSTRACT

Through interdisciplinary collaboration, the civil engineering senior design capstone class at the local university has developed the design of a roadway through The Botanic Garden in Stillwater that implements numerous innovative and sustainable technologies. The team carried out the entire design process, from solicitation and presentations to the client, to the final design that includes a geotechnical investigation, hydrology and hydraulics analysis, permitting requirements, roadway and water feature designs, and a cost and schedule estimate. To facilitate the complex design process, professional engineers and university professors worked in collaboration with the team, lending their advice specific to individual areas of expertise.

Additionally, a group of landscape architecture students worked in allied participation with the design team. As envisioned by The Botanic Garden director, the project was composed of a design that allows for both civil and environmental engineering research and can also serve as an inspiration to universities and students across the country as a teaching and education tool. These design ideals are in parallel with The Botanic Garden's comprehensive plan to become an Integrated Environmental Research and Education Site. The design team undertook extensive research on pavement types and various green infrastructure practices that led to a cutting-edge design that has little to no environmental impact, allows for extensive research capabilities, and has the concepts of sustainability integrated within every feature.

The roadway design incorporates four different sections of pavement to be used in the development of research: Permeable Interlocking Concrete Pavement (PICP) from the Interlocking Concrete Pavement Institute (ICPI), Geopave® Porous Pavement and FilterPave® Porous Pavement from Presto GeoSystems, and a 50% fly ash replacement concrete section as a control. The pavements selected facilitate a green infrastructure design while allowing for vanguard research on the roadway. The integrated site design also includes bioretention swales, off-grid lighting, and a water feature to be used as a retention pond. The rainfall from the road is designed to be piped into the water feature, further establishing this project's focus on the green initiative. The permeable pavement and bioretention swales also provide stormwater filtration that reduces the harmful pollutants that flow into local streams. The comprehensive site design reduces runoff and increases infiltration and evapotranspiration. In addition, these innovative, green infrastructure practices create an environmentally friendly result that is aesthetically appealing and provides a soothing decompression experience that will improve the health, safety, and welfare of the public.

The synergy that developed between the team and professional engineers helped the students attain valuable new skills and knowledge. In conclusion, the students were afforded an extraordinary opportunity to produce a design from conception to final completion that will endure as a part of their university forever.

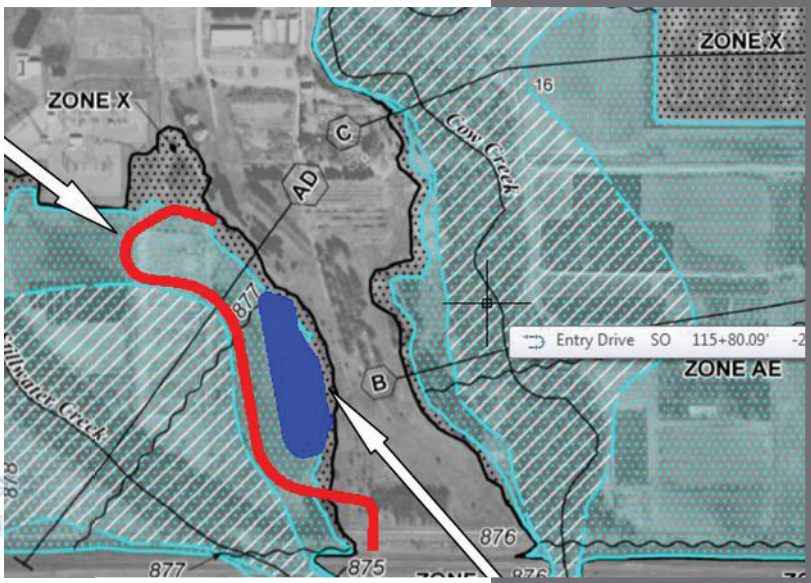


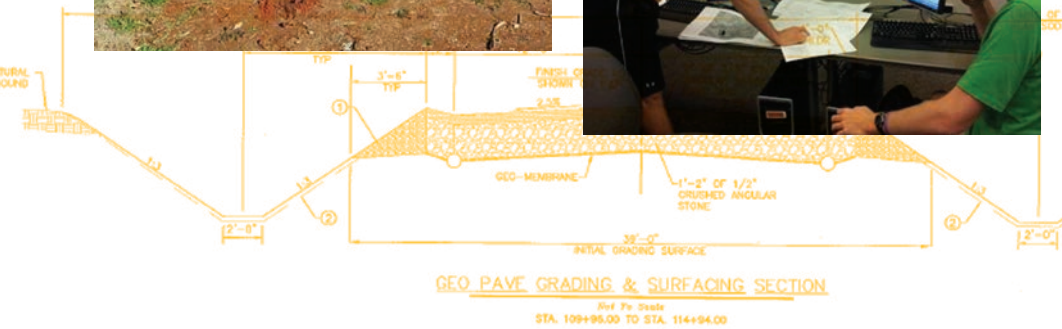
JURY COMMENTS

"An outstanding example of collaboration of students and professional engineers, as well as interdisciplinary interaction, to achieve an outstanding environmental outcome."

"This project was an excellent example of civil engineering and landscape architecture."

"Integrating multiple sustainable elements in this design, coupled with the ability to perform research and serve as an education tool, made this project stand out."





GEO PAVE GRADING & SURFACING SECTION

PERSPECTIVES ON

The benefit to public health, safety, and welfare

This project provided tangible benefit to The Botanic Garden, dedicated to education, teaching, and research for the students and public of the city. The director of The Botanic Garden requested the help of the senior design students for a roadway and stormwater collection design with emphasis on sustainability. These students developed a system that provides safe access to The Botanic Garden through the Stillwater Creek floodplain. The system uses permeable pavements due to benefits for driving safety during storm events and their ability to collect and store the water. The student teams designed the roadway system to transfer the collected stormwater to a water feature that can be used as irrigation for the garden.

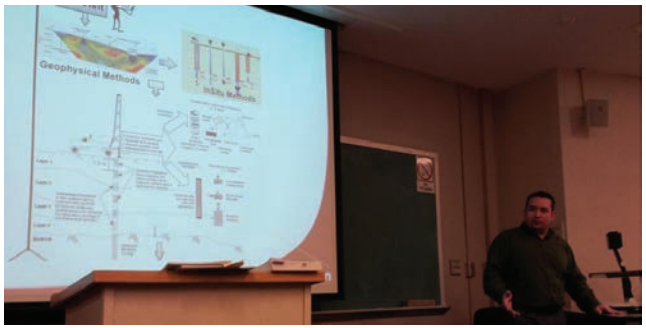
In each phase of the project, the health and safety of those that would be visiting the garden and working in it was a major consideration in advancing various designs. Roadway design was completed to meet DOT standards and requirements in order to protect the public welfare against unreasonable risk of crashes occurring as a result of the design, construction, or performance of the road and to protect the health of the public in the event that crashes do occur. This project also stressed the importance of codes and requirements for design and safety when designing and building within a FEMA designated floodplain; a flawed design could potentially lead to loss of property or life.

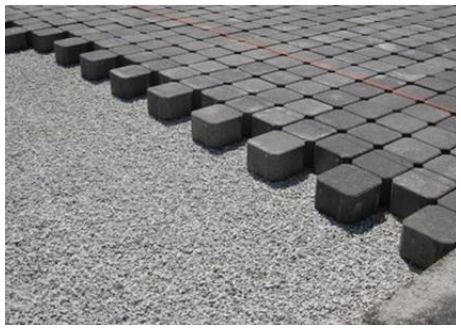
With public welfare as the primary focus, typical road cross sections were specifically designed for this project's unique pavements, and the horizontal road alignment was realigned from The Botanic Garden Master Plan design so that the road would be located outside the FEMA regulatory floodway. By providing engineering services free of charge, with the guidance of professional engineer mentors, the students were able to provide real benefits to The Botanic Garden, where a safe, sustainable, vanguard road and water feature have now been designed for the education and recreation of university students and the public.

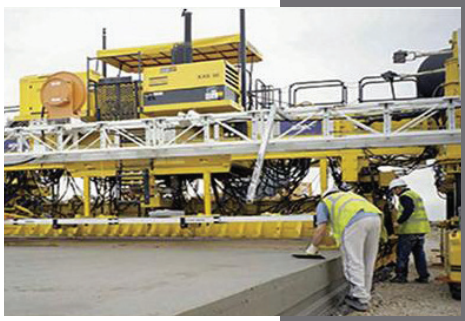
Multidiscipline or allied profession participation

The multidisciplinary cooperation of the civil engineering and landscape architecture departments was an exceptionally rare and unique student experience. Throughout the project, students learned firsthand the reality of how challenging, but rewarding, the integration of multiple disciplines can be for a project.

As the project progressed, the engineering capstone class began to understand the project not just as numbers and designs, but as a system. The teams started to appreciate the importance of the creative concepts offered by the landscape architecture department and how useful their understanding of the aesthetics of a site would be for the project. The landscape architecture students started to grasp that though their ideas were good, they needed to take advice from the engineers when the idea may not be feasible. Then, working as a team, they could revise the concept to incorporate the aesthetic aspects, while not neglecting feasibility and functionality.







In the end, each group came out with a better understanding of the other and how to work together, not despite the differences, but because of the differences. This synergy of multiple disciplines resulted in a comprehensive design of The Botanic Garden that combined the strengths of all contributors and produced a design that integrated sustainability, aesthetics, and functionality.

$7,500 AWARD

PARTICIPANTS

Students
Bea Elise Casem
Farzin Komizi
Sydney Nakao
Scott Stainer

Faculty
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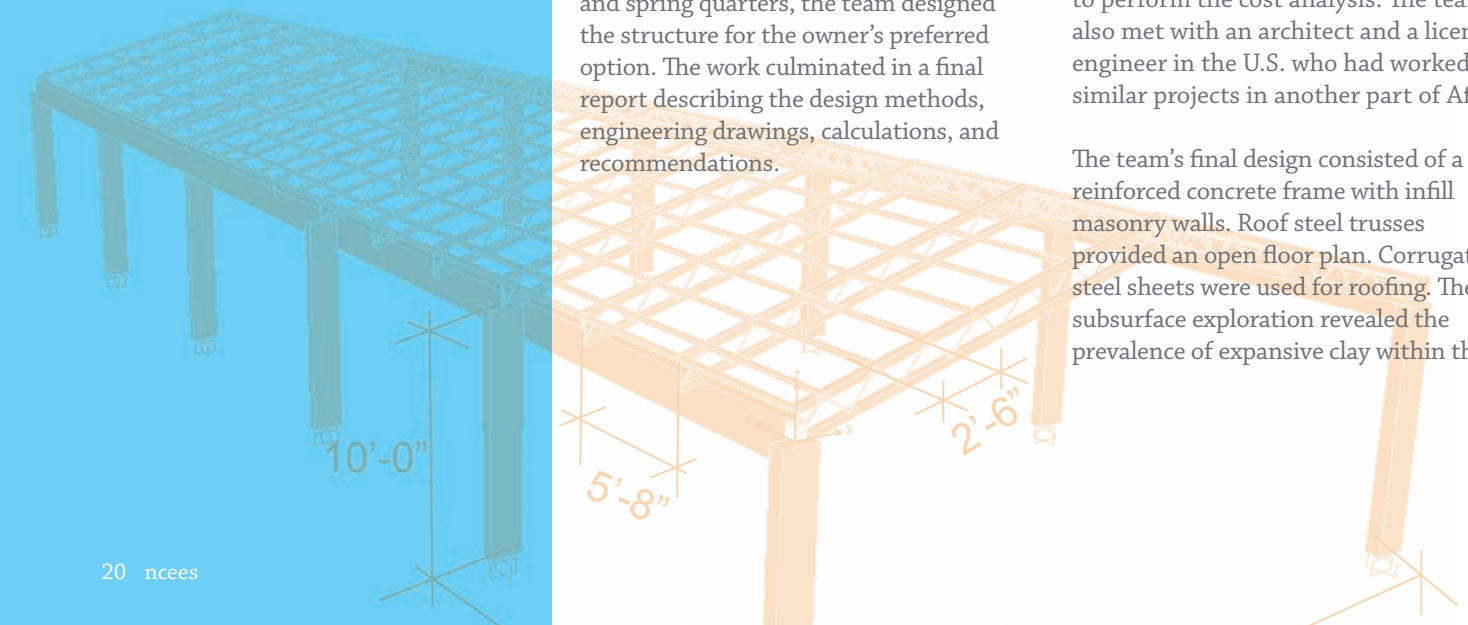
Nirmala Gnanapragasam, Ph.D., P.E.

Professional Engineers and Engineer Interns
Mahi Demissie, E.I.T.
Eset Elemu, E.I.T.
Girma Haile-Iuel, P.E.
Mark Reeves, P.E.

Additional Participants
Yilma Seleshi, Ph.D.
Richard Sundberg, FAIA, LEED AP



ABSTRACT

An Ethiopian immigrant approached us to design an orphanage, learning and community center on her 10-acre property in Ethiopia. All engineering students in our program are required to complete a team-based, nine-month long, real-life senior design project prior to graduation, and this client's need fit well with our mission. In this project, a team of four students worked under the supervision of three liaison engineers of Ethiopian origin residing in the U.S. (a professional engineer and two engineers-in-training) and a faculty mentor (licensed civil engineer) to bring the owner's dream to partial fruition. In fall quarter, the team presented architectural design options for the three proposed structures and a written proposal to the owner outlining the scope of work, project deliverable, and schedule. In winter and spring quarters, the team designed the structure for the owner's preferred option. The work culminated in a final report describing the design methods, engineering drawings, calculations, and recommendations.

The owner requested that the orphanage house 50 children, the learning center house 25 children in each classroom, and the community center contain offices, classrooms, a library, a kitchen, and an assembly hall to accommodate 300 people. The structures had to be easily replicable and be constructed of locally available materials.

The team researched Ethiopian construction practices and applicable design codes and collaborated with a civil engineering faculty member from an Ethiopian university to obtain subsurface information to provide foundation recommendations to the owner. Furthermore, the Ethiopian university contacted its local material suppliers and provided that information to the team to perform the cost analysis. The team also met with an architect and a licensed engineer in the U.S. who had worked on similar projects in another part of Africa.

The team's final design consisted of a reinforced concrete frame with infill masonry walls. Roof steel trusses provided an open floor plan. Corrugated steel sheets were used for roofing. The subsurface exploration revealed the prevalence of expansive clay within the site. To mitigate the potential for swelling and shrinking, the team recommended replacing the native soil with more stable soil and recommended a 5 ft x 6.5 ft spread footing under each column for an allowable bearing capacity of 2000 psf. The team prepared a design package for the owner, which consisted of AutoCAD engineering drawings for the structure, construction cost estimate, and design calculations.

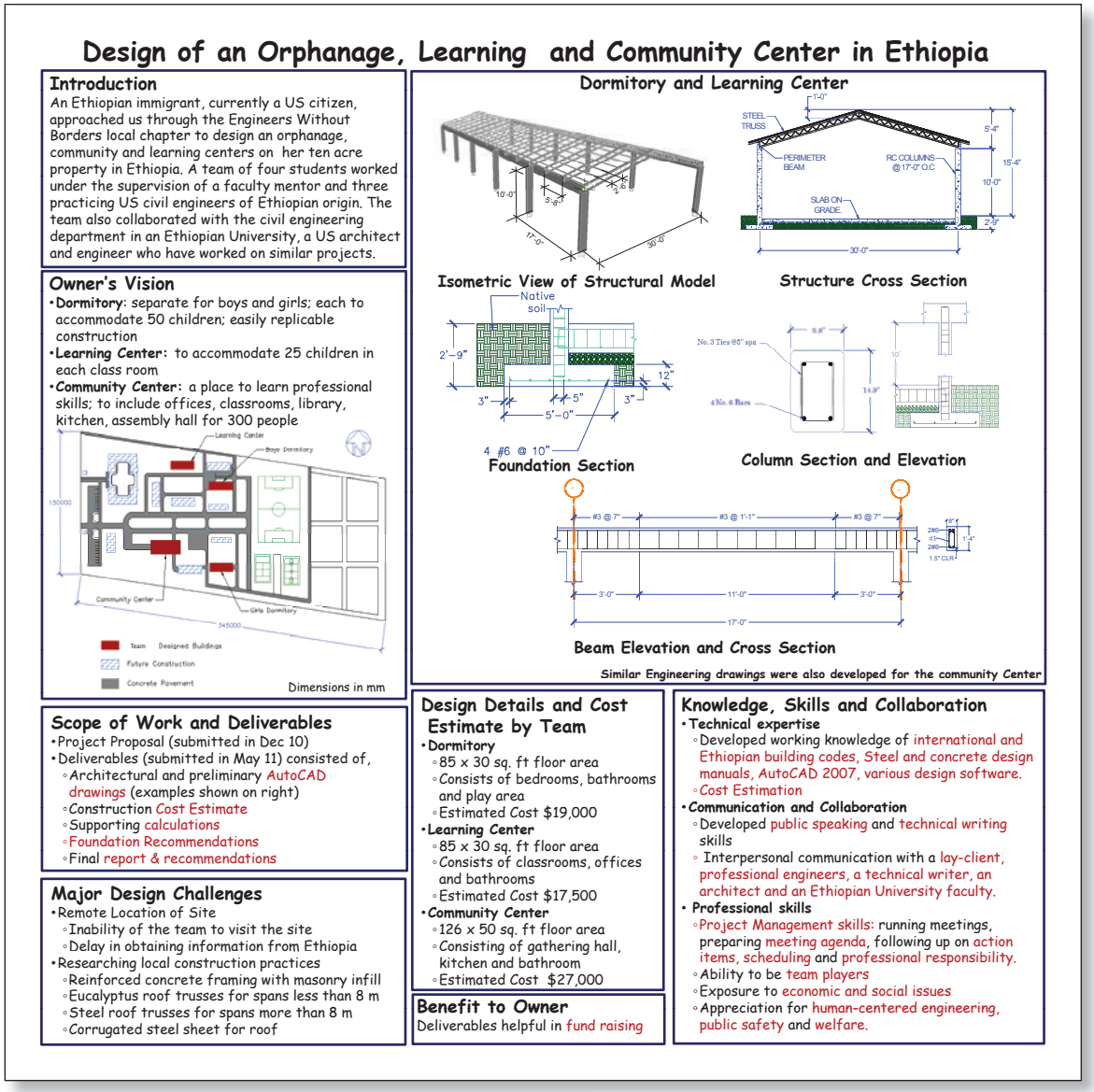
Throughout the year, the team met with the faculty mentor weekly and with the liaison engineers every two to three weeks. Each team member served as the project manager during the year, running meetings, setting agendas, assigning tasks to members, and following up on action items. The project strengthened the team's ability to apply their technical knowledge to a practical problem, to work as a team, to communicate effectively, to develop and hone professional and leadership skills, and to meet the owner's needs.

The design packet developed by the team was useful in the fundraising efforts of the owner. The students benefited from the experience by having a renewed sense of appreciation for human-centered, global issues in engineering.

Seattle University

Department of Civil and Environmental Engineering

Design of an Orphanage, Learning and Community Center in Ethiopia

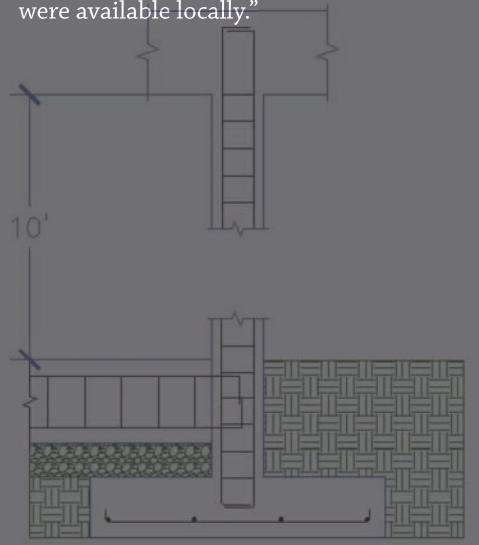


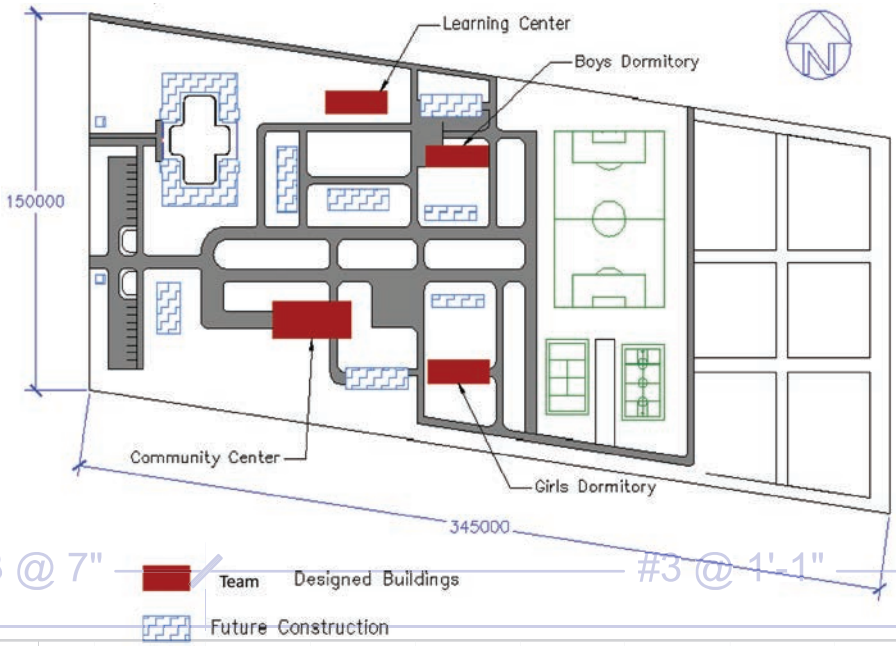
JURY COMMENTS

"The human nature of this project and the concern of the design students for the welfare of the orphans to be served were quite admirable."

"I have no doubt students who participated on this team learned a great deal from interacting with the owner, the local community in Ethiopia, and engineers in the Ethiopian university."

"What impressed me most about the project is that the design team worked with faculty from an Ethiopian university in order to ensure that the materials selected were available locally."





PERSPECTIVES ON

The benefit to public health, safety, and welfare

Children made orphans through AIDS and political unrest are a serious social concern in Ethiopia. Listening to the stories of the plight of these orphans through an immigrant who grew up in that region made the student team aware that their work was for the welfare of a community much in need. The design team decided to go with single storied buildings to prevent any child from falling off a terrace, balcony, or window. The children's safety was of primary concern throughout the design. The project also gave the students an opportunity to be aware of global issues and human-centered engineering.

The knowledge and skills gained

Technical expertise: The students learned how to carry out an owner's dream of a project from the conceptual stage through architectural drawings to engineering design. Through the design process, they acquired the skill to use the following tools:

› Design manuals: International Building Code 2009 (IBC 2009), American Society of Civil Engineers standard 7-10 (ASCE 7-10), American Concrete Institute 318 (ACI 318-08), American Institute of Steel Construction 13th Edition (AISC 13), Ethiopian Building Code Standards 1995 (EBCS 1995)

› Computer-aided drafting (AutoCAD 2007)

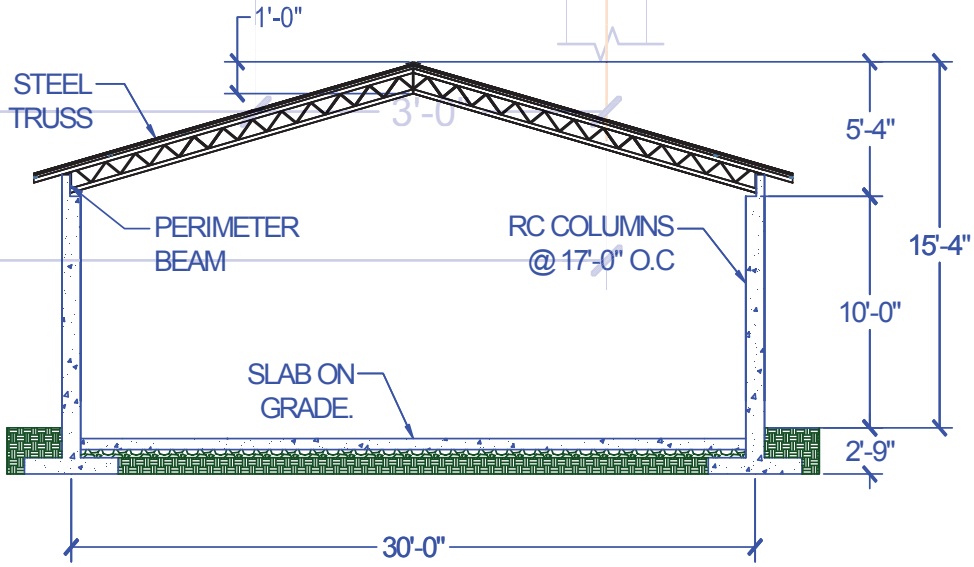
› Design software: SAP2000 for load distribution analysis, PCACol for column reinforcement, Excel spread sheets for design of miscellaneous structural members

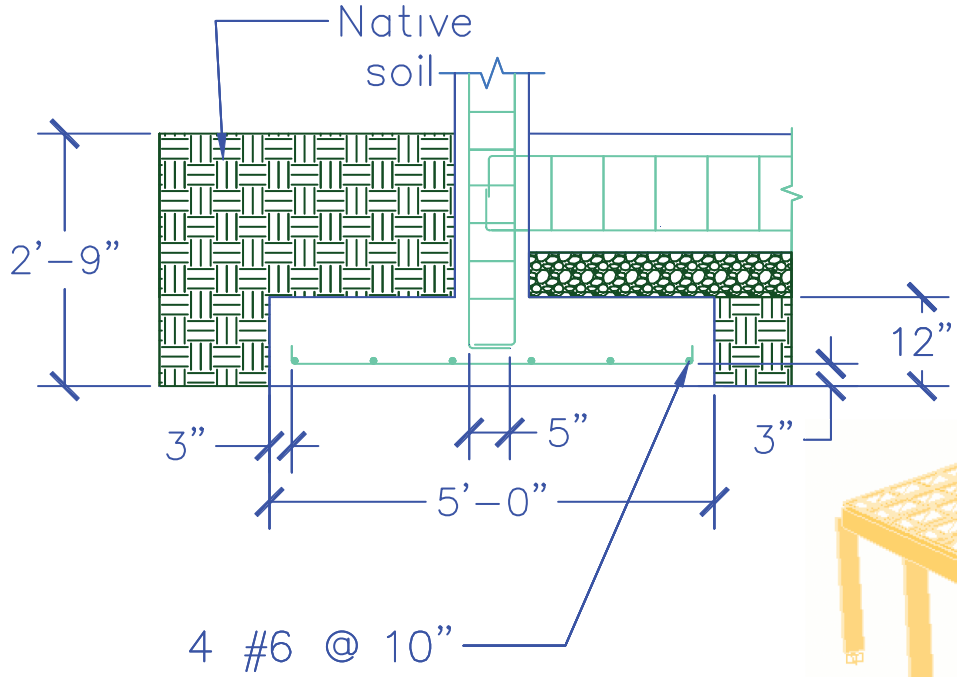
Students had had limited exposure to PCACol and SAP2000 in their structural engineering coursework, but they had an opportunity to work with the software in much detail with the help of the faculty mentor. The team worked with metric units to cater to the Ethiopian owner but included U.S. customary units to make it convenient for the U.S. audience.

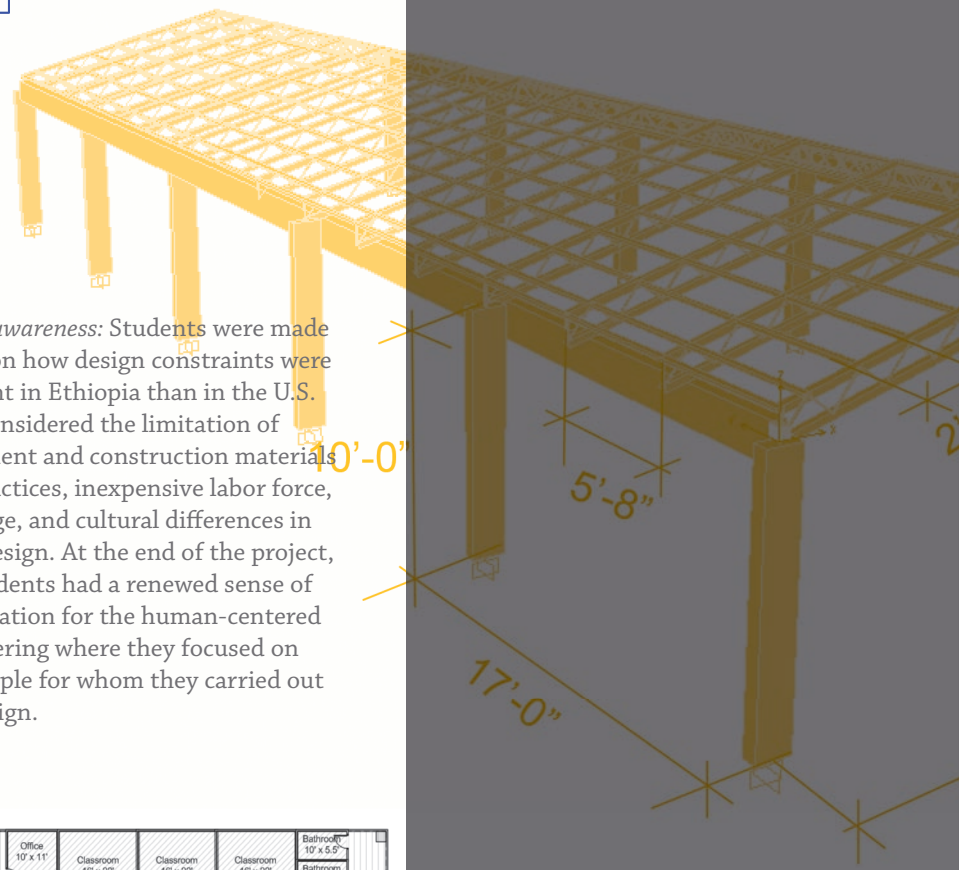
Communication skills: The students gained experience working for a non-engineering client. The team had to translate the owner's "language" of needs and functional requirements to engineering "language" of design parameters and constraints. Then, the team had to prioritize the functional requirements of the owner and convert them into measurable parameters prior to the design. They also faced the challenge of explaining engineering terms and constraints to a lay owner.

The students were required to make oral presentations to their peers twice a quarter. Each student had to make at least one presentation each quarter. The academic year concluded with a grand event on campus where the team presented its work to the entire university community, sponsors of all capstone projects, prospective sponsors, friends, family, and alumni. This event also included a poster presentation. The students also made presentations to the professional community.

Improving technical writing skills of our graduates is an important focus in our program. Therefore, the team was required to submit a written proposal



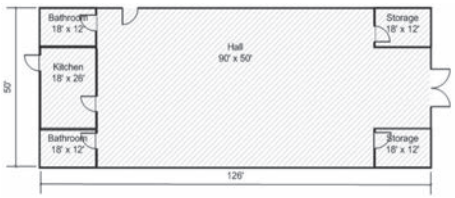


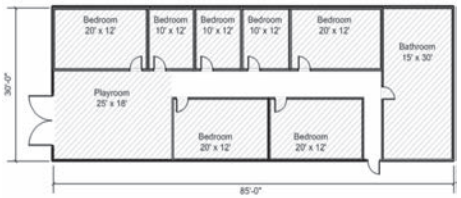


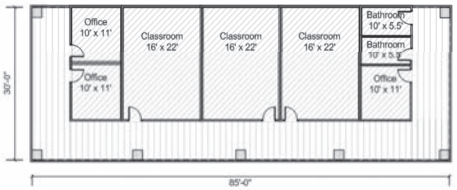
to the owner at the end of fall quarter describing the scope of work, plan of implementation, and schedule. At the end of spring quarter, they submitted a final report describing the work done, engineering calculations, drawings, and other deliverables as initially agreed.

Project management skills: Each team played the role of a project manager for part of the academic year and had the following responsibilities: setting up team meetings, developing meeting agendas, conducting the meetings, assigning tasks to the team members, and following up on action items. In addition, the project manager was in charge of contacting the owner, the liaison engineers, personnel at the Ethiopian university, and the faculty mentor between team meetings when necessary. The project manager also gave a brief informal oral progress report to the class each week.

Global awareness: Students were made aware on how design constraints were different in Ethiopia than in the U.S. They considered the limitation of equipment and construction materials and practices, inexpensive labor force, language, and cultural differences in their design. At the end of the project, the students had a renewed sense of appreciation for the human-centered engineering where they focused on the people for whom they carried out the design.







$7,500 AWARD

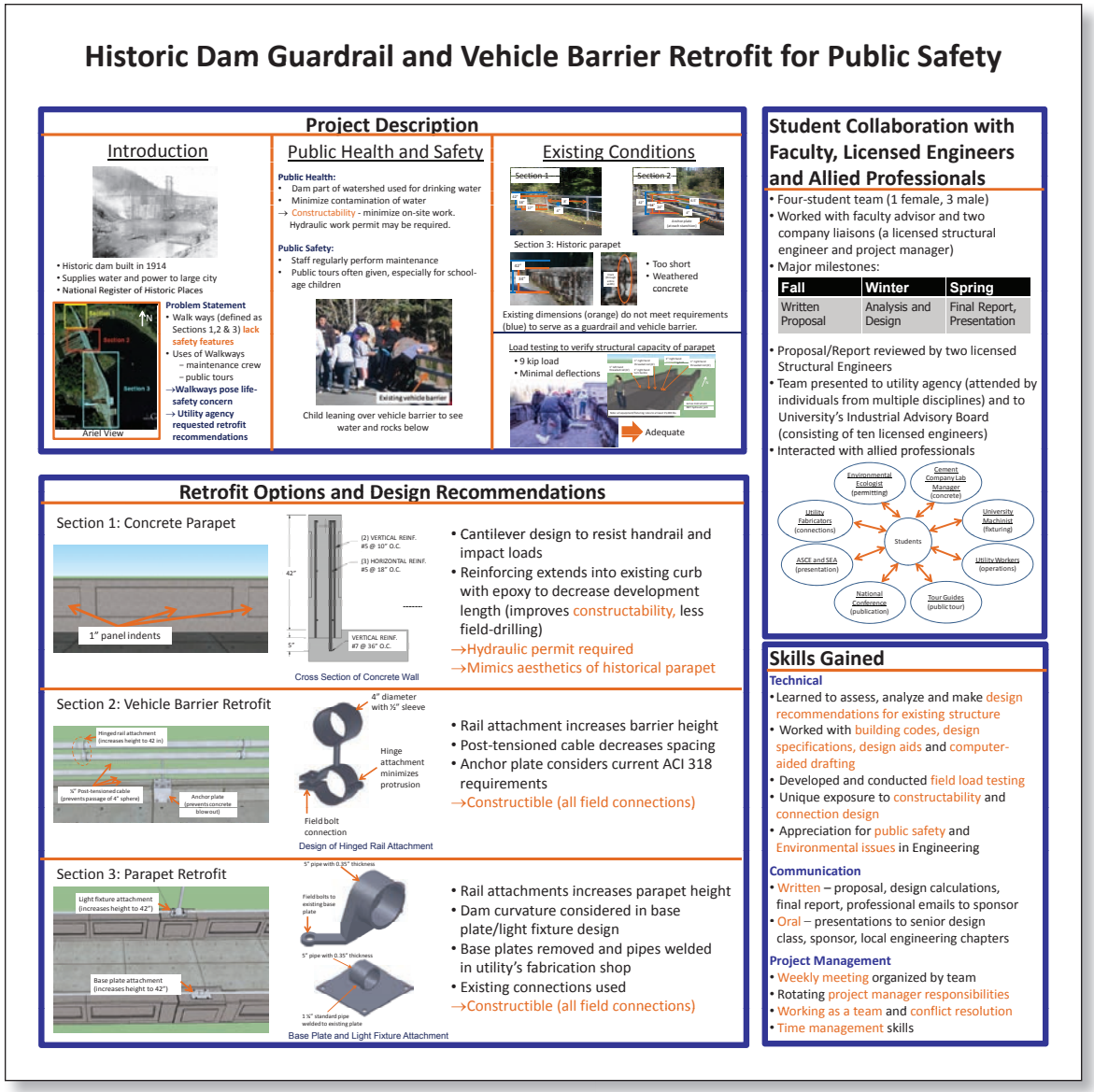
PARTICIPANTS

Students
Wilmurf De Vera
Jamie Mellies
Royce Miyahara
Daniel Pickering

Faculty
Katherine Kuder, Ph.D.
Nirmala Gnanapragasam, Ph.D., P.E.

Professional Engineers
Seattle City Light
Robert Cochran, P.E., S.E.

Additional Participants
Seattle City Light
Bernie O'Donnell
Wanda Shulze



Seattle University

Department of Civil and Environmental Engineering

Historic Dam Guardrail and Vehicle Barrier Retrofit for Public Safety

ABSTRACT

A local utility company issued a request for proposal to our university's capstone program for the retrofit design of guardrails and vehicle barriers on the walkways of a historic dam. Existing safety features pose an immediate life-safety hazard. The walkways are regularly accessed by the utility to perform maintenance and provide tours for the public, particularly school-aged children. Retrofit recommendations were to consider historical aesthetics, environmental concerns (because the water is a drinking source), and constructability.

The walkways consist of three distinct sections with varying safety features: a handrail (Section 1), a vehicle barrier (Section 2), and a concrete parapet (Section 3). The three sections do not meet current geometric and loading criteria to serve as a guardrail and vehicle barrier. All three sections lack the minimum required height of 42"; the existing spacing of horizontal members of the handrail and vehicle barrier exceeds the minimum required spacing of 4". Structural analysis indicates that the handrail cannot withstand vertical loading demand, and the anchor plate in the vehicle barrier is insufficient to prevent concrete blowout.

The structural capacity of the concrete parapet was verified by load testing because as-builts were unavailable and the condition of the concrete was not known. Concrete cores were obtained to determine compressive strength, and the load-deflection behavior of the parapet was measured using a field-test procedure developed by the design team, which involved pulling the two walls on either side of the walkway inward with a hydraulic jack. The results indicate that the parapet has adequate structural capacity.

For the handrail portion, a retrofit option of concrete parapet with 1" panel indents was proposed. The vehicle barrier retrofit included a horizontal rail attachment, post-tensioned cable, and reinforcement plate for the concrete curb. Retrofit for the concrete parapet provided an additional horizontal railing to meet the minimum required height with specialized attachments for the existing base plates.

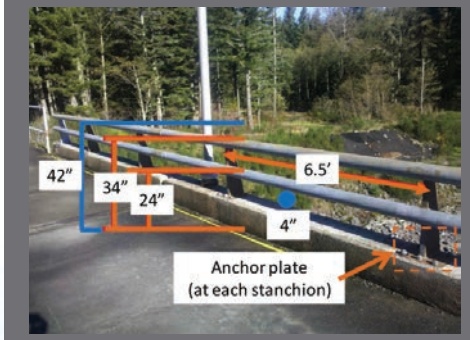
The designs were completed by a four-member senior student team during an academic year. Students met weekly with their faculty advisor and two utility company liaisons, one of whom is a licensed structural engineer and the other a project manager. The team's design calculations were reviewed by the faculty advisor, company liaisons, and two external licensed structural engineers (S.E.s). Project highlights include site visits; the development and implementation of on-site load testing; an opportunity to work with maintenance crews; professional presentations to their peers, the utility company, and local professional chapters (American Society of Civil Engineers and Structural Engineers Association); a visit to the utility's fabrication shop to discuss connection design; and a peer-reviewed conference publication. The project culminated in a final report to the utility company and a poster. Throughout the year, students developed important technical, communication, and project management skills to help prepare them for their future careers as practicing engineers.

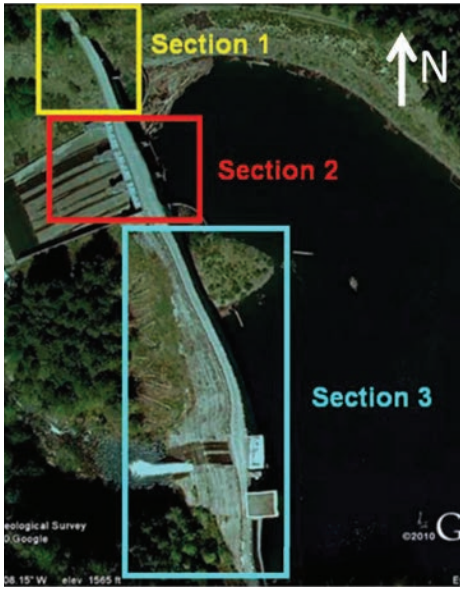
JURY COMMENTS

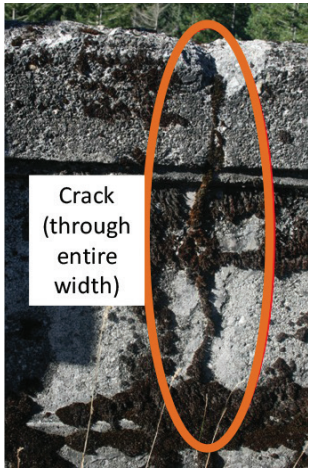
"Impressive project done by a small four-member team"

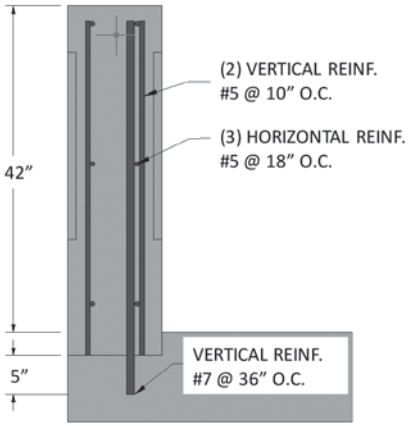
"This project presented significant opportunities for the students to interact with a variety of stakeholders while developing their design."

"This was a simple project that involved several very interesting aspects with codes, historic preservation, and load testing."









PERSPECTIVES ON

The collaboration of faculty, students, and licensed professional engineers

At our institution, senior civil and environmental engineering students are required to complete a year-long, real-world, capstone design project. A team of four students (one female, three male) was assigned to the project described previously, working under the guidance of a faculty advisor and two company sponsor liaisons, one of whom is a licensed structural engineer (S.E.) and the other a project manager.

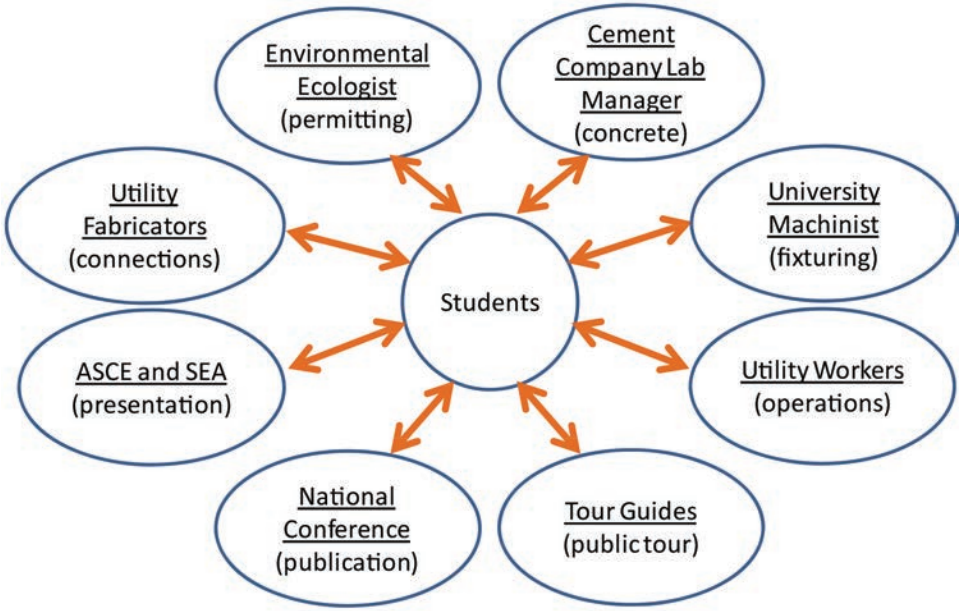
As part of the capstone course, students completed: (1) a project proposal during the fall quarter, (2) the major analysis and design work during the winter, and (3) a final report and presentation in the spring quarter. To accomplish these tasks, the student team held weekly meeting with their faculty advisor and company liaisons. They gave two presentations for the sponsor, one in the fall detailing the proposal and one in the spring explaining the final design. These presentations were attended by other licensed professional engineers (P.E.s) and project managers from the company sponsor.

The team also interacted with licensed professional engineers outside of the sponsor company. They gave presentations at the local chapter of the Structural Engineers Association (SEA) in the fall and to the American Society of Civil Engineers (ASCE) in the spring. A licensed professional engineer who is the technical manager at a local cement company provided guidance for their concrete testing. Finally, the team's final project report was reviewed by two external structural engineers.

The knowledge and skills gained

Project management and leadership: The team organized weekly meetings with the faculty advisor and sponsor liaisons. Throughout the year, students took turns serving as the project manager. The project manager was responsible for preparing the agenda, leading meetings, assigning tasks, and tracking overall progress.The senior design experience is unique in that it helps students to develop a variety of important skills needed for practicing engineers.

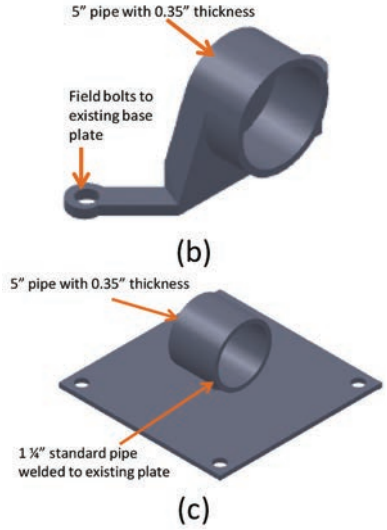
Technical: The students learned how to assess and analyze an existing structure and then prepare design

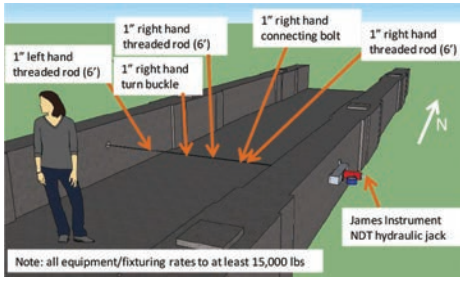


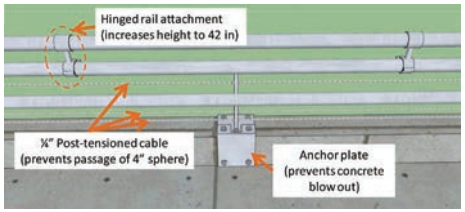
recommendations to remedy structural deficiencies. This process included using
> Building codes: 2009 International Building Code, ASCE 7-10 Minimum Design Loads for Structures and Other Buildings
> Design specifications: American Institute of Steel Construction (AISC) Steel Construction Manual 13th Ed., ACI: 318-08 Building Code Requirements for Structural Concrete and Commentary, 2010 Aluminum Association Aluminum Design Manual
> Computer-aided drafting: AutoCAD 2007, SolidWorks
> Design aid: Hilti PROFIS Anchor 2

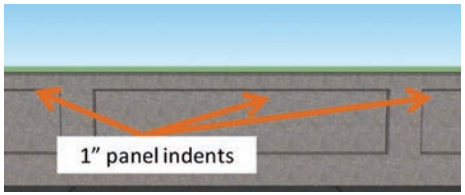
Additionally, the students learned about constructability and detailed connection design, topics not covered in traditional courses. Their final designs addressed site-specific issues of historic preservation and environmental considerations.

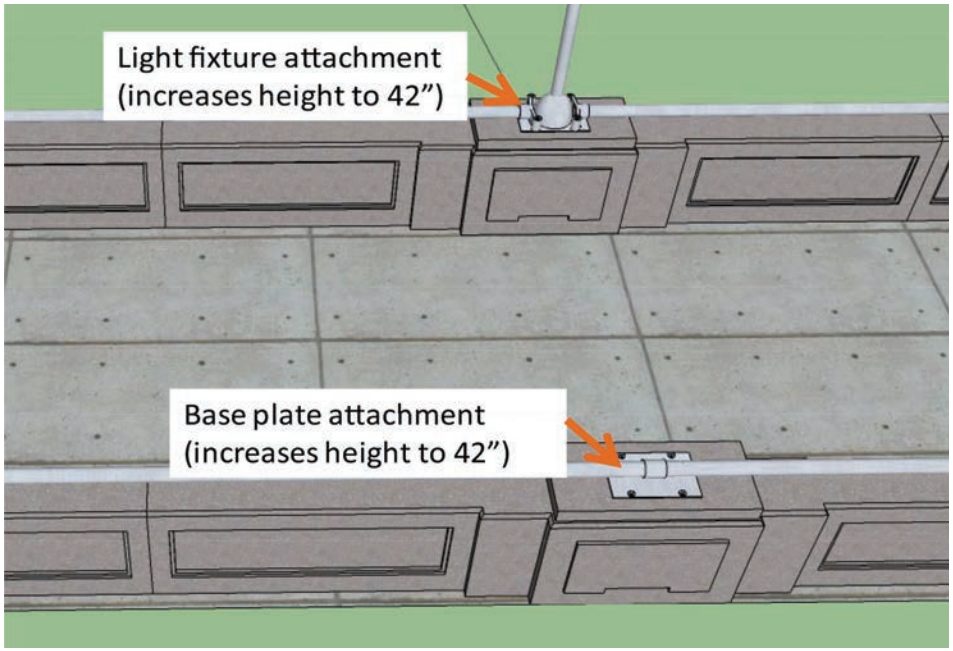
Communication: During the year, students developed both writing and speaking skills. The students submitted a written proposal and a final report for the capstone course. Students provided detailed engineering calculations to the liaison throughout the year and received feedback. The students were also responsible for sending professional emails to the project liaisons. The team prepared oral presentations for their senior design course, the project sponsor, and professional engineering societies (SEA and ASCE).











$7,500 AWARD

PARTICIPANTS

Students

Undergraduate

Ryan Aguayo Padilla
Oscar Chambers
Marcella Chavez
Sofia Escajeda
Carlos Escarcega
Aaron Gallegos
Alfonso Garcia
Oscar Garcia
Carlos Guillen
Matthew Hizon
Carlos Lozada
Manuel Marquez
Manuel Martinez
Nadia Mora
Kimberly Nuñez
Adrian Ontiveros
Charles Opel
Daniela Perez
Oswaldo Quiñonez
Sofia Reyes
Juan Salcido
Ivan Sanchez Soto
Alfonso Sandoval
Miguel Sosa
Mauro Soto
Roy Uribe

Graduate

Mazin Al-Zoubi
Satyen Awale
Nela Blejcharova
Shaddy Castillo Ponton
Jana Cervinska
Lorenzo Cornejo
Iraki Ibarra, E.I.T.
Mouyid Islam
Petr Malina
Edith Montes
Rafael Ramirez Flores
Alicia Romo
Daniel Saenz
David Salgado Manzano
Stefania Semanova
Ivana Simkova
Jiri Tylinch
Jorge Valdez
Edwin Varela
Marketa Vavrova
Yubian Wang

Faculty

Lead Advisors

Carlos Chang Albitres, Ph.D., P.E.
Ivonne Santiago, Ph.D., P.E.

Technical Advisors

Cesar Carrasco, Ph.D.
Kevin Cheu, Ph.D., P.E.
Carlos Ferregut, Ph.D., P.E.
Soheil Nazarian, Ph.D., P.E.
David Novick, Ph.D.
William Walker, Ph.D.
John Walton, Ph.D., P.E.

Professional Engineers and Engineer Interns

Juan Avelar, P.E.
Lurdes Cardenas, P.E.
Edmund Castle, P.E.
Michael Curtis, P.E.
Carlos Duran, E.I.T.
Robert Gonzales, P.E.
Gilbert Guerrero, P.E.
Joe Hernandez, E.I.T.
Taylor Kowalczyk, P.E.
Johanes Makagaube, P.E.
Jorge Martinez, E.I.T.
Irene Ramírez, P.E.
Michael Ramírez, P.E.
Sam Rodriguez, P.E., CFM, CNU-A
Alan Shubert, P.E.
David Varela, P.E.
Isabel Vasquez, P.E.
Edgar Villalobos, E.I.T.

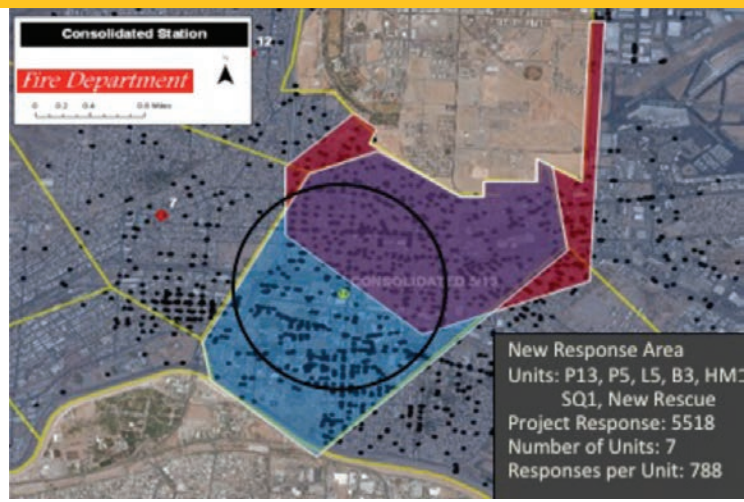
Other Participants

David Alvidrez, AIA
Hans Boenisch
Carl Daniel Jr., AIA, LEED AP
John Eby, P.L.S.
Jessica Gutiérrez
Edgar López, AIA
Román Márquez
Mathew McElroy, AICP, CNU-A
Genaro Mier, AIA
Jorge Mora, AIA, LEED AP
Ralph Richards, JD

ABSTRACT

The city approached our senior project class through the senior design class coordinator and the Engineering in Practice program to collaborate in the development of a smart multidisciplinary design of Fire Station 513. City requirements include a 14,000 ft^2 fire station with seven drive-through apparatus parking bays. The final design of Fire Station 513 must be LEED (Leadership in Energy and Environmental Design) Silver certified by the U.S. Green Building Council (USGBC), comply with the city Smart zone code regulations, and incorporate local art.

The project was developed in two phases over two semesters. The first phase was the planning and design of the layout, which involved working with an architecture firm. Architects showed the students how to maintain awareness of aesthetic functionality while still upholding Smart and construction codes. During the second phase, teams of students worked with faculty and licensed professional engineers to address all engineering aspects for construction, including environmental, geotechnical, structural, transportation, and construction management.



Fire Station 513 will bring a variety of benefits to the community, covering fire emergencies, medical aid services, rescues, protection from natural disasters, car accidents, and other hazardous responses. The Fire Station 513 design is unique for two major reasons. First, it is environmentally friendly, with a LEED Silver Certified design creating a positive change in the community due to a strong integration with the neighborhood, as well as a green infrastructure design to optimize the use of energy and water. Second, it complies with the city Smart Code, which is part of an integrated long-term plan adopted by the city to promote the development of compact, walkable, vibrant neighborhoods with a healthy living environment. The considerations taken into account in the design of Fire Station 513 will serve as a model for future facilities.

University of Texas at El Paso

Department of Civil Engineering

Multidisciplinary Smart Design of Fire Station 513

MULTIDISCIPLINARY SMART DESIGN OF FIRE STATION 513

"Engineering Practice at the Service of our Community"

Abstract

The City approached our Senior Project class through the Senior Design Class coordinator and the Engineering in Practice Program to collaborate in the development of a smart multidisciplinary design of Fire Station 513. City requirements include a 14,000ft² fire station with seven drive-through apparatus parking bays. The final design of Fire Station must be LEED (Leadership in Energy and Environmental Design) Silver certified by the U.S Green Building Council (USGBC), comply with the city SMART zone code regulations, and incorporate local art.

The project was developed in two phases over two semesters. The first phase was the planning and design of the layout, which involved working with an architecture firm. Architects showed the students how to maintain awareness to aesthetic functionality while still upholding SMART and construction codes. During the second phase, teams of students worked with faculty and licensed professional engineers to address all engineering aspects for construction including environmental, geotechnical, structural, transportation, and construction management.

The Smart Design Process

The smart design of the new Fire Station 513 facility involved:

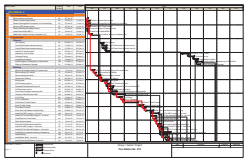
- Architectural Design
- Geotechnical Design
- Construction Management
- Structural Design
- Environmental and Green Design
- Transportation Design

Architectural Design

Various proposals for the architectural design were presented to the architectural firm for review. City regulations on environmental, wastewater management and transportation were taken into consideration for the site layout and design and of the fire station

Construction Management

A project usually takes 180 calendar days (6 months) to complete the design phase, and 240 calendar days (8 months) to build, which is a total of 14 months to complete the construction of Fire Station 513. A budget was also prepared taking into consideration the market price of the materials and labor reported in RS Means 2011. This project will be a lump-sum contract with a cost between 2.8 million dollars and 3.0 million dollars.

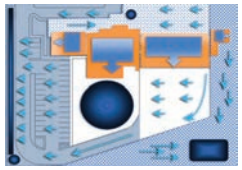


Environmental and Green Design

The students prepared an environmental site assessment using standards from the American Society of Testing and Materials (ASTM), and the Standard Practices for Environmental Site Assessments: Phase I ESA Process (ASTM Designation: E1527-2000).

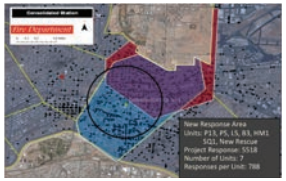
To be LEED Silver certified, the project must obtain 50 to 59 points. Our final design obtained 52 points due to location, storm water management plan, landscaping, and use of sustainable materials.

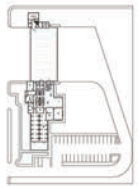
Surface run off will be controlled with shallow channels lined with river rocks leading to several smaller decorative ponds.



Collaboration of Faculty, Students, and Licensed Professional Engineers

This project was an excellent opportunity for faculty, students, and licensed professional engineers, architects, and planners to collaborate on a multidisciplinary smart design of LEED Silver Certified Fire Station 513. Additionally, over the course of the project, students worked with planners and other city officials to ensure compliance with city codes.





Benefit to Public Health, Safety, and Welfare: A Smart Design

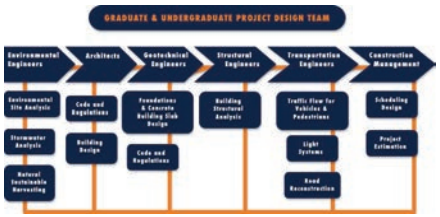
The development of Fire Station 513 comes with an extended variety of benefits to the community covering fire emergencies, medical aid services, rescues, protection from natural disasters, car accidents, and other hazardous responses.

Fire Station 513 is a unique design for two reasons. First, it is environmentally friendly with a LEED Silver certified design. This will create a positive change in the community by integrating a smart location choice, strong neighborhood design, and green infrastructure for buildings, optimizing the use of energy and water, thus improving human and environmental health. Second: It complies with the city Smart Code, which is part of an integrated long-term development plan with emphasis in the creation of compact, walkable, vibrant neighborhoods that promote a healthy living environment.

Multidiscipline and/or Allied Profession Participation

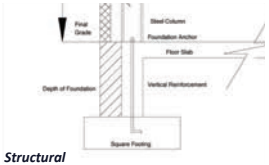
Fire stations require broad participation of experts during the planning and design process. The design of a fire station requires the functionality of a business for the public, the durability to support the daily labor of the fire team, while preserving and maintaining a comfortable facility for the residing first responders.

Students understood that engineering practice requires working as a team in a multidisciplinary professional setting environment to better serve the community.



Geotechnical

A geotechnical report from the site was prepared, including the type of soils and bearing capacity from sites nearby. The geotechnical engineer worked together with the structural engineer to determine the maximum load for the foundation design.



Structural

The final fire station will be constructed using steel framing, concrete masonry units (CMU) bearing walls, and metal roofing. The CMU will be constructed from recycled material to contribute to LEED points.

Transportation

Transportation issues, including turning radius for emergency vehicles, road conditions, and traffic off the surrounding thoroughfares were considered in the design. For the site layout, the turning radius of the fire trucks was taken into account to allow them to easily drive in and out of the station.

Both emergency and employee vehicles will enter and exit off the street located on the east side of the lot. Vehicles enter through the south side of the lot and follow a counterclockwise direction of traffic either into the apparatus bays or to the employee parking area.

Knowledge or Skills Gained

The development of an architectural and engineering design for Fire Station 513 created a unique learning environment for the students. Teams of students approached the project from several disciplines to account for the specific demands of the fire station design.

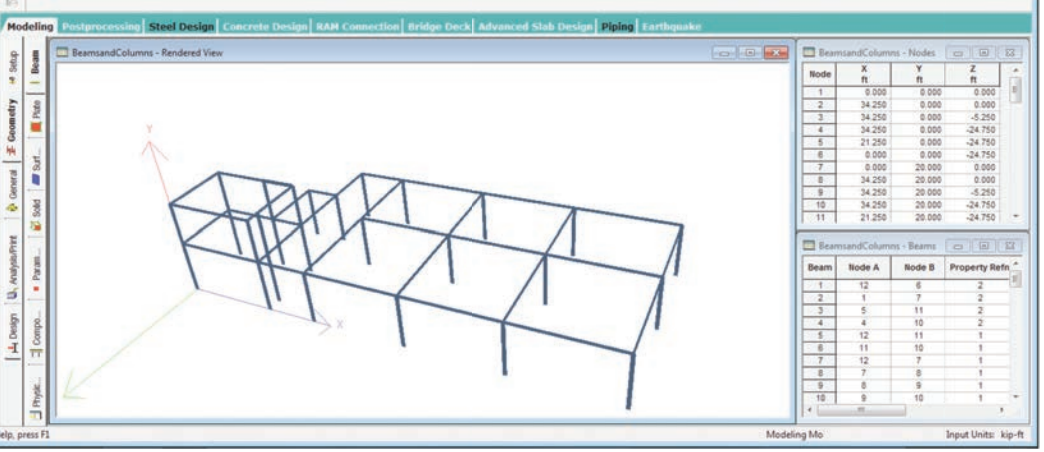
AREA OF EXPERTISE	WHAT WAS DONE?		KNOWLEDGE AND SKILLS GAINED	
Architecture	• Design Floor plan and site layout • Assess required permits		• Design process from beginning to end • Building and tenant codes	• Green building design and LEED Silver Certification
Construction Management	• Scheduling and cost estimate		• Construction process • Cost estimate of a building project	• Use of Primavera software
Geotechnical	• Parking Lot Design • Concrete Design	• Foundations design • Site Preparation	• Design Foundations based on loading • Site preparation for construction	• Cut and fill calculations
Structural	• Placement of Columns • Design of Beams, Columns, Trusses		• Use of STAAD software • Required loadings	
Transportation	• Reconstruction of Roads • Traffic Flow	• Light Systems	• Take into account user-specific condition, such as turning radius of fire trucks • Regulatory and legal requirements for adding a traffic light to a major street	

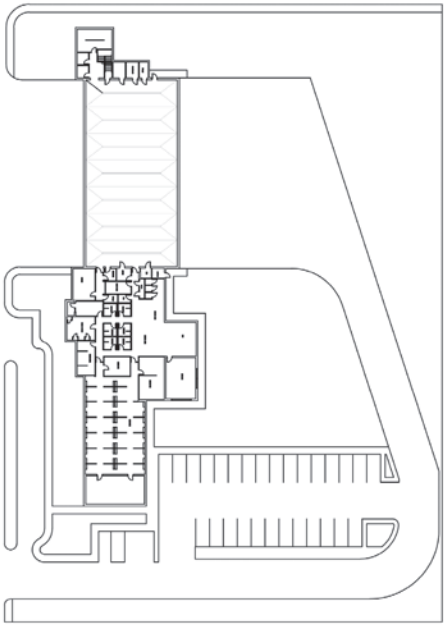
JURY COMMENTS

"This project was well organized and showed tremendous planning and execution."

"I was really impressed with the multidiscipline collaboration on this design. The students worked with a diverse group of professionals to accomplish their goals."

"The student team provided terrific input to the community, while achieving LEED Silver certification. Outstanding!"





PERSPECTIVES ON

The collaboration of faculty, students, and licensed professional engineers

This project was an excellent opportunity for faculty, students, and licensed professional engineers to collaborate on a multidisciplinary Smart design of LEED Silver Certified Fire Station 513.

The project was developed in two phases over two semesters. The first phase was the planning and designing of the layout of the fire station, which involved working with the architecture firm and city officers to learn building codes and permits. During the second phase, teams of students worked with faculty and licensed professional engineers, who served as mentors, to address all aspects of the Smart design including environmental, geotechnical, structural, transportation, and construction management.

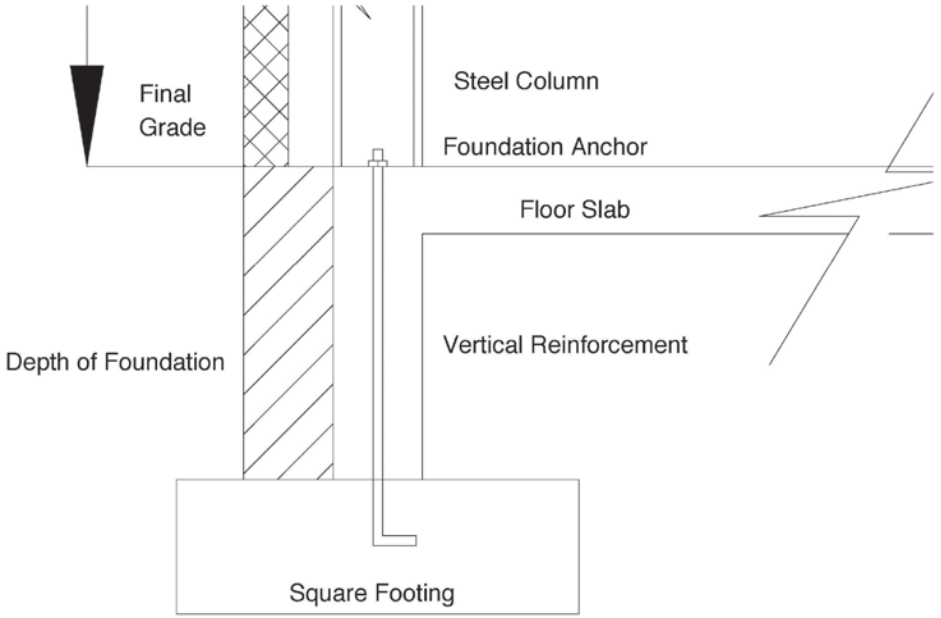
Additionally, over the course of the project, students had to work with planners and other city officials to ensure compliance with city codes. Because there was an existing power pole in the middle of the lot, students had to follow proper procedures and laws to create an easement for the power pole to be moved.

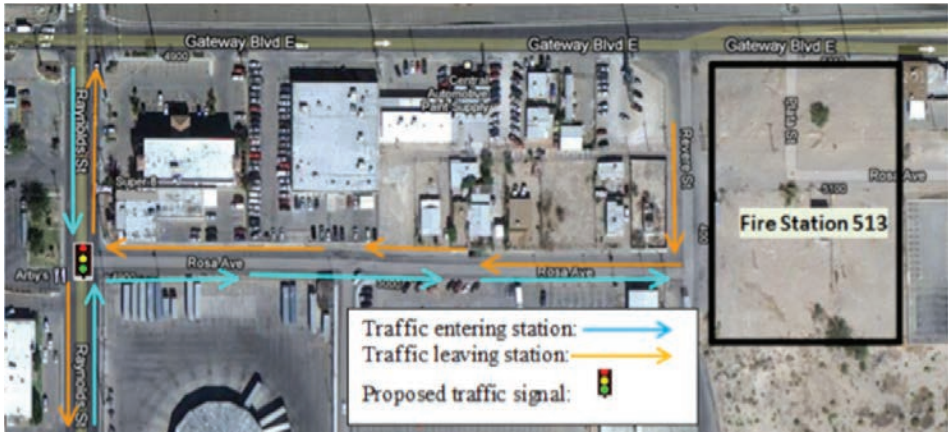
To ensure efficient collaboration and cooperation, weekly team meetings were held along with several presentations to update on the work progress of the fire station design.

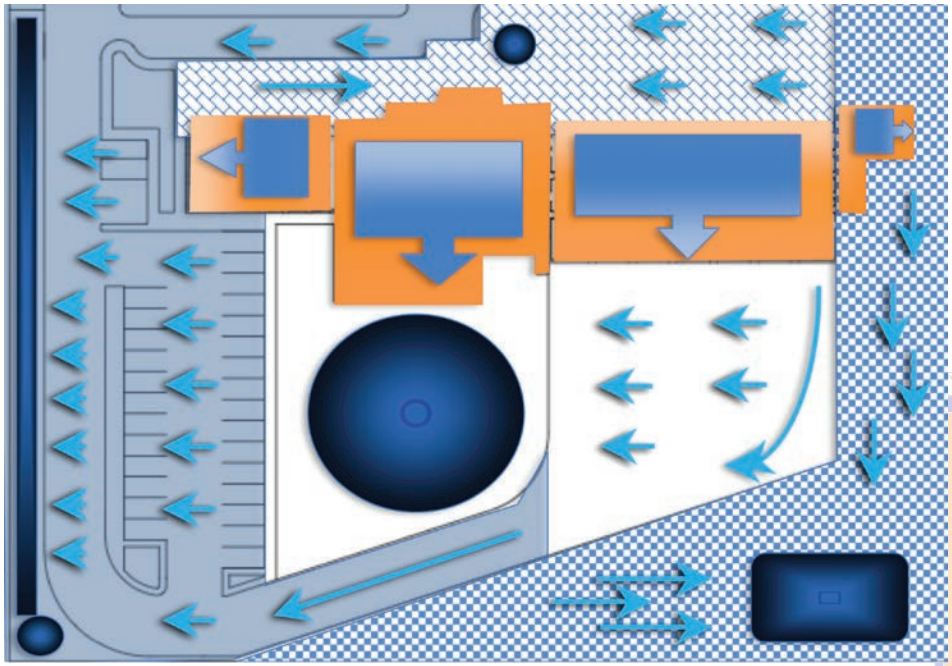
There were also guest speakers on special topics for the design, including Smart codes, permit process, and LEED requirements. This ongoing interaction among students, faculty, and licensed professional engineers enabled them to gain knowledge of engineering practice, learn communication skills, and join the engineering network in the community.

Multidiscipline or allied profession participation

Fire stations require broad participation of experts during the planning and design process. The design of a fire station requires the functionality of a business for the public and the durability to support the daily labor of the fire team, while also preserving and







maintaining a comfortable facility for the residing first responders. This unique set of requirements allowed engineering students to interact with experts serving as mentors in architecture, construction management, environmental, traffic, structural, and geotechnical/foundation analysis. Students understood that engineering practice requires working as a team in a multidisciplinary professional setting to better serve the community.

The knowledge and skills gained

Students learned a long-term career lesson that engineering practice requires working as a team in a multidisciplinary professional environment to design and build facilities to better serve their community. Professional licensed engineers mentored the students to prepare the environmental assessment and stormwater management plan and to integrate the building site into the surrounding traffic patterns. Project managers dissected the building procedures with the students for project scheduling and cost analysis with Primavera planning software. Structural engineers taught students how to design the building structures including foundations. Several guest speakers were invited to present special topics related to the multidisciplinary design: Smart code, transferring conceptual work to software applications such as STAAD, leadership in environmental energy preservation, professional ethics, and technical writing.

$7,500 AWARD

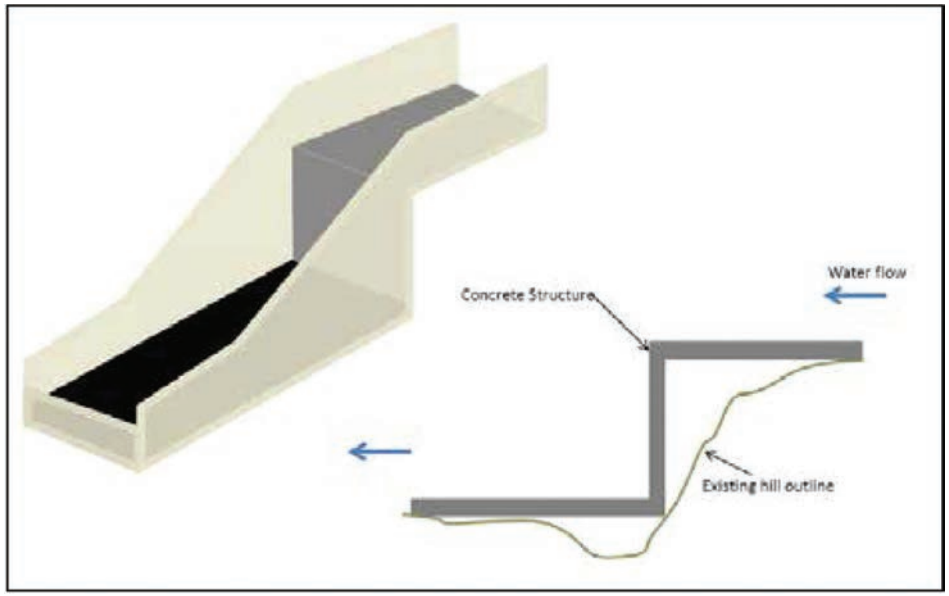
PARTICIPANTS

Students
Allie Beams
Jim Chase
Maria Cherney
Andrew Lund
Ivan Martynenko
Britney Meyer
Melissa Meyer
Ben Reith
Michelle Roy

Faculty
Elizabeth Gingerich, Ph.D.
Michael Hagenberger, Ph.D., P.E.
John Schemmel, Ph.D., P.E.
Peter Weiss, Ph.D., P.E.

Professional Engineers
Robert Andrews, P.E.

Additional Participants
Water council chair Canute Temu and approximately 20 workers from the village of Masaera, Tanzania



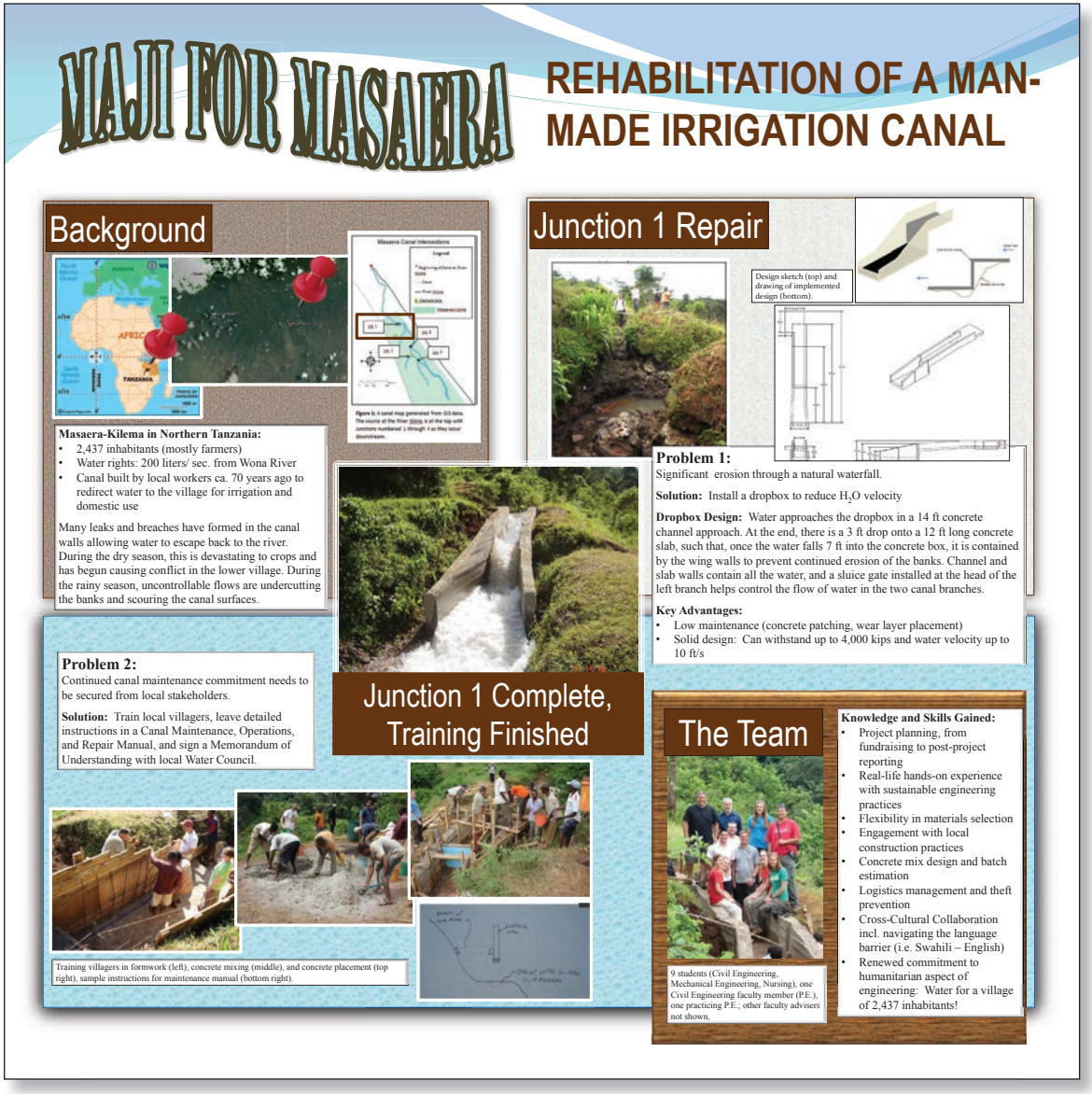
ABSTRACT

For the past four years, about 40 students from our Engineers Without Borders (EWB) chapter have worked with the village of Masaera-Kilema in northern Tanzania to both repair a deteriorating canal and educate the villagers about the importance of water sanitation and canal maintenance. Last year, five civil engineering and two mechanical engineering students and two students from other fields, with the assistance of our civil engineering faculty (all licensed P.E.s), a faculty member from our college of business, and a practicing P.E. from the Chicagoland Professional Chapter of EWB-USA, designed a drop box mechanism to absorb energy from water flow. They then traveled to Tanzania and performed assessments of canal bank health, installed the drop box, trained local workers in concrete mixing and repair methods, and brokered a memorandum of understanding (MOU) with the village's water council to ensure future canal maintenance. Their activities not only contributed to eliminating water losses from erosion and infiltration and securing clean and reliable water supply for nearly 2,500 villagers, but also contributed to the villagers' understanding of, and ability to apply, standardized quality construction methods.

Valparaiso University

College of Engineering

Maji for Masaera: Rehabilitation of a Man-Made Irrigation Canal



JURY COMMENTS

"Excellent collaboration with solid project preplanning brought a strong health-and-safety project into existence."

"The magnitude of the social benefit from such a small project is truly impressive."

"A great project showing the global reach of engineering and the ability of engineering to leave a mark on a community."

PERSPECTIVES ON

The collaboration of faculty, students, and licensed professional engineers

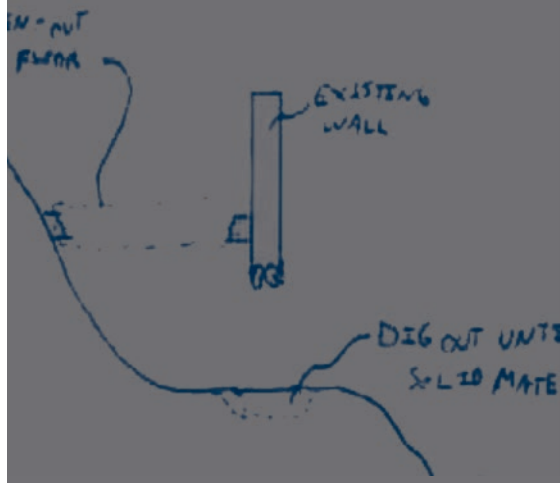
On this trip, the EWB student chapter worked with both licensed and non-licensed engineers. During the design phase, students worked with three faculty members from our civil engineering department (all licensed P.E.s), who supplied their expertise in various facets of structural, architectural, and concrete-mix design. One of these faculty members traveled with the students for ad hoc on-site support, as did a representative from the regional EWB chapter (another licensed P.E.), who contributed his expertise in hydrology and canal design. All of the team members collaborated successfully with the local, mostly practically schooled, workers and provided training in structural matters and concrete mix design.

The benefit to public health, safety, and welfare

The objectives of this project were twofold: On the technical side, students designed and installed a drop-box mechanism to combat the significant erosion at Junction 1 of the canal, thereby reducing an immediate canal breach risk. More than that, though, students also identified sites needing future repair; led village leadership to commit to long-term maintenance; and educated the entire village about the importance, and the process, of maintaining, repairing, and operating the canal effectively and efficiently by demonstrating the most common repairs. In addition, the student team will continue to work with the water council on the completion of a Canal Operation, Maintenance, and Repair Manual. Thus, the humanitarian benefit that a more reliable source of water for field irrigation and domestic usage delivers extends beyond the currently 2,437 villagers to future generations.

Multidiscipline or allied profession participation

Our EWB chapter is a multidisciplinary organization made up of students from the college of arts and science, college of business, college of engineering, and college of nursing, with supporting faculty from all these disciplines and subdisciplines committed to improving the lives of Masaerans. This allows the students to work with communities on comprehensive projects and produce sustainable solutions—the cornerstone to successful service projects.



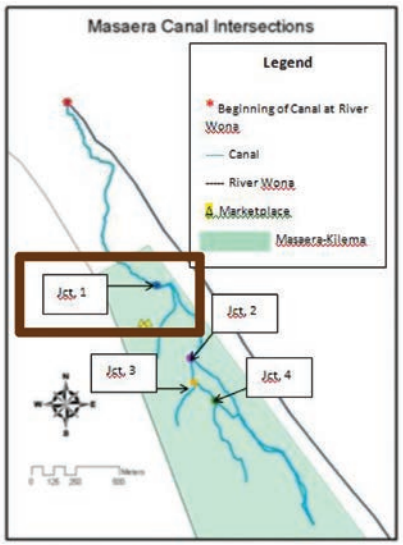
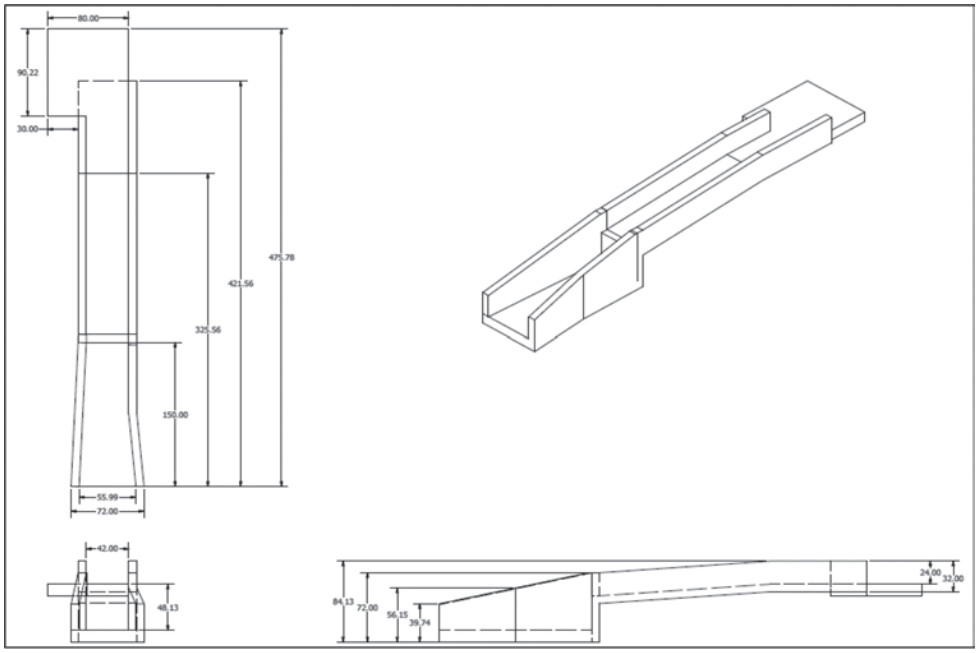


Figure 1: A canal map generated from GIS data. The source at the River Wona is at the top with Junctions numbered 1 through 4 as they occur downstream.



2012 PARTICIPANTS

Boise State University
Department of Mechanical and Biomedical Engineering
Attachment for the Improvement of Metered-Dose Inhaler Usage

California State University, Los Angeles
Department of Civil Engineering
Alamitos Bay Pumping Station Discharge Line Replacement Project

California State University, Los Angeles
Department of Civil Engineering
San Gabriel Coastal Basin Spreading Grounds Levee Seepage Analysis

Christian Brothers University
Department of Electrical and Computer Engineering
Elevator Speed Governor Test System

Florida Atlantic University
Department of Civil, Environmental, and Geomatics Engineering
Dania Beach Nanofiltration Plant Expansion

McNeese State University
Department of Engineering
Erosion and Sediment Transport in Calcasieu Ship Channel

Miami University
Chemical and Paper Engineering Department
An Assessment of Anaerobic Digestion of Biomass at a University

Oklahoma State University
Architectural Engineering Program
Capstone Comprehensive Design Studio: Community Wellness Center

Oklahoma State University
School of Civil and Environmental Engineering
Roadway and Water Feature Design at the Botanic Garden

Rowan University
Department of Civil and Environmental Engineering
Replacement of a Traffic Circle with a Modern Interchange

The College of New Jersey
School of Engineering
Bio-Inspired Wind Power: A Novel Approach and Design for Harnessing Wind Power

Seattle University
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Jacob Smith House Site Improvements

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ProSper: Professional Stretching Performance—An Innovative Stretch Earplug Remover

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Tanguche, Peru, Drinking Water System

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Department of Civil, Environmental, and Architectural Engineering
Components of Bridge Engineering

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Fire Protection Engineering Capstone Project

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Osprey Engineering Consulting Simulator

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Multidisciplinary Smart Design of Fire Station 513

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Wind Turbine Tower Test Facility

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AMSAA SP0002 Improved Diesel Engine Exhaust Brake

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Civil Engineering Capstone Project Recovery Park

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Flood Control Channel Design for a River in Northwest Haiti

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Engineering Haptic Virtual Manipulatives to Enhance K–12 Math and Science Education

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Department of Civil and Environmental Engineering
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