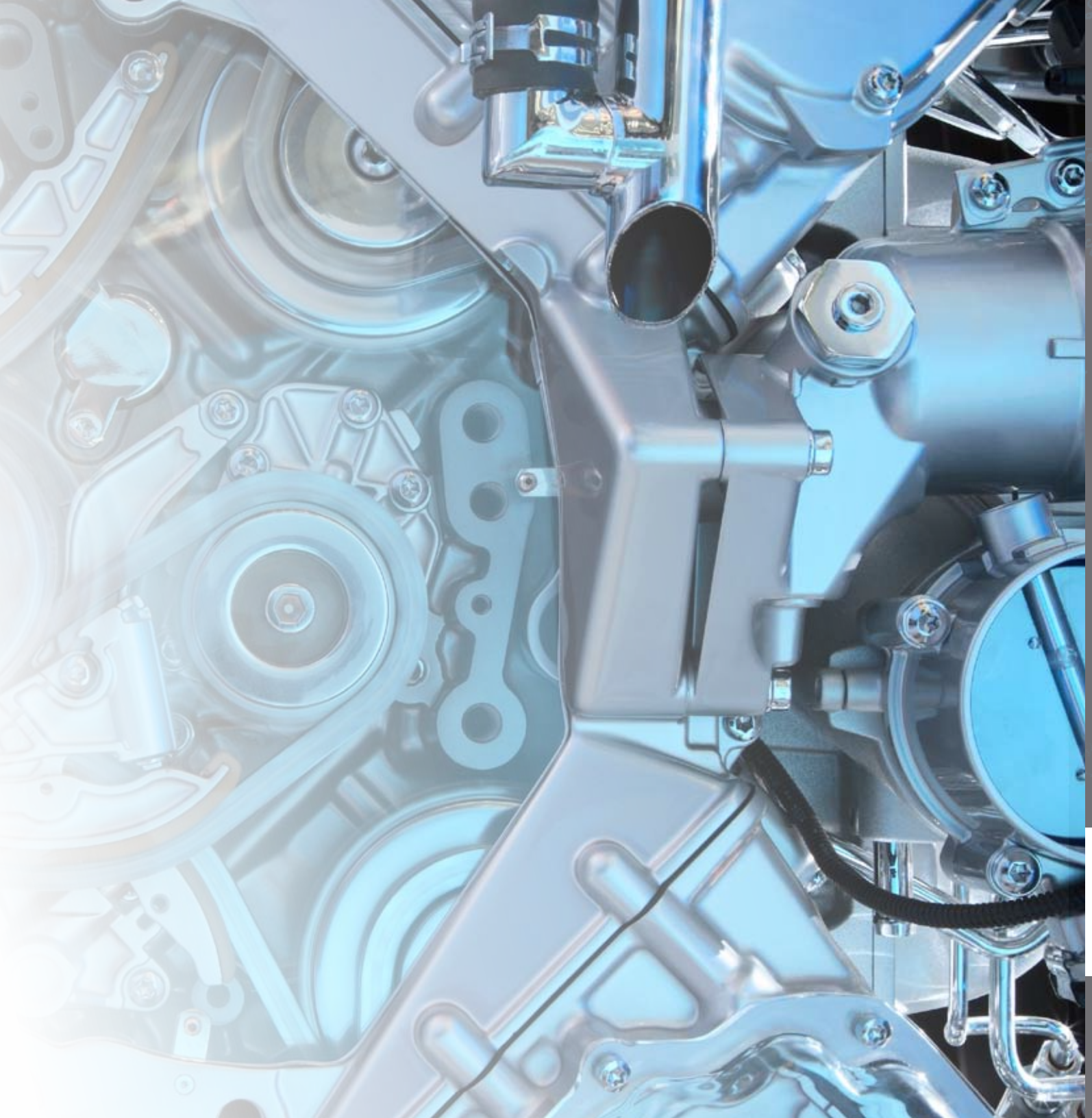


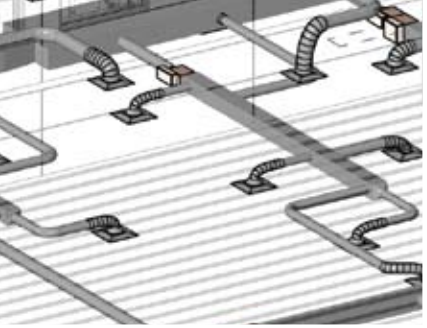
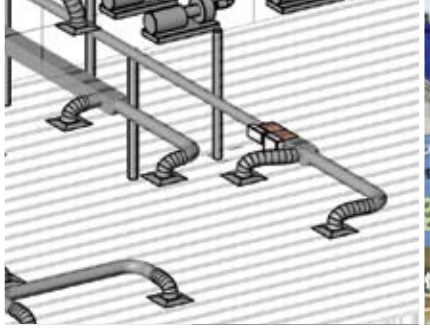
# 2009 NCEES ENGINEERING AWARD

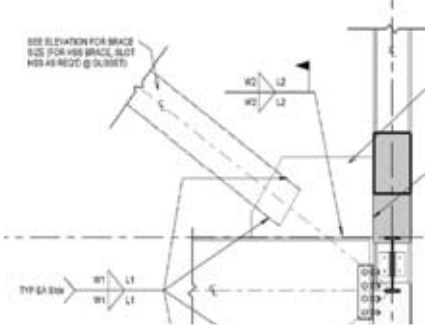
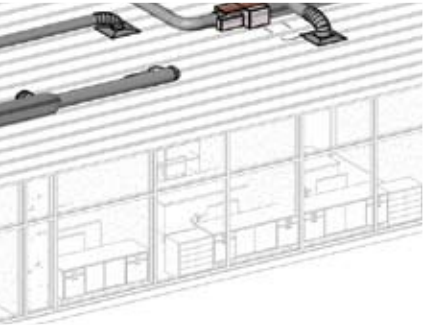
*for Connecting Professional Practice and Education*

# 2009 NCEES ENGINEERING AWARD

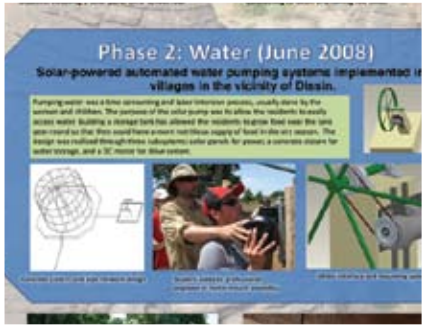
*Inspiring the next generation of professional engineers*

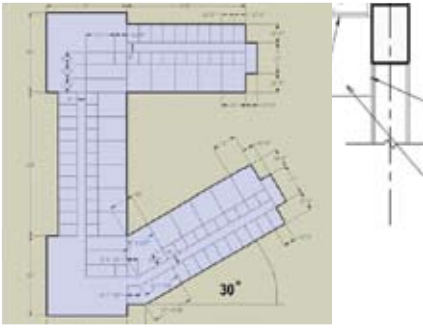
## CONTENTS

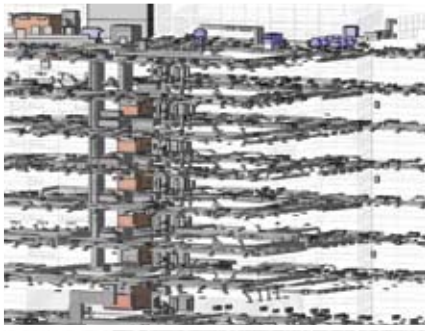




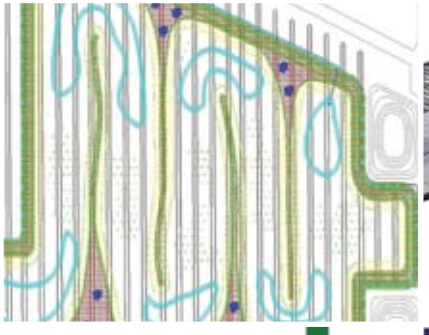
civil engineering
senior design class

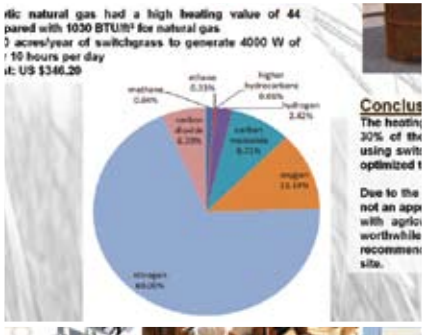





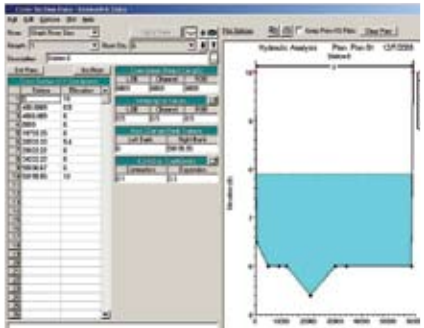










## PRESIDENT'S MESSAGE

NCEES established the NCEES Engineering Award to promote the integration of professional engineering into education and, thereby, encourage more students to start on the road to licensure. Licensure is an essential safeguard for the public, and NCEES wants engineering students to understand its importance as well as its benefits. A P.E. license demonstrates a commitment to technical competency and ethical practice. It's also a mark of distinction that opens up career options.

Collaborative projects give professional engineers an opportunity to impart the responsibilities and privileges of licensure. They also help students see how classroom lessons apply to real-world situations. These collaborations increase students' technical knowledge and teach important lessons about nontechnical issues such as communication, teamwork, professional ethics, and social responsibility.

NCEES invited EAC/ABET-accredited engineering programs to submit projects that demonstrate the integration of professional practice and education. The 28 entries we received covered a range of engineering topics and project types. NCEES assembled a jury of state licensing board members, engineering deans, and engineering society representatives to judge these submissions.

This book highlights this year's winners. We hope that their projects will inspire other engineering programs to develop collaborative activities and encourage more professional engineers to take part.

On behalf of NCEES, I thank the students, faculty, and practitioners for your participation. We applaud your efforts to bring together professional practice and education. Thanks also to the jury members for giving your time and expertise to support this initiative.

We at NCEES look forward to building on the success of this first year to further encourage innovative collaborations between professional engineering and education.

Henn Rebane

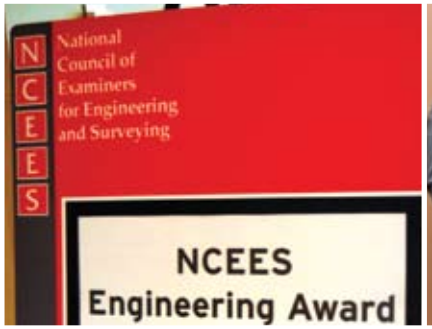
Henn Rebane, P.E.
2008–09 NCEES President









Experiences

National
Council of
Examiners
for Engineering
and Surveying
NCEES
NCEES
Engineering Award
Jury Meeting


Architect
Division
Structural
Division

Overture Engineering
Project Site
Team F
Environmental
Division



DESIGN FOR THE DEVELOPING WORLD









NCEES


## 2009 NCEES ENGINEERING AWARD JURY

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

**Peter Hutchison, P.E., P.L.S.,** Jury Chair
Wyoming Board of Registration for
Professional Engineers and Professional Land Surveyors

**Fred Choobineh, Ph.D., P.E.**
Nebraska Board of Engineers and Architects

**George Gibson, P.E.**
Oklahoma State Board of Licensure for
Professional Engineers and Land Surveyors

**William Pierson, Ph.D., P.E.**
West Virginia State Board of Registration for
Professional Engineers

**Lew Brown, Ph.D.**
Dean of Engineering, South Dakota State University

**Harvey Palmer, Ph.D., P.E.**
Dean of Engineering, Rochester Institute of Technology

**Mickey Wilhelm, Ph.D., P.E.**
Dean of Engineering, University of Louisville

**Peter Carrato, Ph.D., P.E.**
EAC Vice Chair–Operations, ABET

**J.P. Mohsen, Ph.D.**
President-Elect, American Society of Engineering Educators

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

**David Waugh, P.E.**
Past President, National Society of Professional Engineers

## JUDGING PROCESS

The jury met in Clemson, South Carolina, on March 12, 2009, to conduct a blind judging of the 28 submissions. Each submission consisted of a display board, abstract, and reports. The jury reviewed the abstracts and reports prior to judging and viewed the display boards at the judging. The jury established a shortlist and then further reviewed these projects. The jury voted by secret ballot to establish the six award winners and, ultimately, the grand prize winner.

The jury considered the following criteria in its deliberations:

Successful collaboration of faculty, student, and professional practitioners

Benefit to health, safety, and welfare of the public

Effectiveness of display board as visual representation of project

Impact on raising social consciousness

Impact of partnering teaching and practice

Multidiscipline and/or allied profession participation

Knowledge or skills gained

Enrichment of professional leadership

Viability of technology used in project

Effectiveness of abstract

## PARTICIPANTS

### Students

Over 160 students were involved in the senior design capstone projects, including the following from the featured Everglades restoration project:

### Winsberg Farms Wetland Restoration Project

Matthew Landschoot
Aaron McDaniel
Chris McIntyre
Jernard Perkins
Joshua Reichert
Luke Tucker
Gene Whatley
Zachary Zehnder

### Tamiami Trail Modifications Project

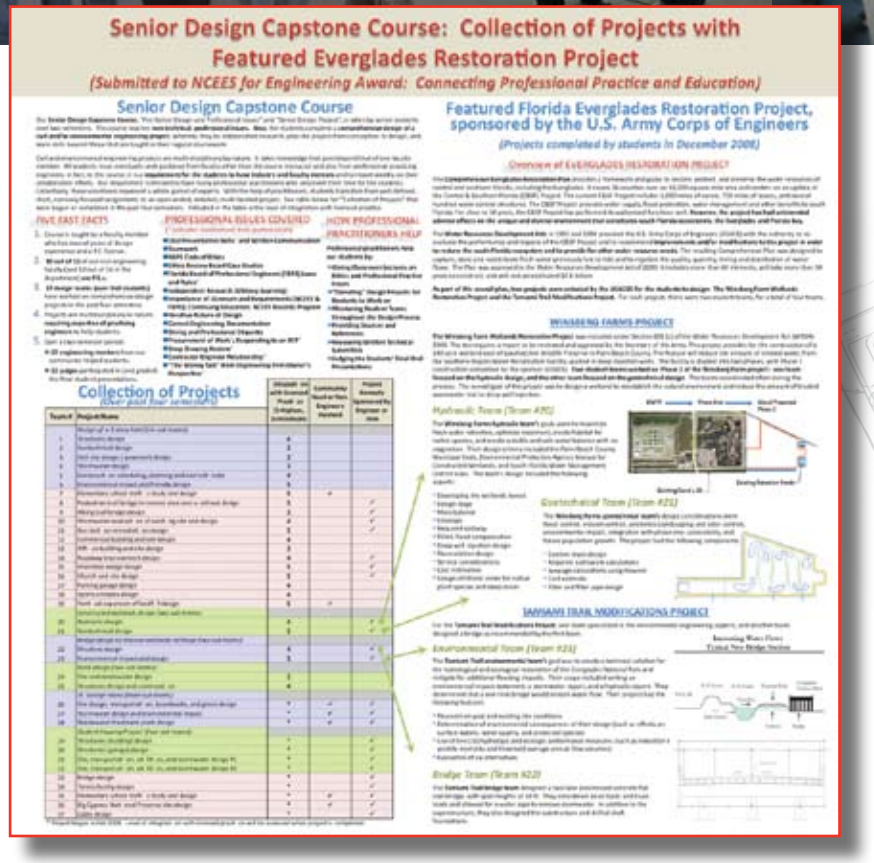
Toniette Addison
Clinton Bagwell
Catherine Carella
Sean Johnson
Andres Lastra
Marc Manarang
Christopher Rawl

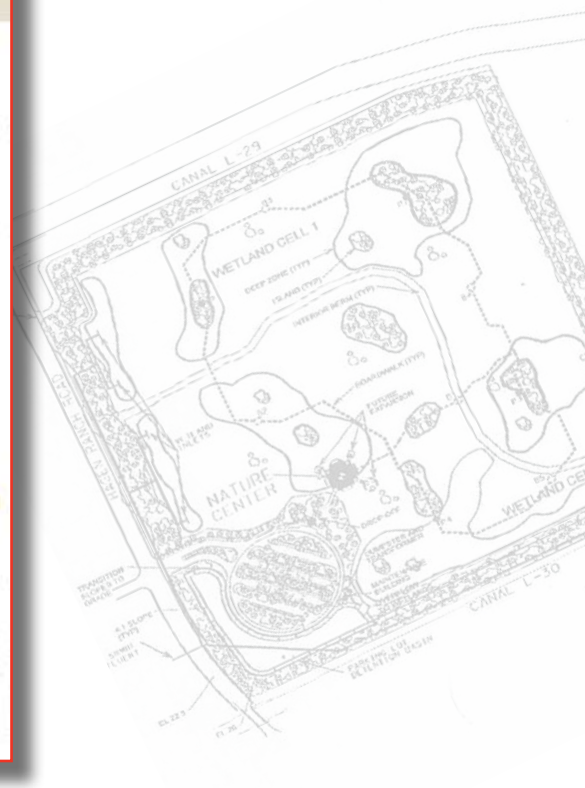
### Faculty

Michelle Rambo-Roddenberry, Ph.D., P.E.
Tarek Abichou, Ph.D., P.E.
Yassir AbdelRazig, Ph.D.
Amy Chan Hilton, Ph.D.
Gang Chen, Ph.D.
Clayton Clark, Ph.D.
Sungmoon Jung, Ph.D.
Wenrui Huang, Ph.D., P.E.
Primus Mtenga, Ph.D., P.E.
Ren Moses, Ph.D., P.E.
Virgil Ping, Ph.D., P.E.
John Sobanjo, Ph.D., P.E.
Lisa Spainhour, Ph.D., P.E.
Kamal Tawfiq, Ph.D., P.E.
Michael Watts, Ph.D.
Jerry Wekezer, Ph.D., P.E.

# $25,000 GRAND PRIZE




Senior Design Capstone Course: Collection of Projects with Featured Everglades Restoration Project
(Submitted to NCEES for Engineering Award: Connecting Professional Practice and Education)
Senior Design Capstone Course
Featured Florida Everglades Restoration Project, sponsored by the U.S. Army Corps of Engineers
(Projects completed by students in December 2008)
Collection of Projects



# Florida A&M University-Florida State University

Department of Civil and Environmental Engineering

**Senior Design Capstone Course: Collection of Projects with Featured Everglades Restoration Project**



## ABSTRACT

Our capstone courses, "Pre-Senior Design and Professional Issues" and "Senior Design Project," are taken by students over a two-semester period. The first purpose of these courses is to give our senior students an understanding of non-technical, professional issues, such as how to work effectively in teams, good oral and written communication skills, and ethics. The second purpose is to give them an opportunity to complete a comprehensive design of a civil and/or environmental engineering project, whereby they do independent research, plan the project from conception to design, and learn skills beyond those that are taught in their regular coursework.

Civil and environmental engineering projects are multidisciplinary by nature. It takes knowledge that goes beyond that of one faculty member. All students must eventually seek guidance from faculty other than the course instructor and from professional practicing engineers; in fact, this course requires students to have industry and faculty mentors and to report weekly on their collaboration efforts.

In part because of this capstone course, our department and professional practitioners have fostered a mutually beneficial relationship over the years. This course is taught (or managed, rather) most effectively when professionals who are involved in design on a day-to-day basis volunteer their time for the students. Collectively, these volunteers represent a whole gamut of experts. They help us by giving classroom lectures, donating real-world projects and background information, mentoring students, reviewing submittals, and judging oral presentations. With the help of practitioners, students transition from well-defined, short, narrowly focused assignments to an open-ended, detailed, multifaceted project.

This submittal explains the objectives of the course, the role of practicing engineers and faculty, course requirements, and types of projects that have been designed by students recently. For each project, a rating for the integration with licensed practice is given. This collection of projects includes a variety of topics and was supported by many faculty, engineers, and engineering firms/agencies. At the end of this submittal, a detailed description of a featured project, sponsored by the U.S. Army Corps of Engineers, for the Florida Everglades Restoration is provided.

We appreciate NCEES for giving engineering programs this opportunity to showcase their partnership efforts, and we thank ABET, the engineering deans, ASEE, NAE, and NSPE for their partnership by being on the award jury. We hope that news of this award will encourage professionals to get involved with engineering students across the nation, because their time and sharing of knowledge make a difference.

## PRACTITIONERS

Participating practitioners and firms include the following:

**Featured Project**

James Boone, P.E.; Robert Medlock, P.E. (U.S. Army Corps of Engineers)

Bill Armaghani, P.E. (Ardaman & Associates)

Kevin Aubry, P.E. (Dunkelberger Engineering and Testing)

Wesley Markham, P.E. (Arcadis Engineering)

Rodrigo Herrera, P.E.; Thavaj (Joe B.) Bhuvasorakul, Ph.D., P.E. (Florida Department of Transportation)

**Other Projects**

Marc Ansley, P.E.; Lora Hollingsworth, P.E. (Florida Department of Transportation)

Sal Arnaldo, P.E. (City of Tallahassee)

Douglas Barkley, P.E.; Jamie MacDonnell, E.I.; Brian Kever, P.E. (Barkley Consulting Engineers)

Myron Hayen, Ph.D., P.E.;
Judith Hayden, P.E.;
Tom Hayden, P.E. (EGS)

Victor Herrera, E.I.; Kathy Burke, P.E. (BPS&J)

John Sliger II, P.E. (Registe, Sliger Engineering)

## PERSPECTIVES

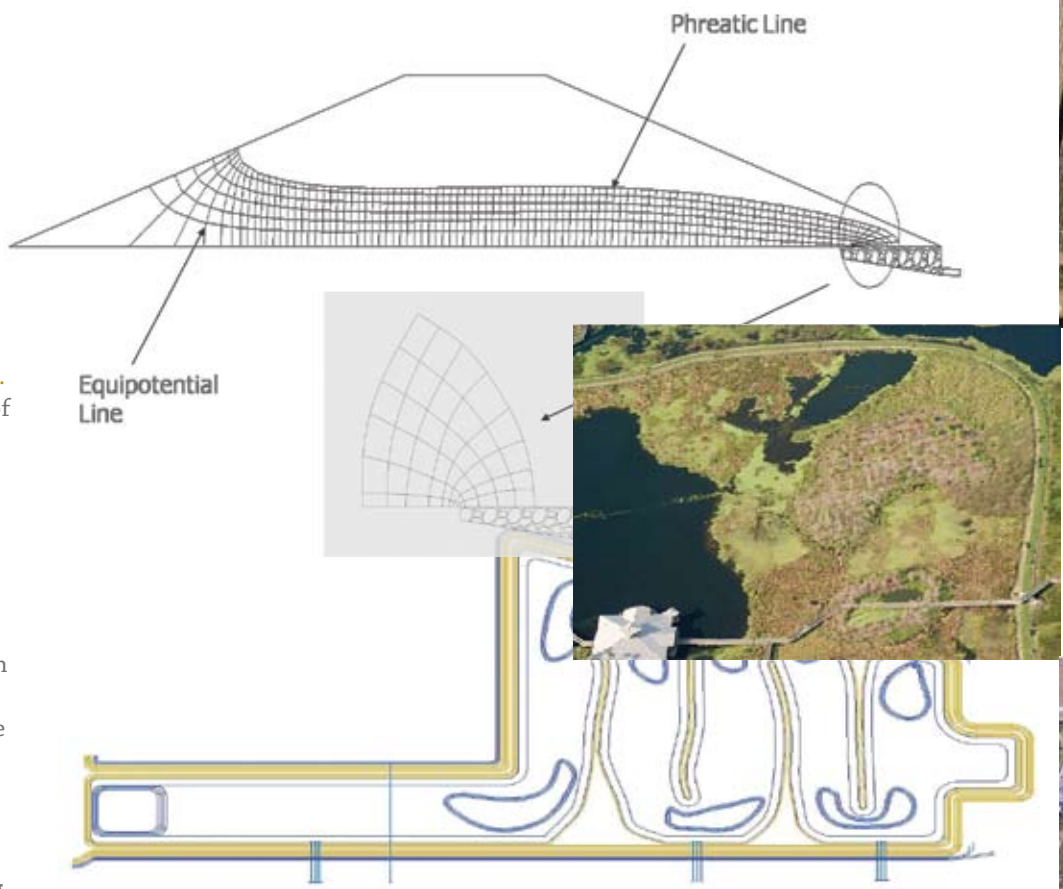
**FACULTY**

Michelle Rambo-Roddenberry, Ph.D., P.E.
Assistant Professor, FAMU-FSU School of Engineering

**Why did FAMU-FSU want to get professional engineers involved in the senior capstone course?** They help us to integrate professional practice issues into the design projects. Our projects have a more real-world feel when engineers are involved. The students really appreciate having mentors to guide them, and the faculty find that the bar is raised when professionals judge the presentations.

**When did FAMU-FSU begin including professional engineers in senior capstone projects?** Professional engineers started sponsoring senior capstone design projects in 2001.

**How has the involvement of professional engineers grown since this time?** Professional engineer involvement has been expanded over the years. In addition to sponsoring projects and mentoring students, they also judge and critique the students' final presentations. The final presentations have become more intense, and I think we are expecting more out of the students as the years go by. Also, several engineers visit the class to discuss topics such as ethics, procurement of work, an engineer's duties and obligations, and the contractor-engineer relationship.

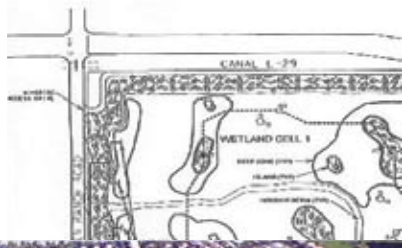


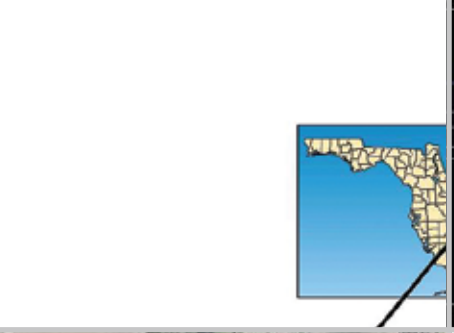
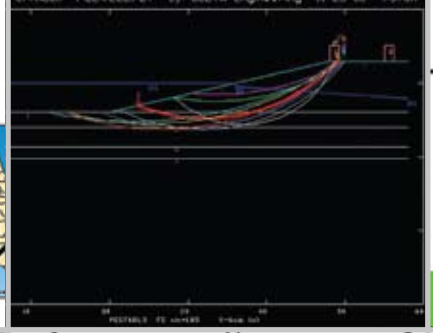
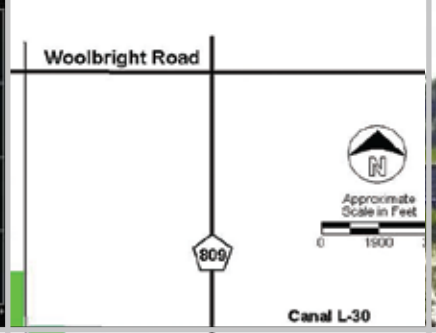

**What's ahead for the course?** We will continue to evaluate the course and its effectiveness. We have to make sure that it provides a valuable learning experience for the students and that it is kept up-to-date with ABET's criteria.

**What advice do you have for other universities wanting to bring professional engineers and students together?** Particularly [for] a capstone course: 1) Be flexible. Allow the students to develop a scope that they are prepared to handle. 2) If an individual faculty member manages a capstone course, he or she should be willing to allow students to work in areas that are outside his or her area of expertise. He or she should be able (and, more importantly, willing) to direct students to other experts who can help them. 3) Trust the students to rise to the challenge! Set the bar high and let them know the seriousness of the project. 4) Say "thank you" to the professional engineers to let them know how much they are appreciated.

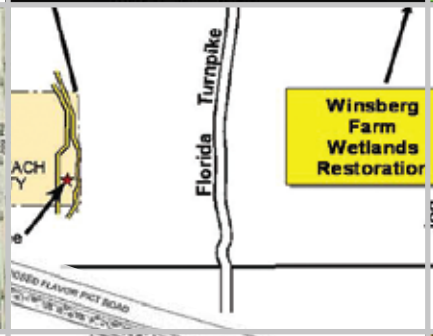
**How does FAMU–FSU plan to use the $25,000 prize?** We plan to use the prize money to enhance our senior students' design experience. We will likely purchase design software, make enhancements to our senior design lab, or provide resources to the students for travel related to their project or for project deliverables preparation.

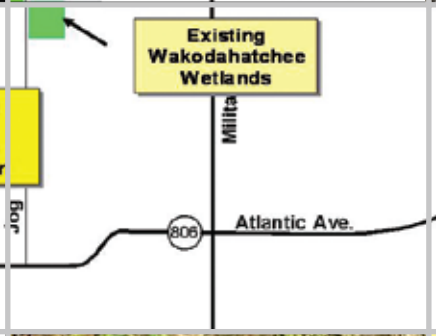
**Winsberg Farms Wetland Restoration Project**

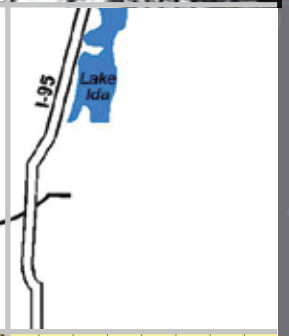


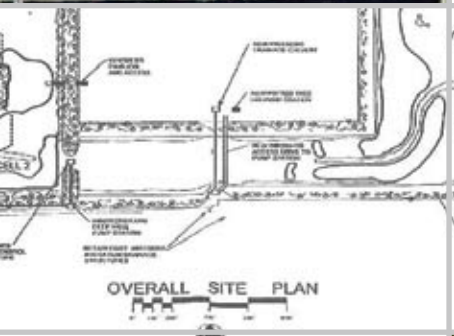




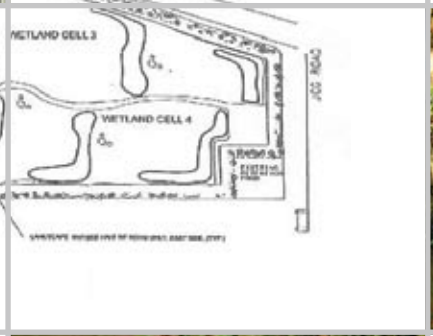


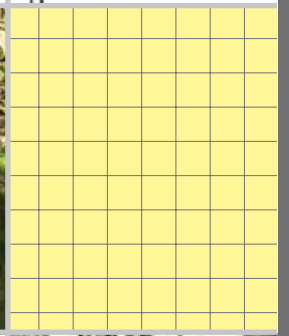


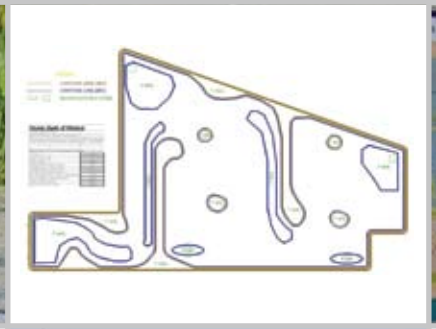
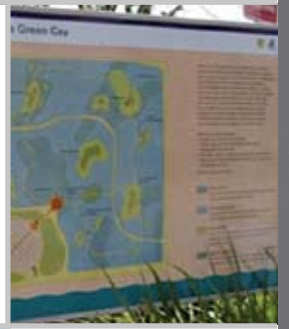


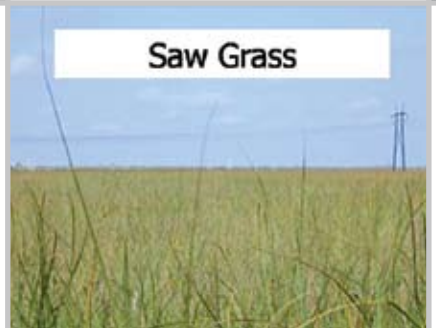











## JURY COMMENTS

"The 'pre-senior' design course provides a strong introduction for the students of key issues like ethics, public health, social responsibility, and other ancillary elements that can make the difference between success and failure in a P.E. design context."

"This is a great submission that demonstrates strong interactions of practitioners with the engineering faculty and students."

"Great benefit to health, safety, and welfare of the public"

**STUDENTS**

Raymond Bendt (Bald Point State Park Elevated Cabins)

Daniel Benitez (University Village Building Design)

Chad Finch (State Road 263—CSX Railroad Overpass)

Kyrina Moultrie (Woodville Elementary Traffic Study/Design)

Angelo Nieves (Big Cypress National Preserve: Backcountry Access Point)

Aaron Jared Ray (Site Development of St. George Island's Commercial District)

David Sanders (St. George Island Stormwater Retrofit Design)

Kayna Shipp (State Road 263—CSX Railroad Overpass)

Katie Signore (Big Cypress National Preserve: Backcountry Access Point)

**What did you like best about participating in the project?**

*Nieves:* Our project is actually going to be implemented at the national preserve.

*Bendt:* It allowed me to bring together many different areas of civil engineering and combine them into a single project where a great many aspects had to work together.

*Moultrie:* The best thing about the project was the nature of it. I like that we were able to choose a division of civil engineering that we were interested in and learn more about it with the help of industry mentors.

**What did you learn?**

*Benitez:* There is a need to being able to adapt to any new problems that arise and you must be able to change your design throughout the project.

*Signore:* This project taught me a lot about the nontechnical side of engineering. Projects aren't only about the calculations and if something's structurally sound. It also has to do with teamwork and the group getting the project completed.

*Shipp:* For our team, one of the biggest challenges was using our time efficiently. Our design project was multidisciplinary; thus, often we had different members waiting on certain portions of the design to be completed before they could proceed. To optimize everyone's skills, the team members who were waiting helped with drawing and checking calculations.

**How did the participation of professional engineers improve the experience?**

*Ray:* They provided valuable insight and criticism of proposed design and explained how features and aspects of the project could be changed for different benefits such as economical or environmental impact.

*Benitez:* It shed light on areas of the project that required attention which we never even thought of. [It] also taught us about certain design conventions used due to ease of construction and production.

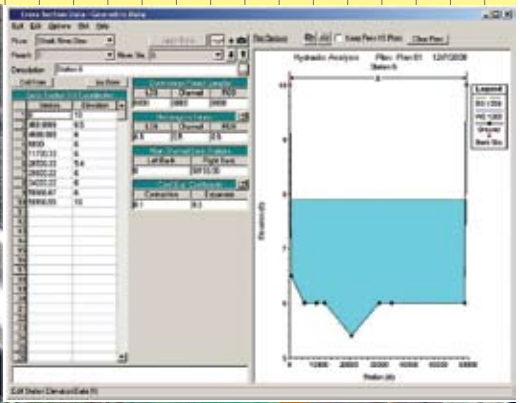
*Shipp:* One of the main goals of our team was to complete a project that was as "real world" as possible. Simply, our team wanted experience on a practical project that we might actually be given as an engineer. Even though we were given design examples, our team needed further guidance as to how certain values and dimensions were determined. The professional engineers who guided our team helped us to understand each piece of the project.

**What do you think the engineers learned by working with students on the project?**

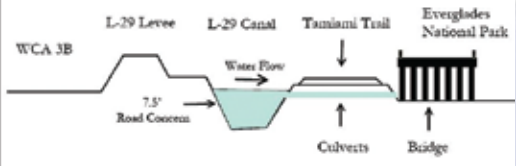
*Sanders:* Probably that we still have a long way to go! Seriously, though, I would think that they learned that there are young enthusiastic minds out there that really want to learn the right way to do things in civil engineering.

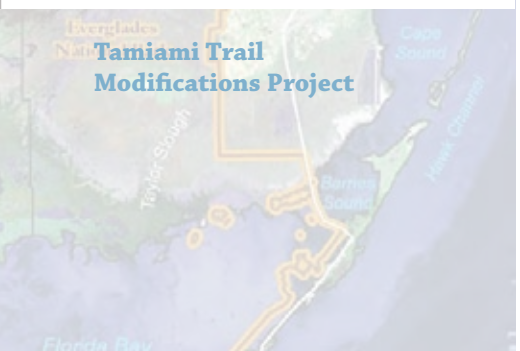
*Bendt:* I believe the engineers gained a better understanding of the material which colleges are preparing graduates with at this point in time and that helped them to stay more in touch with the educational side of engineering which they do not have as much contact with.

*Finch:* I think the most important thing the professional engineers learned from us is that, despite the fact that we are only students, we have the foundation to put together a professional project within our scope of work.


**Increasing Water Flows**
**Typical New Bridge Section**




**PRACTITIONERS**

Douglas Barkley, P.E.

Katherine Burke, P.E.

Victor Herrera, E.I.

John Sliger II, P.E.

### Why did you get involved with the FAMU–FSU capstone course?

*Herrera:* I am a graduate from the department and saw the importance of connecting education with local professionals. This class provided an excellent opportunity for me to get involved.

*Burke:* I think I got "nominated" or referred by Victor. [He] asked and I said okay since I think it is important to mentor younger engineers. This year's group of kids was engaged and willing to learn, so I was happy to spend whatever time they needed for the project.

*Sliger:* We have hired many entry-level engineers and interns to work at our firm. We have found that there was a lack of knowledge in the understanding of load paths and lateral stability issues. RSE staff felt that this was a good way for us to address these issues.

### What did you learn from working with the students?

*Sliger:* The students want to learn. Lay out what is expected of them, and they will rise to the challenge.

*Herrera:* You can observe a level of growth, even if minimal, during this process. From the first day they meet with you and present their scope to the day you see them present in front of the panel; there is a level of maturity that you like to think you had some influence in making happen. I learned that the more we can put toward supporting younger education, the sharper and better engineers we are building for the future.

### What knowledge or skills do you think the students took away from collaborating with professional engineers?

*Herrera:* I think the students realized the importance of deadlines as well as how to interact with the public. We had our team meet with the school they were working with and it allowed them an opportunity to see how everyone reacts differently to certain situations. A big realization they had with our project was that perception is different in every person. Although our standards and guidelines tell us what should be done, we must always be aware of the client's desires/needs while keeping their safety in mind.

*Burke:* I think they learned that the design process is not cast in stone; it is iterative, and on each portion of the design, the team has to work together for the project to fit. They learned that one seemingly minor change in one part of the site could and often does have ramifications elsewhere on the site.

*Barkley:* The senior design course is the best opportunity for the students to discover how complex real-world engineering is and how much they need to learn. It definitely prepares them for their first post-school job.

*"The students were really involved in all phases of the project, from concept through evaluation and design. The interaction between the students and the federal interagency design team offered unique experiences in real-life scenarios. This project was a great learning tool for the students and provided valuable input to the team working in the Everglades. The project also provided a valuable test for students to decide if they were interested in the environmental/ ecosystem restoration aspects of engineering."*

—James Boone, P.E.;
Robert Medlock, P.E.
(U.S. Army Corps of Engineers)

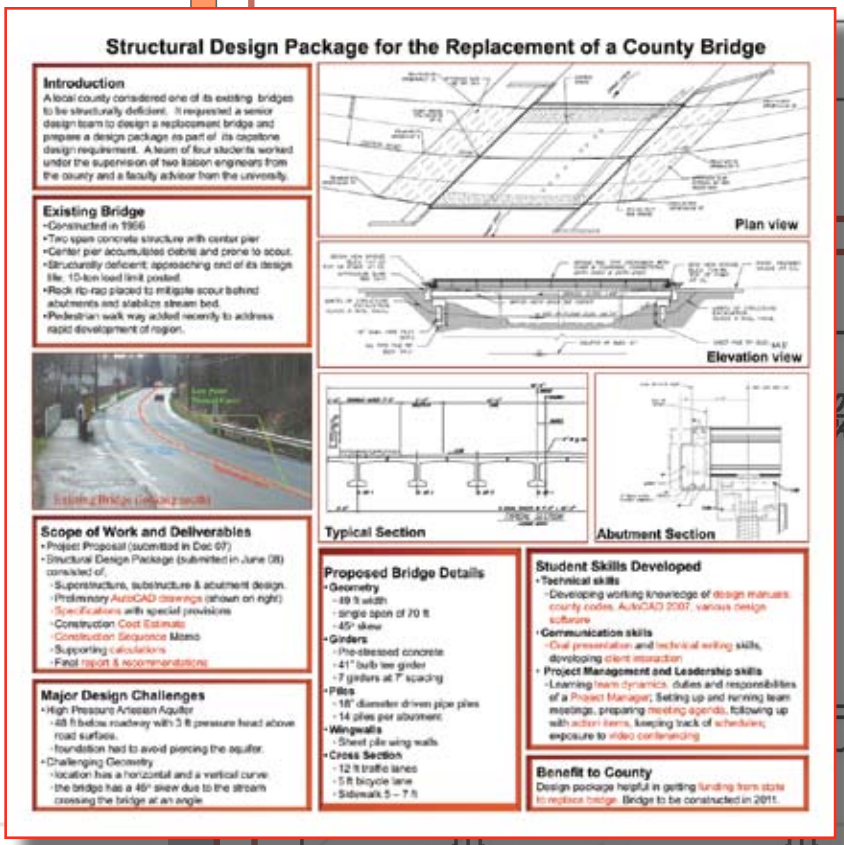
PARTICIPANTS

**Students**
Edward DeBroeck
Brandon Estrella
Matthew Hennessey
Ryan Tilley

**Faculty**
Jefferey Dragovich, Ph.D., P.E.

**Practitioners**
Brian Larmore, E.I.T.;
Art Louie, P.E.; Lisa Wirt, P.E.
(Snohomish County Department of Public Works)

# $7,500 AWARD




Typical Section

# Seattle University

## Department of Civil and Environmental Engineering

**Structural Design Package for the Replacement of a County Bridge**


## ABSTRACT

All engineering students of our university are required to complete a year-long, industrially sponsored senior design project prior to graduation. In the project described below, a team of four students worked under the supervision of two liaison engineers from a local county and a university faculty advisor on the design of a bridge requiring replacement. In fall quarter, the students prepared a written proposal for the county outlining the project, scope, and plan of work, project deliverables, schedule, and budget. The design was done in winter and spring quarters and culminated in a report describing the design methods, engineering drawings, calculations, and recommendations. The team made oral presentations to the county at the end of fall, outlining the project approach, and in spring quarter, describing their final design.

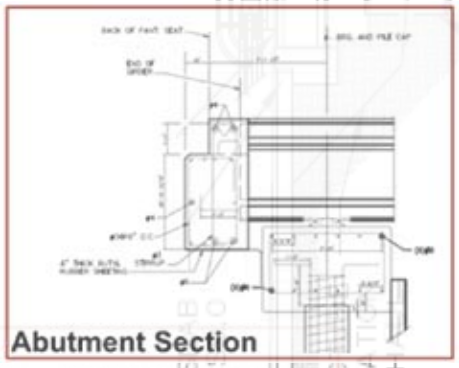
A local county identified one of its bridges as structurally deficient and not in compliance with current standards for lane width and pedestrian access. In addition, the bridge had several design challenges: the center support and abutment had experienced severe scouring and erosion; the site had a high pressure artesian aquifer located 48 feet below the road surface; the roadway profile had both a horizontal and vertical curve.

The county requested the student team to submit a structural design package for a single span, pre-stressed concrete bridge superstructure, substructure, and roadway approach slab. In response, the team designed a 70-ft-long, 49-ft-wide bridge superstructure using decked bulb tee girders. The bridge has two 12-ft vehicle lanes, two 5-ft bike lanes and two 5- to 7-ft sidewalks. The substructure consists of 18″ diameter cast-in-place concrete piles. The team also designed the abutment consisting of sheet pile walls.

The student team prepared a structural design package for the client consisting of structural plans and details using AutoCAD 2007, construction specifications including special provisions, a construction sequence memo, construction cost estimate, and design calculations. The team submitted 30%, 60%, 90%, and 100% submittals to the county.

During the academic year the student team met with the faculty advisor weekly and with the liaison engineer biweekly or weekly to discuss team progress. Because the sponsor was located 30 miles away from the university, some of the sponsor meetings were held via videoconferencing. Each team member served as the project manager during the year, running team 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 learn and practice project management and leadership skills, and to meet the clients' needs.

The county submitted the preliminary design package to the state department of transportation in the summer of 2008 requesting funding. This was the only bridge within the county approved for full replacement.

Abutment Section


## JURY COMMENTS

"The close connection between the students and licensed P.E.'s was impressive. Additionally, the quality of the work done by the students and the depth and breadth of their analysis was exceptional."

"A very realistic project was undertaken that could very well be an assignment for a junior engineer within the first few years of a career as a civil engineer."

"This is an excellent example of a well-executed senior design project, supervised by both faculty and practicing engineers, to create a design solution for a public problem."

## PARTICIPANTS

**Students**
Civil engineering undergraduate student body

**Faculty**
Kevin Lansey, Ph.D.
Mohammed Ehsani, Ph.D.

**Practitioners**
Jack Buchanon (WLB Group)

Melvyn Green (Melvyn Green and Associates)

Scott Larson, P.E. (RBF Consulting)

Brooks Keenan, P.E. (Transystems)

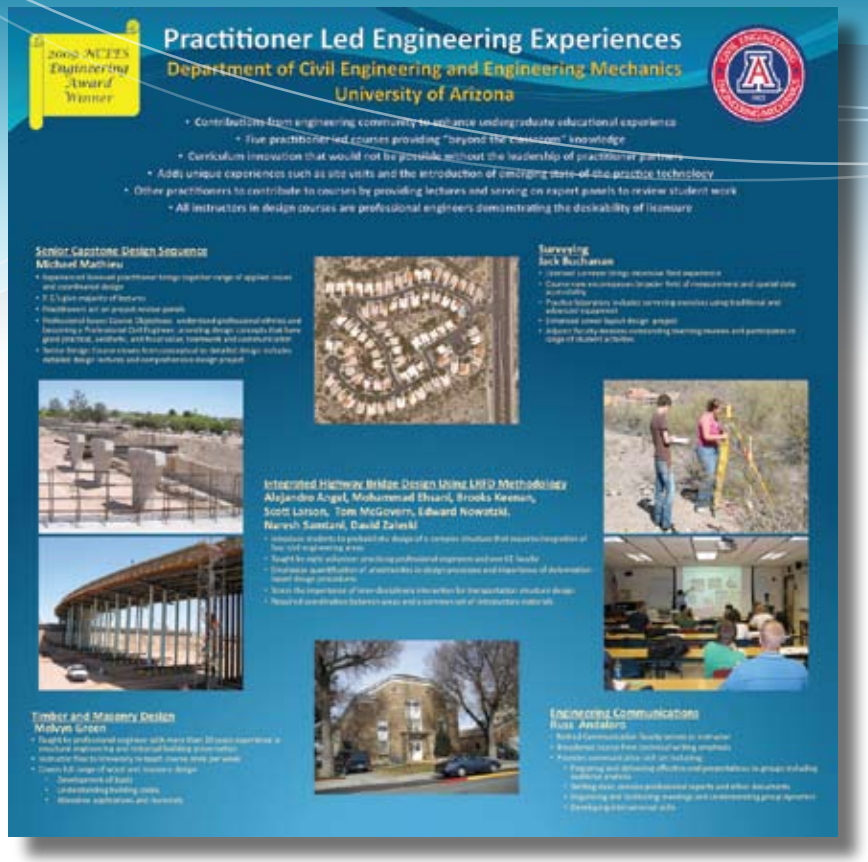
Michael Mathieu (Mathieu Engineering Corp.)

Tom McGovern, P.E.; Alejandro Angel (PSOMAS)

Naresh Samtani, Ph.D., P.E.; Ed Nowatzki, Ph.D., P.E. (NCS Consultants)

Dave Zaleski, P.E. (Pima County Department of Transportation)

# $7,500 AWARD




## ABSTRACT

Our program is fortunate to have significant support for our students and our educational mission from the local community. A number of professionals have invested their knowledge and time to lead and collaborate on advanced practically oriented experiences for our Civil Engineering students. These practitioner instructors take time from their firms and become positive models for our students. This group fills a gap by teaching material that our faculty is unable to teach or that is better suited to being taught by practitioners. Their involvement in the curriculum expands opportunities that are geared to real world applications. In particular, they have partnered with faculty to develop communication and surveying courses and participate in our senior design sequence in a range of capacities, including course leader. Finally, a group of eight practitioners organized and offered a novel bridge design course centered on newly accepted probabilistic design procedures. These successful partnerships are summarized in this submission for consideration for an NCEES Engineering Award.

These courses provide an outstanding link between students and practice in a range of curriculum components including design and developing communication

# University of Arizona

Department of Civil Engineering and Engineering Mechanics

**Practitioner-Led Engineering Experiences**

and teamwork skills. Collaboration results demonstrate curriculum innovation that would not be possible without the leadership of our practitioner partners. The practical emphasis has added unique experiences such as site visits and the introduction of emerging state-of-the-practice technology in the curriculum. In addition to practitioner leadership of the courses, the instructors extend our network in the community by inviting other practitioners to contribute to courses by providing lectures in their specialty areas and serving on expert panels to review student work. The latter activity has led to a significant impact on professionalism and quality of presentations. Positive impacts on applicable award evaluation criteria are discussed below.

Successful collaboration of faculty, students, and professional practitioners and impact of partnering teaching and practice—Our departmental alumni and friends have recognized the opportunity to support our department and work in tandem with our faculty to develop novel educational experiences that better prepare graduates. The two most collaborative efforts are the practitioner-initiated bridge design course that was collaboratively organized and taught by practitioners and faculty and our capstone design courses that are led by a practitioner with lectures taught by faculty and practitioners. Capstone design evaluation teams were comprised of a mix of the two groups.

Benefit to health, safety, and welfare of the public—Practitioners are more acutely aware of the need to design for safety, and students are more open to accepting this guidance from practitioners who have that perspective. Technically, the bridge design course was based on new technology that accounted for the uncertainties in all aspects of the design. Understanding and applying this newly instituted approach will improve the safety of transportation structures designed by these graduates.

Impact of raising social consciousness—The senior design course under practitioner leadership has added modules on social issues, including requiring students to attend a public meeting to develop an understanding of the social implications of their work and the strength of public opinion. As civil engineers, this understanding is critical.

Knowledge and skills gained—The success of these courses and the amount of material learned is documented in student evaluations. Passing this knowledge to the students is a tribute to the instructor's quality and communication skills. We can measure this success, as our students have consistently scored average to above average scores on the FE exam in structural design and surveying.

Professional leadership—All instructors in design courses are professional engineers demonstrating the desirability of licensure. Further, the first semester of our two-semester design course includes a range of professionalism topics, including an ethics module taught by practitioners.

## JURY COMMENTS

"A strength of this submission was the involvement of industry practitioners in delivering engineering coursework."

"The key distinction between the winning entry and a more traditional senior design experience is the intimate role that practicing engineers play in the development and teaching of the key elements of the course sequence."

"A strong effort has been made to supplement existing faculty talents by using licensed professionals in key courses."

# $7,500 AWARD

## PARTICIPANTS

**Students**
Students of Civil Engineering Systems Design classes, 2008–2009

**Faculty**
Deborah O'Bannon, Ph.D., P.E.

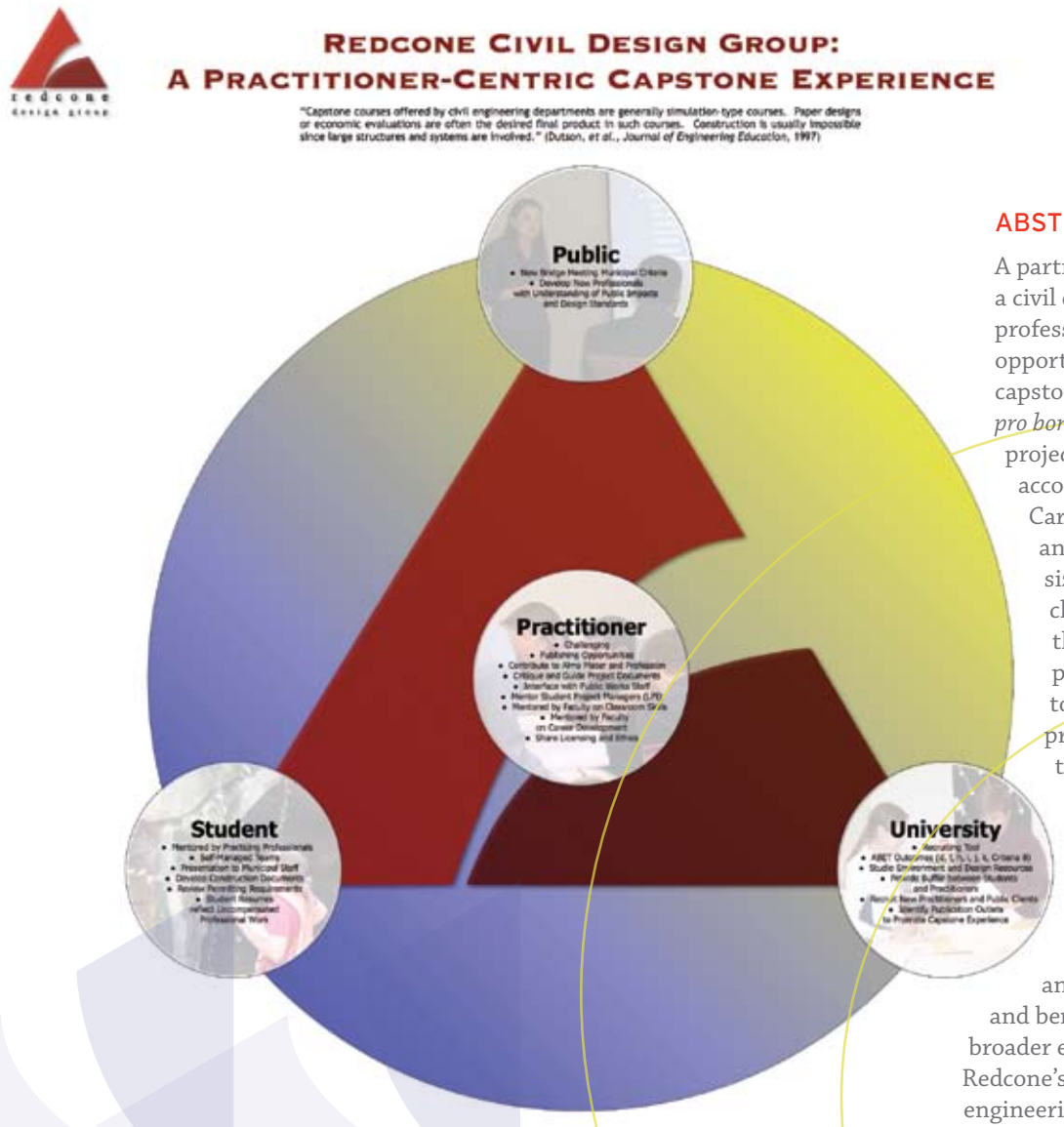
**Practitioners**
Thomas Kimes, P.E.
(HDR Engineering)

Erich Schmitz, E.I., LEED
(TranSystems)


# University of Missouri–Kansas City

Department of Civil and Mechanical Engineering

**Redcone Civil Design Group: A Practitioner-Centric Capstone Experience**





## ABSTRACT

A partnership between a municipality, a civil engineering department, and professional practitioners created the opportunity for a civil engineering capstone class (Redcone) to provide *pro bono* engineering services on public projects that will be constructed according to the students' design. Care is taken by the practitioners and the faculty to select right-sized projects that will be challenging and meaningful to the students. Throughout the process, the students are expected to understand that the ethical, professional, and design decisions they make affect public health and safety. The class provides a transition between school and the workplace, with marked increase in the professionalism of the students. The practitioners, students, faculty and client share responsibilities and benefits that gain respect in the broader engineering community and ensure Redcone's continuation as a viable civil engineering capstone experience.


## JURY COMMENTS

"This program fully addresses the need for students to understand and appreciate the high level of accountability and social responsibility experienced by practicing engineers designing solutions for the public sector."

"Design projects within the program are of a size to complete in a year's time. Makes the experience more meaningful for the students."

"This submission was an outstanding partnership of professional practitioners, the city, and the civil engineering department."

## PARTICIPANTS

**Students**
Sean Blocher
Josh Bobo
Bryce Evans
Michael Gilliam
Robert Hageman
Benjamin O'Neil
Ipshita Thomas
Jonathan Wooten

**Faculty**
Ignatius Fomunung, Ph.D.
Ronald Bailey, Ph.D.
Prakash Damshala, Ph.D.
Philip Kazemersky, Ph.D.
Joseph Owino, Ph.D.

**Practitioners**
Tim Andrews (Tennessee Valley Railroad Museum)

Richard Brown, Ph.D. (University of Tennessee at Chattanooga)

Jeff Cannon (River City Company)

Tom Dugan (Chattanooga Area Regional Transportation Authority)

Mark Hairr (UTC Center for Energy, Transportation, and the Environment)

Ron Littlefield (Mayor, City of Chattanooga)

Ani McClain (United States Green Building Council, East Tennessee Chapter)

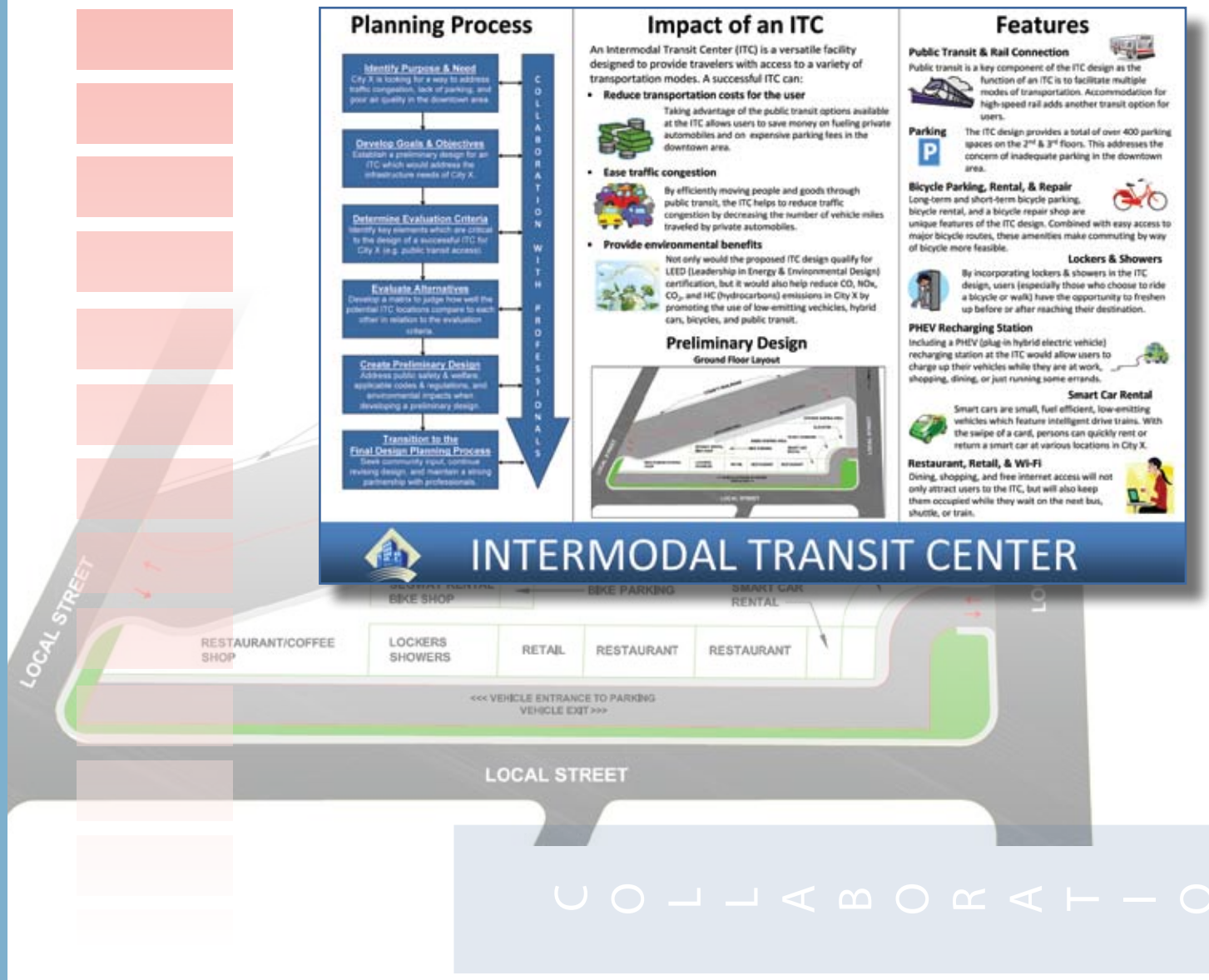
Steve Meyer, P.E. (Volkert & Associates)

Philip Pugliese (Outdoor Chattanooga)

Eddie Tate; Ariel Soriano, P.E.; John Van Winkle, P.E. (City of Chattanooga Public Works)

Melissa Taylor (Chattanooga-Hamilton County Regional Planning Agency)

# $7,500 AWARD




COLLABORATION

# University of Tennessee at Chattanooga

Department of Civil Engineering

**Intermodal Transit Center**

## ABSTRACT


"City X" is rapidly emerging; it is home to many manufacturing and service industries and has been labeled as the fastest growing major city in "State X." Along with this prosperity, however, there comes more traffic, increased emissions, and less parking. How can these challenges be overcome?

A team of eight senior-level engineering students sought to find a solution to the problem. Their answer: an Intermodal Transit Center (ITC), a facility whose function is to connect various modes of transportation in an efficient manner. A successful ITC can reduce transportation costs for the user, ease traffic congestion, supply parking, and provide environmental benefits, including reduced emission. The objective of Phase I of the ITC project was to propose a preliminary design for an ITC in City X, home to the students' university. Phase I was completed during the fall 2008 semester and fulfilled the requirements for part one of the capstone design class under which it was supervised. Phase II of the project, to be completed in the spring 2009 semester (in part two of the capstone design class) will involve the detailed structural design of the ITC, traffic flow study, and cost analysis.

Phase I of ITC project involved collaborative efforts between government officials, engineers, urban planners, transportation specialists, local businesses, city personnel, transportation providers, environmental specialists, and financial contributors. Students were able to apply classroom knowledge to a real-world scenario using skills from a variety of disciplines. In the civil engineering field, structural analysis and transportation planning (including applicable legislative procedures) were used. Environmental engineering knowledge was used in determining building materials, site location, and facility layout. Good engineering management skills ensured practical schedules and productive meetings. The student design team also used the principles of safety engineering to design an ITC that would assure public welfare.

Students also made use of available technology to enhance the project. Computer programs such as AutoCAD, Microsoft Project, Microsoft Word, Microsoft Excel, and Microsoft PowerPoint were utilized. In addition, students established a Web page (to be made available to the public upon completion of Phase II) through the university Web site, which showcases the project and informs readers about how an ITC would impact City X. Furthermore, the team used an online file exchange system to maintain strong communication and document progress.

By combining engineering skills, professional guidance, and technology, the student team successfully proposed a preliminary design for an ITC in City X. The design is tailored for the needs of City X and includes the following features: parking, public transit connections, shuttle services, smart car rentals, restaurants, retail space, free Wi-Fi, bicycle rentals, bicycle repair shop, bicycle parking (long-term and short-term), access to bicycle routes, lockers and showers, PHEV (plug-in hybrid electric vehicle) refueling stations, and accommodations for future rail connection.

Taking advantage of the opportunity to engage in a project that addresses actual concerns of the local community was truly a worthwhile endeavor. Students have taken great pleasure and satisfaction in knowing they have made a significant contribution towards a venture that has a strong possibility of being realized. Establishing an ITC in City X would certainly bring substantial benefits to the local area. After all, that is what the engineering profession is really about – having a share in strengthening the community!




## JURY COMMENTS

"This is a 'best in class' example of how a team of students can be fully engaged in a complex, multidisciplinary project that addresses a real-life problem in which professional licensure is absolutely critical."

"The planning and presentation to the public for final approval provides an excellent experience for the students."

"A unique aspect of this project was the engagement of the students with government officials and city personnel. This gave the students a strong perspective on real-world engineering."

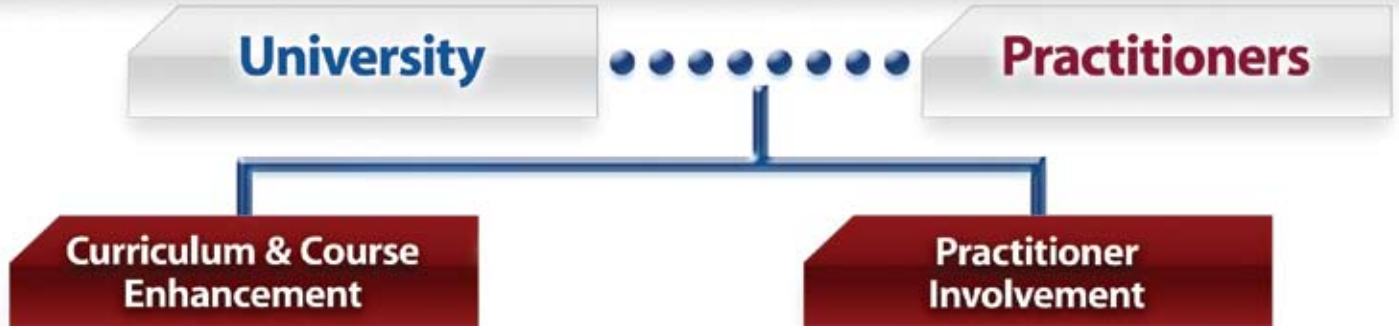
## PARTICIPANTS

**Students**
Over 180 students have participated in the initiative since its creation, including the following officers of the Sustainable Land Development Student Club:
Mallory Barkdull
Tyson Catlett
Yuri Chandler
James O'Shaughnessy

**Faculty**
Randy Dymond, Ph.D., P.E.
Kevin Young, P.E.

**Practitioners**
The Land Development Design Initiative currently has 22 corporate sponsors who provide financial support to the program. Its general membership includes practitioners from 55 firms.

# $7,500 AWARD






## ABSTRACT

A large team of professional engineers has rallied around a call for participation in the development of a new emphasis in land development design within a Department of Civil and Environmental Engineering (CEE) at a major land-grant institution. While as many as one third of graduating civil engineers go to work in the land development industry, few civil engineering programs in the country have any course or emphasis in land development within their curriculum. The Land Development Design Initiative (LDDI) involves more than 70 engineering and land development firms and directly involves industry professionals in teaching, mentoring, curriculum development, and promoting land development to undergraduate students. This paper describes LDDI and the effort to bring together undergraduate CEE students and faculty with industry professionals in order to improve land development design education.

# Virginia Tech

## Charles E. Via Jr. Department of Civil and Environmental Engineering

### Land Development Design Initiative

Strategic planning for LDDI began in early 2006 with the development of an advisory board and continued with statewide outreach meetings in four major regions of the state. The purpose of these meetings was to share the LDDI vision and recruit industry professionals to participate in development of the land development design program at the University. These early efforts have resulted in over 150 practitioners who now participate in this initiative, donating time, energy, and their firms' resources to achieve LDDI priorities. Participation is kept active by the advisory board's biweekly teleconferences and quarterly meetings, semiannual general membership meetings, e-mail, a quarterly newsletter, and a collaboration Web site that enables sharing files, discussions, and a chat room. Organization of the LDDI group has resulted in the creation of two major committees: Curriculum and Course Enhancement and Practitioner Involvement.

The major objective of the Curriculum & Course Enhancement Committee (CCEC) is to develop a strong land development design curriculum with coursework that prepares students for the land development design profession. The major objective of the Practitioner Involvement Committee (PIC) is to develop a strong and sustainable relationship between the private and public sectors of the land development profession and CEE students at the University. This relationship is intended to increase awareness of land development as a career path and to help students prepare for a career in the land development design profession.

The CCEC is chaired by a professional engineer not otherwise affiliated with the University, and is comprised of other practicing engineers and University faculty. Among the ways the CCEC is improving land development design education at the University is through the development of a land development design "track" within the CEE curriculum, inclusion of practitioners in existing courses, and creation of new courses.

The PIC facilitates numerous events each semester that bring students together with industry professionals. These events include presentations during "Land Development Information Nights," during classes, and at student club meetings, such as the student chapter of the American Society of Civil Engineers (ASCE). The committee has also developed a Web site, brochures about land development career opportunities, and has promoted the development of a student club to facilitate interactions between students and practitioners. Furthermore, the PIC has encouraged participating companies to ensure meaningful internship experiences for students by adopting a list of best practices.

### JURY COMMENTS

"Impressive level of cooperation and constructive partnership between a community of licensed professionals and the engineering faculty to create both an educational program and a set of valuable real-life design experiences for students that addresses an important need in our society regarding land management."

"A well-organized and carefully designed process for introducing professional practice with significant involvement with professional engineers."

"This initiative highlights one very important aspect of civil engineering that is often not emphasized in many civil engineering programs."

## PARTICIPANTS

**Students**
Maria Argueta
Sarah Arnberger
Brian Backer
Matt Bartlett
Lexi Beebe
Sam Boland
Chelsea Cross
Ryan Drysdale
John Foster
Eric Gould
Erin Greensberg
Kyle Hudson
Cassie Krahe
Aren Kriks
Jason Langel
Eric Redmond
Zach Rodenburg
Jenna Smith
Mike Vittetoe
Audrey Wiedemeier

**Faculty**
Barry Butler, Ph.D.
Keri Hornbuckle, Ph.D.
Craig Just, Ph.D.

**Practitioners**
Africa Espina; Cindy Quast (Stanley Consultants)

# University of Iowa HONORABLE MENTION

Department of Civil and Environmental Engineering

**Pilot Program for Expanding Connections between Professional Practice and Education**

## ABSTRACT EXCERPT


The Pilot Program for Expanding Connections between Professional Practice and Education has been embedded in an existing service-learning course, Design for the Developing World, in the department of civil and environmental engineering. The program enabled practitioners to participate more fully in course content delivery and in design team activities by emphasizing integrated participation to enhance student learning objectives.

The course content typically focuses on water, sanitation, energy, shelter, and food security technologies and appropriate designs for sustainable development in resource-poor countries. The pilot program has extended the capabilities of the course to teach the concepts of professionalism, ethics, and public engagement by using licensed, engineering practitioners as design team members.

Student/practitioner design teams developed solutions for drinking water, wastewater, and energy needs for a real-world "indigenous school" and surrounding neighborhood in the Mexican community of Xicotepec de Juarez. These designs will be assessed by a follow-up team and will then be presented to the neighborhood leaders in Xicotepec during spring break 2009, with hopes that further design and subsequent implementation will soon follow.


# 2009 NCEES ENGINEERING AWARD PARTICIPANTS

**Colorado State University**
College of Engineering
*Professional Learning Institute*

**Duke University**
Department of Civil and Environmental Engineering
*Overture Engineering: A Bridge Between College and Practice*

**Florida A&M University-Florida State University**
Department of Civil and Environmental Engineering
Senior Design Capstone Course: Collection of Projects with Featured Everglades Restoration Project

**Florida International University**
Civil and Environmental Engineering
*Civil Engineering Senior Design Class*

**Kansas State University**
Department of Architectural Engineering and Construction Science
*Connecting LEED to Professional Practice and Education*

**Kansas State University**
Department of Architectural Engineering and Construction Science
*Connecting Professional Practice and Engineering*

**Kansas State University**
Department of Architectural Engineering and Construction Science
*Supporting the Architectural Engineering PE Exam*

**Lehigh University**
Department of Civil and Environmental Engineering
*Professional Masters Program in Structural Engineering*

**Missouri University of Science and Technology**
Department of Civil, Architectural, and Environmental Engineering
*CE/ArchE/EnvE 298: Senior Design*

**Northern Arizona University**
Engineering and Professional Programs
*Design4Practice and DACs Integrated Assessment*

**Pennsylvania State University**
Department of Mechanical and Nuclear Engineering
*The Switchgrass Sustainability Project*

**Purdue University**
College of Engineering
*Engineering Projects in Community Service (EPICS)*

**Seattle University**
Department of Civil and Environmental Engineering
*Structural Design Package for the Replacement of a County Bridge*

**United States Military Academy**
Civil and Mechanical Engineering
*Cadet District Engineer Program (CDEP)*

**University of Alabama at Birmingham**
School of Engineering/Mechanical Engineering
*Thermal Systems Design Course Development*

**University of Arizona**
Department of Civil Engineering and Engineering Mechanics
*Practitioner-Led Engineering Experiences*

**University of Idaho**
Mechanical Engineering Department
*A Leadership Culture for Undergraduate Capstone Design and the Graduate Experience*

**University of Iowa**
Department of Civil and Environmental Engineering
*Pilot Program for Expanding Connections Between Professional Practice and Education*

**University of Maryland**
A. James Clark School of Engineering/ EWB-USA UMCP
*Engineers Without Borders—Dissin, Burkina Faso Project*

**University of Missouri-Kansas City**
Department of Civil and Mechanical Engineering
*Redcone Civil Design Group: A Practitioner-Centric Capstone Experience*

**University of North Carolina at Charlotte**
William States Lee College of Engineering
*Powered Manipulator for a Standard Garbage Bin*

**University of North Dakota**
School of Engineering and Mines
*Online Undergraduate Degree Program*

**University of Pittsburgh**
Department of Civil and Environmental Engineering
*Freshman to Senior Professional Experience*

**University of Tennessee at Chattanooga**
Department of Civil Engineering
*Intermodal Transit Center*

**University of Virginia**
School of Engineering and Applied Science
*ecoMOD*

**Virginia Tech**
Charles E. Via Jr. Department of Civil and Environmental Engineering
*Land Development Design Initiative*

**Webb Institute**
*Winter Work 2008: An Interdisciplinary/ Inter-professional Approach to Naval Architecture and Marine Engineering Education*

**Wright State University**
College of Engineering and Computer Science
*High Altitude Balloon Project*

NCEES Engineering Award for Connecting Professional Practice and Education

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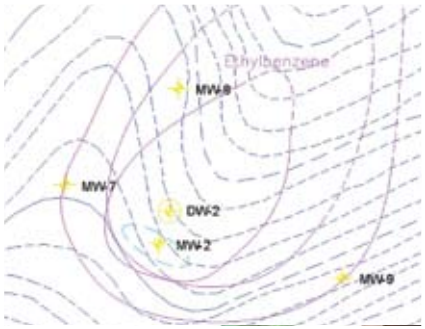


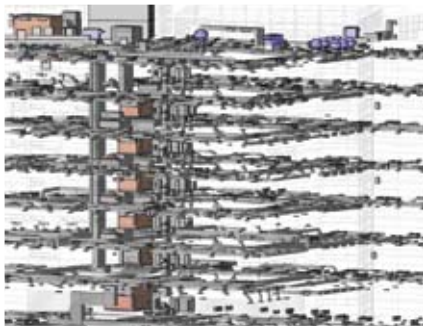

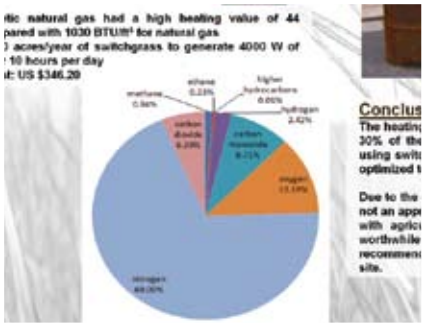






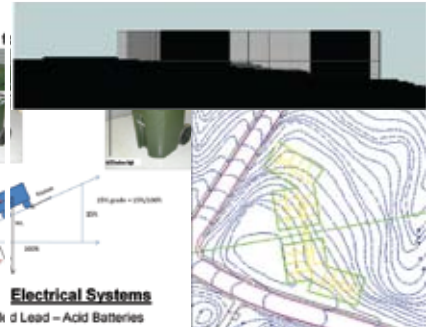


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