
**DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

# GRADUATE PROGRAM SELF STUDY

**September 2016**

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# 1 EXECUTIVE SUMMARY

The Department of Civil and Environmental Engineering (CEE) offers advanced study for the degree of Master of Science and Doctor of Philosophy. Degrees offered include Master of Science in Civil Engineering (MSCE), Master of Science in Environmental (MSEnvE) and Doctor of Philosophy in Civil Engineering. The areas of specialty are Structures, Geotechnical, Construction, Transportation, Water Resources, and Environmental Engineering. An important aspiration for the unit was to enhance the research capabilities of the faculty (especially in high impact and interdisciplinary areas) in order to provide greater opportunities for advanced research to graduate students, and enhance the quality of graduate students in knowledge, research skills, and communication skills. Since 2011, the department recruited a new department chair, seven new Assistant Professors with lines for an additional two positions, and four Professors of Practice. Together with a strong core of tenured faculty, the unit has strong expertise to address the technical challenges associated with the sustainability of civil and environmental engineering systems, especially in emerging research areas. Laboratories and research capabilities have been recognized at the state and national level including Tier 1 UTC for Accelerated Bridge Construction, NSF EF designation for the NHERI program recognizing the Wall of Wind as well as State and local support of research in transportation, environmental, bridge, and corrosion engineering. In support of this aspiration, advanced graduate courses addressing emerging research areas have been created and continue to be done so. New classes in emerging research areas in Hurricane Engineering, Wind Engineering, Corrosion Engineering, Building Diagnostics, and Geographic Information System among others add to the already deep program curriculum in Civil and Environmental Engineering. The unit has seen tremendous growth in external research funding and laboratory research capabilities to support advanced research with recognition by state and national institutions. From 2013-2016, the unit has been awarded over $16.3 million in external funding.

The strengths in the expertise and capabilities of the faculty to support advanced learning and research is clear. The increases in doctoral student enrollment and degree production are related to the increase in academic capabilities of the unit since the last review, in 2013. Weaknesses to continuously recruit highly talented graduate students, challenges to improve the graduate program to support diverse and interdisciplinary research, and opportunities associated with the current successes, as well as geographic resources to facilitate research in emerging areas, such as infrastructure sustainability and sea-level rise, continue to be addressed. The unit is currently following a 12-point graduate program schedule that derived from a self-study, doctoral student survey, and external assessment of the program in 2013. The unit will need to continue to support the progress and successes of the faculty to attain externally funded

research and graduate high level students, by working with the university to minimize bureaucracy, provide better ancillary support services, and address space allocation for junior faculty. The unit will also need to carefully assess the role of the graduate program to encourage continuing education of professionals as the economy continues to improve in the civil and environmental engineering profession sector.

The Graduate Program Self-Study was drafted by Assistant Professor and Graduate Program Director Dr. Kingsley Lau and reviewed by the Associate Chair of Graduate Programs Dr. Hector Fuentes and Department Chair Dr. Atorod Azizinamini.

## 2 PROGRAM OVERVIEW

The Department of Civil and Environmental Engineering (CEE) offers advanced study for the degree of Master of Science and Doctor of Philosophy. Degrees offered include Master of Science in Civil Engineering (MSCE), Master of Science in Environmental Engineering (MSEnE) and Doctor of Philosophy in Civil Engineering. The areas of specialty are Structures, Geotechnical, Construction, Transportation, Water Resources, and Environmental Engineering.

An important aspiration for the unit was to enhance the research capabilities of the faculty (especially in high impact and interdisciplinary areas) in order to provide greater opportunities for advanced research to graduate students and enhance the quality of graduate students in knowledge, research skills, and communication skills. Since 2011, the department recruited a new department chair, seven new Assistant Professors with lines for an additional two positions, and three Professors of Practice. Together with a strong core of tenured faculty, the unit has strong expertise to address the technical challenges associated with the sustainability of civil and environmental engineering systems, especially in emerging research areas. Furthermore, the unit houses the doctoral program for construction engineering allowing for collaboration with affiliated faculty from the college's School of Construction. The unit has seen tremendous growth in external research funding and laboratory research capabilities to support advanced research, with recognition by state and national institutions. From 2013-2016, the unit has been awarded over $16.3 million in external funding.

The enhanced research capabilities in facilities and expertise allows the unit to offer excellent opportunities for advanced research in vital and emerging research areas, including sustainability in construction and operation of highway systems, resiliency to natural disasters, sustainability of aging infrastructure, climate change, sustainable materials, and pollution remediation. The unit has seen the recruitment of Dr. Atorod Azizinamini from the University of Nebraska-Lincoln as department chair. He

was awarded the White House and the U.S. Dept. of Transportation honor as Champion of Change for his work in bridge engineering. Furthermore, under his leadership, the unit houses the first federally funded center on accelerated bridge construction (FIU ABC-UTC), to address the technical and economic difficulties of building and replacement of critical transportation infrastructure. The unit has promoted growth in the area of wind engineering. In partnership with the International Hurricane Research Center, the unit houses an internationally renowned center for wind engineering to address mitigation of hurricane damage. With the completion of the Wall of Wind research facility (the largest and most powerful university research facility of its kind), the research group is anchored by its director Dr. Arindam Chowdhury, world-renowned wind engineer Dr. Peter Irwin as Professor of Practice, and its growing team of wind engineering experts. The research center was designated by NSF as an Experimental Facility under the Natural Hazards Engineering Research Infrastructure (NHERI) Program. Furthermore, the unit houses the Lehman Center for Transportation Research (LCTR), member of several University Transportation Centers. The unit also houses research facilities in the area of structural engineering, corrosion and materials infrastructure durability, water resources and environmental engineering, and computational geo-mechanics.

The recruitment of highly talented and energetic assistant professors (Drs. Xia Jin, Kingsley Lau, Ioannis Zisis, David Garber, Seung Jae Lee, and Priyanka Alluri among others) from strong civil engineering programs such as Texas-Austin, Illinois-Urbana Champaign, Concordia, and Clemson University has vitalized an already strong core of tenured faculty. Advanced graduate courses addressing emerging research areas have been created and continue to be done so. In addition, Professor of Practice positions support coursework and research related to industry practice. The department has National Academy of Engineering member, Larry Griffis, as Professor of Practice providing advanced graduate coursework in tall building design reflecting his 40+ years of professional experience. New classes in emerging research areas in Hurricane Engineering, Wind Engineering, Corrosion Engineering, Building Diagnostics, and Geographic Information Systems among others add to the already deep program curriculum in Civil and Environmental Engineering.

The unit continues to strive for excellence in graduate education and research and has implemented policies for continuous quality improvement to enhance student quality and preparation for future roles in academia and practice. The unit has an Associate Chair for Graduate Studies as well as Graduate Program Director, a Graduate Program Advisory Committee that seats faculty of different ranks and from the different areas of academic specialization, and academic advisors to support the Major Professor and graduate students. Important policies have been set in place to ensure

quality throughout the graduate program. The unit is currently following a 12-point graduate program schedule that derived from a self-study, doctoral student survey, and external assessment of the program in 2013. The schedule is detailed in Section 3. Tangible changes in the program procedures include an exit requirement for Master students following the all-course option track. They are required to provide a written and oral presentation of a major work evaluated by two faculty members as part of graduation requirements. This requirement was set to enforce important technical communication skills for students not submitting a Master thesis or Master project report. Another change was the adoption of a uniform policy for administration of the Doctoral comprehensive/qualifying exam. The exam is administered on pre-scheduled dates with a uniform exam format.

The unit continues in its assessment of graduate program policy to enhance the quality of the program and the students, and to promote research in emerging topics and interdisciplinary research. The unit has strived to provide graduate students opportunity to create and participate in social gatherings, including the annual Graduate Research Day where students are recognized for their work in research, hosting a celebration of the cultural diversity of the graduate study body where music, food, and dance was shared by the students, and supporting student-run organizations, including the Institute of Transportation Engineers, where the FIU student group recently won its sixth award recognizing them as the best student chapter.

# 3 PROGRAM ANALYSIS

## 3.1. Program Description, Purpose, and Objectives

The mission of the Department of Civil & Environmental Engineering (CEE) is to teach, conduct research and serve the community through professional development and technology transfer. The CEE pursues excellent teaching by providing quality education that will enable its graduates to demonstrate their technical proficiency, their ability to communicate effectively, their responsible citizenship, their lifelong learning, and their ethical behavior in their career and professional practice. The CEE also encourages activities that enrich the student potential for career and professional achievement and leadership. The CEE is committed to providing graduates who improve the quality of life, meet the needs of industry and government, and contribute to the economic competitiveness of Florida and the nation. The CEE strives to attain a level of research and scholarly productivity befitting a major research university and warranting national and international recognition for excellence.

The mission of the State University System of Florida is to provide undergraduate, graduate and professional education, research, and public service of the highest quality through a coordinated system of institutions of higher learning, each with its own mission and collectively dedicated to serving the needs of diverse state and global society. The state universities will a) support students' development of the knowledge, skills and aptitudes needed for success in the global society and marketplace, b) transform and revitalize Florida's economy and society through research, creativity, discovery, and innovation, c) mobilize resources to address the significant challenges and opportunities facing Florida's citizens, communities, regions, the state, and beyond, d) deliver knowledge to advance the health, welfare, cultural enrichment, and economy through community and business engagement and service.

Goals by the State University System have been set for a) teaching and learning, b) scholarship, research, innovation, and c) community and business engagement. Goals in these three areas and the unit's role in achieving them are listed below.

**Teaching and Learning**

*Goal: Strengthen quality and reputation of the universities.*

The unit has taken concerted efforts to recruit highly talented faculty to join its core of already tenured-faculty. This effort will ensure that the university will continue to be well represented in the technical and academic communities. Furthermore, the unit has strived to broaden its expertise in emerging research topics and supporting enhanced research laboratory capabilities. This effort allows for teaching and learning in emerging topics and knowledge in frontier research subjects and access to state-of-the art research facilities for teaching and learning. Advanced topics in Bridge, Transportation, Environment and Water Resources as well as emerging areas in hurricane, Wind, Corrosion, Geo-mechanics among others are development and introduced to class room and research oriented graduate education

*Goal: Increase Degree Productivity and Program Efficiency.*

The unit continues to assess its performance in graduate program policy with dedicated participation of the Associate Chair for Graduate Studies, Graduate Program Director, Graduate Program Advisory Committee, and advisors to support the faculty and students. The unit supports a combined Bachelor/Master Program for the Civil and Environmental Engineering program to allow better access to graduate education for the student constituency. The unit participation in reviewing policies strives to

provide efficient programs that maintain quality education and support emerging topics and interdisciplinary research.

*Goal: Increase the Number of Degrees Awarded in STEM/Health.*
The unit is recognized as a program of strategic emphasis. The unit continues to grow in research capabilities. The unit is well represented by faculty members awarded external research funding. At the master level, undergraduate students are fully encouraged to seek opportunities in graduate education in the combined Bachelor/Master program or the Master programs for the all-course or thesis tracks.

**Scholarship, Research, and Innovation**

*Goal: Strengthen the Quality and Reputation of Scholarship, Research and Innovation and Increase Research Activity and External Funding*
The unit has taken concerted efforts to recruit highly talented faculty to join its core of tenured-faculty. This effort will ensure that university will continue to be well represented in the technical and research communities. Furthermore, the unit has strived to broaden its expertise in emerging research topics and supporting enhanced research laboratory capabilities. The efforts by the unit have led to strong external funding research support (Over $16.3 million in the last 3 years), and state and national recognition of laboratories and research capabilities including Tier 1 UTC for Accelerated Bridge Construction, NSF EF designation for the NHERI program recognizing the Wall of Wind as well as State and local support of research in transportation, environmental, bridge, and corrosion engineering. The efforts has led to recognition by Washington News for Top 20 placement among national universities, recognition in the Carnegie Classification Institutions of Higher Education as R1 Doctoral University Highest Research Activity, and the unit being placed in the US and World News rankings, with full expectation for further acknowledgement.

*GOAL: Increase Research Commercialization Activities*
The wide scope of research expertise housed in the unit and the successes in scholarly work in research will lead to opportunities in research commercialization. The unit understands the importance of this and will support faculty that pursues such activities from their scholarly work.

**Community and Business Engagement**

*GOAL: Strengthen Quality and Recognition, Increase Level of Engagement, Increase Workforce.*

A major part of academic research in Civil and Environmental Engineering is rooted in community engagement especially in sustainability of civil infrastructure. The unit is already heavily engaged with National, State, Local, government and private institutions in support of infrastructure including bridge, transportation, environmental, water, wind and corrosion engineering. As mentioned earlier, the unit continues support its faculty and enhance its research capabilities which will lead in higher quality, recognition, and engagement. The unit also encourages collaboration with other units with specializations to address interdisciplinary challenges. Research in these areas are highly specialized and graduate education in the classroom and research develop the workforce to continue to address sustainability and resilience of civil and environmental infrastructure.

Civil and Environmental Engineering by its nature is rooted in understanding and solving problems and challenges related to infrastructure systems vital to economic prosperity, societal support, and environmental sustainability. Much of the expertise housed in the unit and the research conducted by the faculty supports the community at all levels. Examples include the need to resolve how the country and State handle challenges with its aging infrastructure, including materials durability challenges and how to replace and build infrastructure without having burden to the transportation system (Accelerated Bridge Construction). How can the country and State use novel materials, methods, and innovations to support sustainable highway systems? How can the region and State provide resilient infrastructure due to harsh and catastrophic environmental exposures including hurricane and storm surge? How can the State provide sustainable infrastructure with the effects of sea level rise? How can the State ensure a sustainable environment that is sensitive to pollutants that are associated with economic assets and how can damage such as oil spills be remediated? How can the State assess the challenges of growing urban populations and the technical and safety challenges associated with dependency on automobile transportation? These important questions among many more are currently being addressed by the unit in research and providing the technical training for a needed workforce now and in the foreseeable future.

### 3.2 Programmatic Information

Figures 1-2 shows the headcount for master and doctoral students from 2007-2015. Enrollment at the Master Level decreased by -49% and -64% for Civil and Environmental Engineering, respectively over the last 6 years. Enrollment at the Doctoral Level for Civil and Environmental Engineering increased by 30% over the last 6 years.

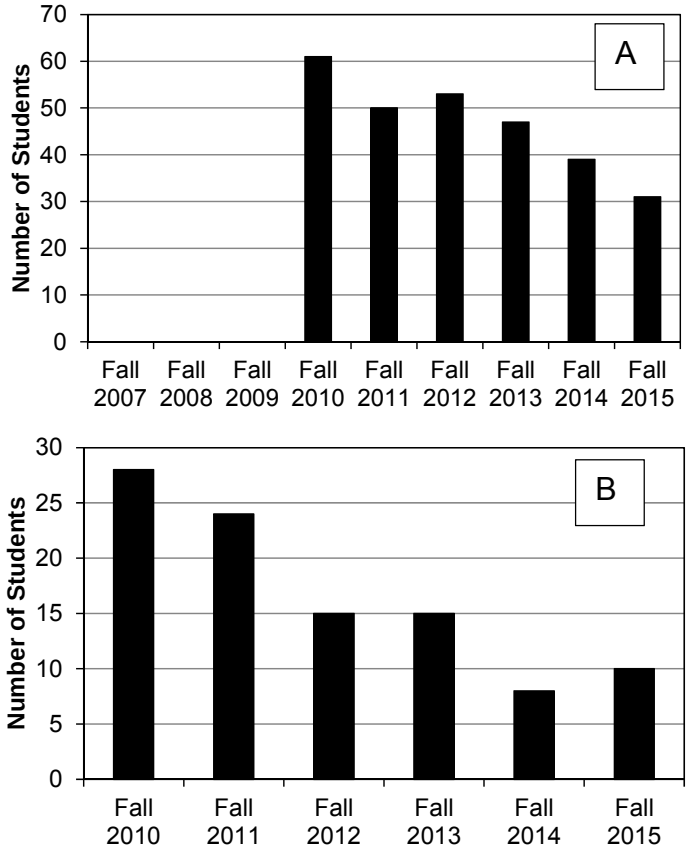


Figure 1. Headcount for Master students. A) Civil and B) Environmental Engineering Department. Source: AIM.

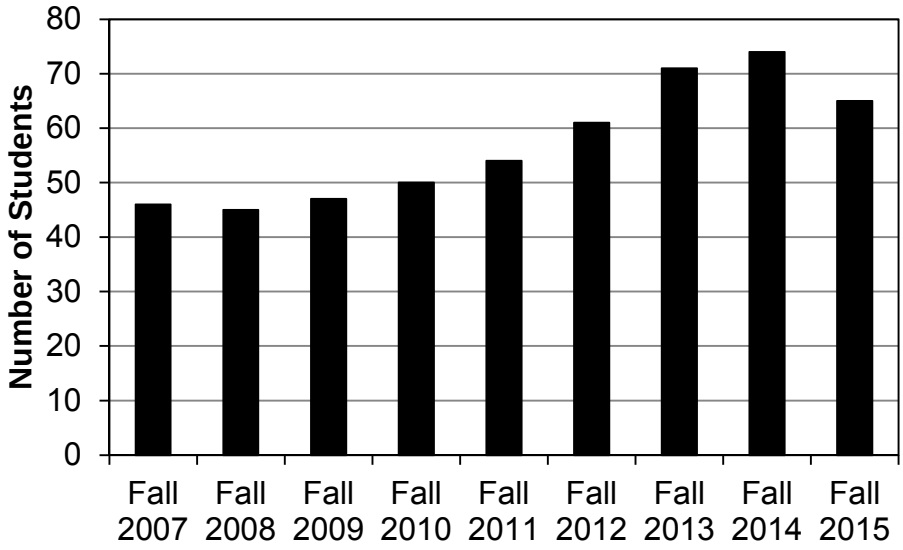


Figure 1. Headcount for Ph.D. students in Civil and Environmental Engineering Department. Source: AIM.

Figures 3-4 show the degree production for the Masters degrees and doctoral degree. Master degrees in Civil Engineering awarded fluctuated between 21 and 30 over the last 6 years. Master degrees awarded fluctuated from 9-18 between 2009-10 and 2013-14, but decreased to 1 in 2014-15. Doctoral degrees awarded increased by 2 over the last 6 years.

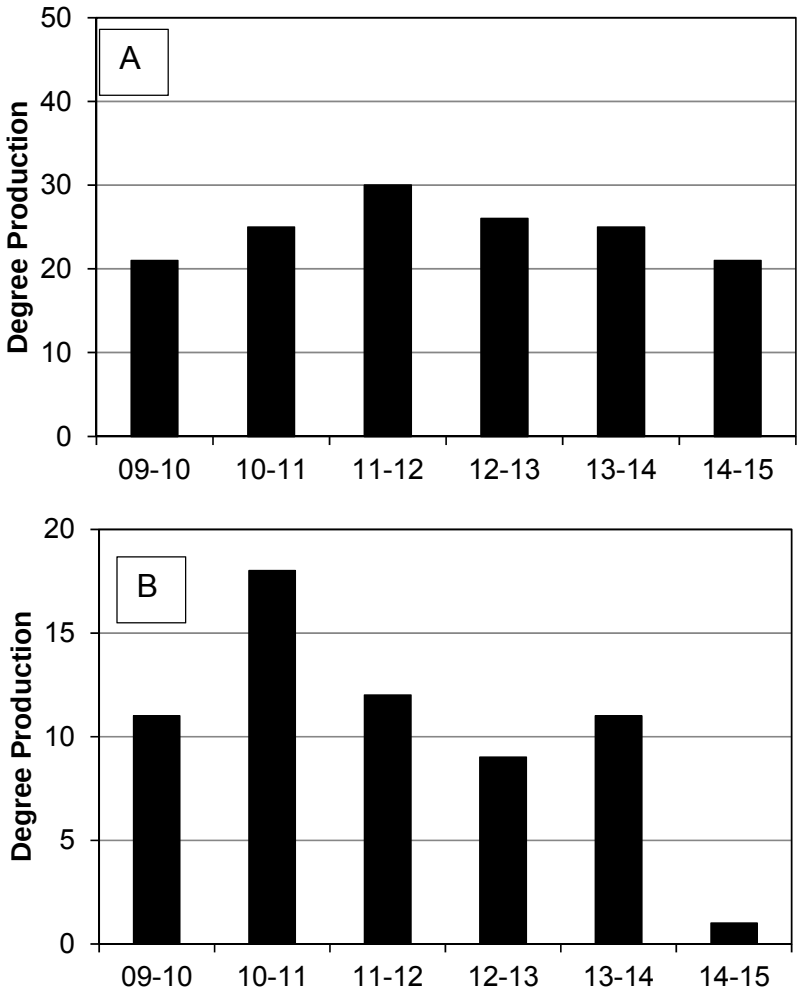


Figure 3. Degree Production for Master Programs.
A) Civil Engineering. B) Environmental Engineering Source: AIM.

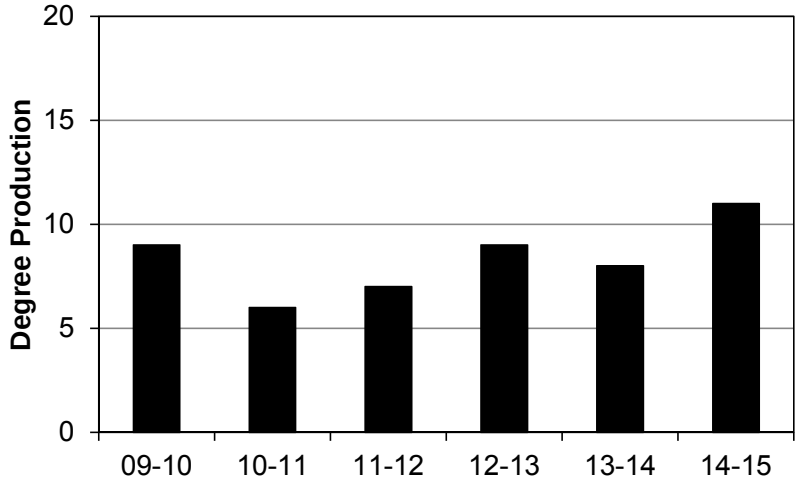


Figure 4. Degree Production for Doctoral Program in Civil and Environmental Engineering. Source: AIM.

Table 1 shows the instructional effort from 2012-2015. The percent of full-time faculty fluctuated between 98.61% and 100% at the graduate level over the last 3 years. Table 2 shows FTE and Fundable Student Credit Hours from 2010-2015. Table 3 shows employment data for Master graduates. Average annual salary increased slightly over the last 4 years of post-graduate data. Percent employed after 1 year increased dramatically from 2010-2011 (48%) to 2013-14 (74%).

Table 1. Instructional Effort

| Year | Percent Full Time | Total Course Credits |
|---|---|---|
| ’12 - ‘13 | 99.17 | 483 |
| ’13 - ‘14 | 100 | 507 |
| ’14 - ‘15 | 98.61 | 577 |

Source: AIM

Table 2. FTE and Fundable Student Credit Hours

| Year | Master | | Doctoral | |
|---|---|---|---|---|
| | FTE | FSCH | FTE | FSCH |
| ’10 – ‘11 | 46.9 | 1502 | 28.8 | 922 |
| ’11 – ‘12 | 40.2 | 1285 | 32.4 | 1036 |
| ’12 – ‘13 | 39 | 1248 | 32 | 1024 |
| ’13 – ‘14 | 27.3 | 873 | 41.6 | 1330 |
| ’14 – ‘15 | 21.3 | 681 | 40.8 | 1307 |

Source:AIM

Table 3. Employment and Continuing Education Data for Master Graduates

| Year | No. of Graduates | %Employed after 1 Year | Average Annual Salary | %Continuing Education |
|---|---|---|---|---|
| ’10 – ‘11 | 25 | 48% | $53,964 | 0 |
| ’11 – ‘12 | 30 | 60% | $48,428 | 0 |
| ’12 – ‘13 | 24 | 50% | $59,208 | 17% |
| ’13 – ‘14 | 23 | 74% | $54,984 | 9% |

Source: FETPIP

Note: The years noted above represent the graduation years for FIU Masters recipients. The salary and continuing education figures are based on outcomes from one year after graduation. *Salary data are only for graduates who are employed full-time in Florida. Salary data are not provided for years with 10 or fewer full-time employees.

Table 4 shows the graduate time to degree. The average time to degree for Master's students has fluctuated over the last three years. The average time to degree for Master's students is 23% lower in 2012-13 than in 2007-08 for Civil Engineering. The average time to degree for Doctoral students has decreased over the last 5 years and has remained relatively unchanged from 2007-2008 to 2012-2013.

Table 4. Graduate Time to Degree (Years)

| Year | Master | | Doctoral |
|---|---|---|---|
| | Civil | Environmental | |
| '10 – '11 | 2.06 | 1.89 | 5 |
| '11 – '12 | 1.85 | 1.87 | 4.62 |
| '12 – '13 | 2.25 | 2.07 | 4.96 |
| '13 – '14 | 1.68 | 2.09 | 5.38 |
| '14 – '15 | 2.33 | 1.67 | 4.52 |

Source: AIM

The increase in enrollment in doctoral students is reflective of the effort by the department to enhance the research capabilities and priorities of the unit, the hiring of additional faculty as Assistant Professors and Professors of Practice, successful award of funding from external sources, opening of new testing facilities such as the Wall of Wind, and increased recognition of the department in countries such as Iran and Bangladesh. The constituency of the Master program has mostly comprised of students and professionals with interest in engineering practice rather than research and academia. The decline of enrollment in the Master programs is likely directly related to the pickup of the local and State economy for entry-level civil engineering jobs in construction and transportation. Figure 5 showing data for the state of Florida from the US Department of Labor Bureau of Labor Statistics show the trends in employed workers in the trade, transportation and utilities as well as construction sectors. Similar trends were observed regionally for the Miami-Ft. Lauderdale-West Palm Beach, FL area. The increase in jobs from 2010 to current date correlates well with the general drop in number of enrolled Master students. The general increase in Master students employed after 1 year is supporting evidence of increased employment opportunities in engineering practice after the global recession. The department is poised well for the future in research with a pipeline of international students that can support its needs. However, the drop in Master students shows a smaller pool of domestic students at the Master level that can be recruited to the doctoral program. Recruitment of high quality doctoral students continues to be a priority for the unit.

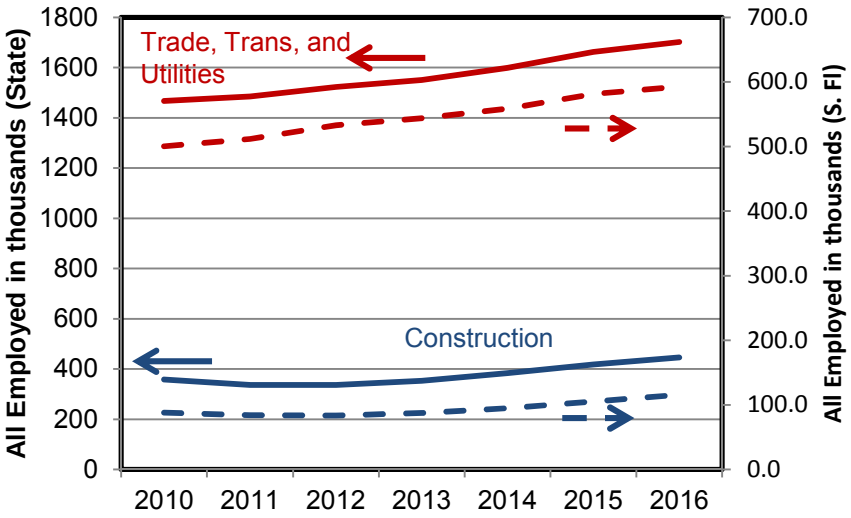


Figure 5 Bureau of Labor Statistics for Trade, Transportation, and Utilities and Construction Jobs in Florida and Miami-Fort Lauderdale-West Palm Beach, FL . Data from January of each year from 2006-2016. Source: (http://www.bls.gov/regions/southeast/florida.htm#eag)

The degree production of the doctoral and master degrees follows the enrollment trends from 2010. The time to graduate for the Master degree is consistent with the majority of the student constituency following the all-course option with many being employed while pursuing the degree. The time to degree for the doctoral degree exceeding 4 years reflect a significant portion of the doctoral students in the program working part-time or full-time while pursuing the degree. This value may fluctuate as the program is changing in its research culture as several new faculty have joined the department and research visibility has increased.

### 3.3. Evaluation of the Graduate Program

The unit continues to strive to assess and enhance the graduate program including the Master and Doctoral programs. In 2013, the University Graduate School invited Amr Elnashai from the University of Illinois, Urbana-Champaign to review the Civil and Environmental Engineering Department. His review is attached in Appendix B. As a result of that assessment, the unit established a Graduate Program Enhancement Schedule as show below. Table 5 outlines priorities, goals, action plan, and time schedule.

Table 5. CEE Graduate Program Enhancement Schedule

| Priority 1 | Description of improvement identified by UGS | Goal | Action Plan | Period of Development & Implementation | Progress Status |
|---|---|---|---|---|---|
| 1. | **Implement a strategic plan for the recruitment of highly qualified applicants in all areas of the doctoral program (Item 1 of UGS letter)** | Enhancement of graduate education and research output and quality | Marketing person is hired that is helping in this regard. Further, several faculties are making personal visits to various universities for recruiting purposes. These efforts have resulted in recruiting quality graduate students from such universities as Georgia Inst. Of technology and several other U.S. institutions. | 01/2013 – 08/2015 | Ongoing process |
| 2. | **Expand course offerings and separate undergraduate and graduate level courses (Item 3 of the UGS letter)** | Appropriate delivery of body of knowledge at undergraduate and graduate levels | Since 2011, the faculties have eliminated several courses that were cross listed and have offered new courses to undergraduate students only. | 01/2012 – 12/2012 | completed |
| 3. | **Improve and diversify the mix of internal and external support for doctoral students, with** | Increase extramural funding by faculty members that includes RAs | Since 2011 department has implemented several policies- First | 01/2012 – Present | Policy is in place |

| | | | | | |
|---|---|---|---|---|---|
| | **emphasis on increasing the number of RAs funded by faculty grants and contracts (Item 4 of UGS letter)** | | is offering TA to Ph.D. students only. Second, the students are supported for first year, using 50% funds from TA and 50% RA. We are also being flexible in implementing this policy. We still have several internal issues preventing complete implementation of this policy | | |
| 4. | **Place greater emphasis on community-building activities in the program, with more frequent opportunities for new students to meet and socialize with faculty members and doctoral students in earlier cohorts (Item 9 of UGS letter)** | Establish a good social environment to welcome new students and integrate them into the | We started to have a social program with graduate students in the beginning of the semester, since 2012 and this effort will continue. | 08/2012 – Present | Continuous process |
| 5. | **Maintain a consistent level of student quality and research output (Item 2 of UGS letter)** | Seek high level of student performance | Hiring new faculties and more emphasis on nationally visible research initiatives has resulted in enhancement of research | 8/2011- Present | Continuous process |

| | | | | | |
|---|---|---|---|---|---|
| | | | productivity. This is however a continuous process and being also emphasized by enforcement of admission standards (GPAC, GPD and Faculty) and performance via student presentations and publications (Faculty) | | |
| ***Priority 2*** | | | | | |
| 6. | **Improve communication to students at all stages of the program starting with a well-organized orientation and detailed graduate student manual (Item 5 of UGS letter)** | Effective communication with all students. Maintain a graduate student manual. | The content of the first meeting with graduate students are scheduled to be improved and plans call for improvement in communicating the expectation and consequences to newly arrived graduate students and make the communication process a continuous one. In addition, the student manual will be revised to | 09/2013 – 12/2014 | Start in Fall 2013 |

| | | | | | |
|---|---|---|---|---|---|
| | | | make it more comprehensive and user friendly. A new Graduate Program Committee (GPAC) has formed which should help the process. | | |
| 7. | **Implement mentoring training in the department for graduate faculty (Item 8 of UGS letter)** | Provide graduate faculty with approaches to best guide graduate students | This item will be part agenda for faculty retreat to be held on August 2013 | 09/2013 – 12/15 | Start in Fall 2013 |
| 8. | **Expand teaching and research opportunities for graduate students (Item 7 of UGS letter)** | Provide opportunities to graduate students to have teaching and research experiences throughout their degree programs | Have all students serving as TAs or instructors, at least one term, during their degree programs. Require all students attending two quality-teaching workshops. | 01/2014 – 12/2016 | Start in Spring 2014 |
| 9. | **Discuss and develop departmental standards for qualifying exams, dissertation quality, as well as for the presentation of doctoral defenses (Item 10 of UGS letter)** | Continued enhancement of the quality of graduate performance and research output | Hold a series of faculty meetings to discuss. GPAC & GPD will develop plan for faculty and administrative review. This item is part of agenda for Fall 2013 faculty retreat | 01/2014 – 12/2016 | Start in Spring 2014 |
| 10. | **Improve consistency of** | Within the scope of Item | Within the scope of Item | Within the scope of Item 9 | Within the scope of Item |

| | | | | | |
|---|---|---|---|---|---|
| | **qualifying exams (Item 6 of UGS letter)** | 9 | 9 | | 9 |
| 11. | **Expand training opportunities essential to succeed in academic settings: grant-writing, cover letters, job applications, teaching and research statements, IP and Tech transfer, as well as manuscript and grant reviews (Item 11 of UGS letter)** | Enhance the preparation of students to successfully compete for job opportunities and pursue long-life professional lives | This item will be discussed during Fall 2013 faculty retreat | 08/14 - 07/17 | Start in Fall 2014 |
| 12. | **Develop strategies for graduate students' placement in the workplace (Item 12 of UGS letter)** | Assist students in joining the workplace | Identify FIU programs (e.g., alumni, engagement, etc) and/or develop in-unit programs | 08/14 – 07/17 | Start in Fall 2014 |

In addition to continuous endeavors to address those listed priorities, a series of ad-hoc faculty meetings in the summer of 2015, orchestrated by the department chair and the Graduate Program Advisory Committee, was dedicated for review and enhancement of the CEE graduate program. Department faculty meetings in the following fall and spring semesters dedicated portions of the time to discuss and vote for implementation of policies. The topics of discussion included admission of graduate students without civil engineering background into the doctoral program, advising by affiliated faculty and non-tenure/tenure earning faculty, core course requirements, and doctoral candidacy requirements. These topics were discussed not only to self-assess the efficacy of the programs, but also to discuss the role of interdisciplinary work in emerging research areas. Discussions to adopt less stringent course requirements for doctoral research students to allow for greater level of interdisciplinary study and promote advanced research in high impact areas were often heated, but resulted in agreement by the unit that doctoral students with sufficient background in civil engineering should be granted more flexibility in their doctoral curriculum. Furthermore, the unit discussed the level of remediation in coursework required for interdisciplinary

students interested in doctoral research in Civil and Environmental Engineering. These challenging questions involving reflection of the programs resulted in differing viewpoints. A positive result of these discussions led to the creation of departmental recommended policies and procedures for doctoral candidacy, and clarification of the university policies for doctoral advising by non-tenured/tenure earning faculty. A sampling of unit activities in the evaluation of the graduate program is given in Appendix B. The department continues to address the graduate program through the Graduate Program Advisory Committee which meets monthly in the Fall and Spring academic calendar.

In the Spring of 2015, the unit gave a survey to doctoral students to assess their experiences. The results of the survey are as follows:

**Civil and Environmental Engineering**
**Doctoral Program Student Survey. Spring 2015.**

**Admission Process and Communication**

1. How did you decide on attending the Ph.D. program at FIU?

- Research prospects in program : 5 students
- Strong program in Transportation : 2 students
- Searching the Internet
- Funding Opportunity
- An alumni friends referral
- Expert faculty in area of interest

2. Were you satisfied with the various steps of the admission process? Please explain.

- Yes : 8 students
- Difficulties in communication and got misleading information : 2 students
- Admissions took a long time

3. Do you have any suggestions to improve any of the steps of the admission process? If so, please describe them below.

- The University needs more discipline.
- Better communication needed within the department
- The admission/funding process is not clearly given on Departmental Website. Providing further information on how to become and apply for a TA on the website would be helpful.

- The deadline for international student applications is not clearly given on the website.
- Flexible rules would be welcome.
- Process could be faster.
- No suggestions : 4 students

4. Did you attend the UGS orientation program? If you did not attend it, why?

- Yes: 10 students

If you did attend, is there anything that you expected to have been addressed?

- An explanation about submitting D forms for PhD students would be helpful
- All issues regarding education and life at FIU
- No comment: 7 students

5. Did you attend the CEE orientation program? If you did not attend it, why?

- Yes : 8 students
- No, due to health issues
- No, due to visa issues

If you did attend, is there anything that you expected to have been addressed?

- Information regarding mandatory course requirements in the program need to be stressed : 2 students
- The details of the PhD program including requirements, and constraints,
- Information regarding best time to submit D forms, additional scholarship/internship opportunities, and how a student can get involved in local civil engineering industry.

**Ph.D. Requirements**

6. In your view what improvement could be incorporated in the Ph.D. degree program policies, procedures and other applicable requirements?

- The course work needs to be revised

- All procedures and deadlines regarding D forms for PhD students need clarification
- The qualifier exam questions should not be the same as the Midterm and Final exam questions.
- Some math courses can replace subject courses by considering them as core courses, with approval from ones advisor,
- Providing a scientific writing course or workshop.
- Revision of the qualifying exam to include research challenges
- Annual evaluation should not be mandatory. The required time between the D3 form submission and graduation should be shortened
- Course requirements need to be more flexible. It should be based on ones research topics
- The qualifier should also test the research ability of students
- The Minimum GRE requirement is not clear, and needs to be updated
- Applicant research experiences should be considered.

7. Did you take the Qualifying Exam this last Friday, March 20, 2015? If you did, do you have any suggestions to improve the exam organization and environment?

- Yes : 3 students
- No : 7 students

Remarks
- It was not fair. Some students took 4 courses while others took 8 courses.
- I liked it because it was more organized than previous qualifying exams.
- The 8 hour exam was too long.
- I did not like the environment that much.

8. Are you satisfied with the level of content and quality of the courses that you have completed? Please explain.

- Yes : 9

Remarks
- There are opportunities to improve the type of courses offered by including more demanding/interesting topics in civil engineering. My observation is that the same courses are offered in a cyclic pattern without introducing new courses, with some exceptions. In some cases, the

course content needs to be updated and grad courses need to be upgraded in terms of contents in comparison with the corresponding undergraduate course.
- Some courses were very good and helped build my knowledge but a few courses were not useful.
- Courses were useful
- No explanation : 6 students

9. How many years do you expect to take to complete your Ph.D. requirements and graduate?
- 2 years : 2 students
- 3 -4 years : 4 students
- 4 - 5 years : 4 students

**Career Development**
10. Are you pleased with the departmental opportunities that FIU offers you to present your research work and improve your writing and oral communication skills (e.g., graduate research days, attendance to conferences, graduate seminar, etc.)? Please explain.

- Yes : 9

Remarks
- The CEE research day and weekly graduate seminar is helpful. **However,** Department can initiate some travel funds for high achieving students to present their research and also represent FIU CEE in conferences within Florida
- These sessions give us self-confidence and improve our oral communication **but** the only problem I faced at this department is that we have very rare Americans,

The graduate seminar is helpful in developing communication skills
- Conference attendance is helpful
- It would be better if we have more opportunity to attend the lectures of guest speakers
- Graduate seminar could improve the oral and communication skills and I hope there is some writing workshops for technical reports and thesis.

- No 1,

Remarks
- We need more opportunities to improve our writing skills

11. Are you satisfied with your access to your advisor and his/her guidance?

- Yes : 10 students
Remarks:
- My advisor is helpful and knowledgeable
- I would be happy if my advisor had more time for me, but successful people are always busy

12. Other comments. Feel free to elaborate on any other items that you believe are important to ensuring that you get a top level education while pursuing your Ph.D. degree program at FIU.

- Offering new and interesting courses : 2 students
- Encouraging students to publish
- Arranging a job fair for CEE doctoral students
- Committee members should ask questions after presentation of PhD proposal or dissertation defense.
- No comment : 7 students

**Student Learning Outcome:**

- Ability to conduct research either independently or in a team. Graduates (project/thesis options) of the program will be able to conduct quality research in the fields of Civil and Environmental Engineering.
- Oral and written communication skills. Project/Thesis option students will be able to communicate the results of their research in a professional forum. Non-thesis option students will successfully present a written and oral presentation of a major works study.
- Professional growth and learning. Graduates will be able to interact professionally with employer, supervisor, colleagues as well as students in the class that they serve as teaching assistants.

**Program Objectives:**

- Establish successful careers in civil and environmental engineering
- Collaborate on multidisciplinary teams to address social and environmental challenges
- Pursue lifelong learning and professional development.

The assessment process for the graduate programs is similar to that for the undergraduate programs. The outcomes are assessed through a) course portfolios, b) written and oral presentation assessments, c) qualifying exams, d) research projects, thesis, and dissertations, e) exit surveys, f) publications, and g) co-curricular resumes.

The Master students following the all-course options are evaluated by their cumulative GPA following a set core curriculum and are evaluated by two faculty members on a written and oral presentation of a major works at the Graduate Student Seminar CGN6939. All Master students following the all-course option have met minimum acceptability in communication skills since regular assessment has been instituted in the last two years. The Master students following the project or thesis track are evaluated by their cumulative GPA following a core curriculum and project or thesis hours and are evaluated by three faculty members in a written and oral presentation of their research proposal and final defense of a written project report or thesis. Few Master students follow the project or thesis tracks. Those that do are likely funded in external research and had regular supervision by a Major Advisor and exceeded minimum requirement for successful completion of the thesis. In the Spring 2016 semester, 2 students working on an interdisciplinary project related to corrosion durability of post-tensioned tendons were conferred the Master of Science (one in Civil Engineering and one in Environmental Engineering) following the thesis track. Together, they have published four peer-reviewed conference papers and gave seven presentations at international conferences. One of those students has enrolled in the doctoral program in the Summer 2016 semester. The unit should promote continuing education of high performing Master students into the doctoral program. As described earlier in Table 3, graduates of the Master programs are showing increased rates of employment.

The doctoral students are evaluated by their cumulative GPA following curriculum requirements, successful completion of a qualifying exam, successful oral defense of a written proposal and final defense of a written dissertation by up to 5 faculty members, and publications. All doctoral students are required to enroll in the Graduate Study Seminar each semester where they present their research to their colleagues. Doctoral students are also encouraged in the annual Graduate Student Day

poster presentations where they present their work to the college and the public attendees. All doctoral candidates passed qualifying exams since uniform testing procedures were enacted in 2015. Doctoral students found out of compliance with University Graduate School policies (particularly those exceeding time limits) have been dismissed.

### 3.3. Research Productivity

From July 2013 to March 2016, the unit was awarded $16.3 million in external funding. A listing of awards is shown in Appendix C. Approximately 250 awards were granted to 18 separate Principal Investigators from the unit in this time period. The awards varied as the number of awards included initial awards, increases, and supplements. The highest initial award amount was $1.4 million for a Tier 1 UTC. The lowest initial amount was $2,000 for a fellowship program. The average initial award was $108,407.

The faculty continues to well represent the university in its academic productivity and service in national and international organizations. A listing of peer-reviewed publications is shown in Appendix D.

### 3.4 Strengths, Weaknesses, Opportunities, and Challenges

The strengths of the graduate program include the energy and enthusiasm brought by newly recruited faculty members since 2011 to vitalize the department, direction of an ambitious department chair, and the stalwart custodianship of the department by several of the senior faculty members that have kept the program aloft. The faculty at large is highly talented and respected within their research fields providing the unit with the expertise in emerging research areas. Much of the faculty has established research in important areas of study.

Weaknesses in the graduate program include the ability to continuously recruit highly talented graduate students especially those with good technical communication skills to support the research activities of the unit. This was thought to be related to the relatively poor visibility of the university. Top domestic students tend to enroll in other State universities and highly qualified international students often rely on university rankings in their application decisions. Weakness in the program also includes poor support or lack of support by university ancillary offices and lack of resources to support academic and research endeavors. Trivial tasks such as purchasing to more difficult problems such as allocation of space are often difficult leading to frustration amongst the faculty.

Opportunities arise with the successes in establishing expertise in research areas. Expertise in the areas of bridge, transportation, environmental, water, wind, materials durability and sustainability, corrosion, and geo-mechanics allow for opportunities to attract external funding relating to important areas of civil and environmental infrastructure sustainability. These areas affect local, state and national (private and government) entities. Furthermore, national and state recognition of research facilities such as NSF EF and national UTCs provide opportunities for successful award for externally funded research. Another opportunity arises from the location of the FIU Engineering campus in South Florida. The location is prime for research dealing with the environment, infrastructure, and climate change. For example, the Everglades offer an opportunity for researchers to investigate the health, mitigation, and sustainability of the environmental habitat. Vast civil infrastructure systems in a coastal urban environment present technical challenges in infrastructure resiliency and sustainability due to material degradation and hurricane impact. Coastal urban environments such as Miami Beach facilitate research for engineering solutions on the impact of sea-level rise. FIU is among the 10 largest public universities in the US, the only public university in Miami, and first in the nation in Hispanic serving institution. A large population will have local student talent to support the graduate program.

Challenges in the graduate program include improving the image of the department for domestic and international student recruitment. The university is not necessarily well known by students in the US or outside of Latin America for academics outside of international business. Another challenge that affects the graduate program is the conflicting views of graduate study and research in an engineering field that historically has emphasized engineering practice over interdisciplinary research that is required in emerging research areas. Existential questions that have been challenging the program include how much of the conventional civil and environmental engineering fundamental curriculum are a doctoral program graduate expected to master when research requires interdisciplinary knowledge or focus on topics outside of the conventional curriculum. Unit cohesion sometimes falters in face of the many challenges in defining graduate program policies. The highly scrutinized performance metrics placed on the units for production of doctoral graduates stigmatizes the importance of research Master students. This does not foster development of balanced research groups and graduate student development and tutelage. Attrition of support staff has become a burden at multiple levels of administration creating superfluous burden on the faculty and staff. The high cost of living in Miami can make recruitment and retention of non-local students, staff, and faculty difficult and makes the unit less competitive even with institutions within the state. Greater financial resources in research budgets must be allocated to the student thus causing research proposals to

be less competitive in cost. Furthermore, attrition of students, staff, and faculty can be aggravated due to the costs and difficulties in acculturation to the local environment, especially by international students lacking strong speaking skills in English and Spanish, insufficient access to easy transportation, as well as the support framework of having friends and family nearby. The final challenge is warding off complacency that forms in light of the many challenges.

## 4 CONCLUSIONS

This segment is to be completed after the consultant visits FIU and submits report.)

4.A. Strategic Planning and Improvement Action Plan

To be developed after the consultant visits.

4.B. Program Review Summary Report

To be developed after the consultant visits.

# APPENDIX A: GRADUATE CATALOG

# Civil and Environmental Engineering

**Atorod Azizinamini, Ph.D., P.E.,** *Professor and Chair*
**Omar Abdul-Aziz, Ph.D.,** *Assistant Professor*
**Hesham Ali, Ph.D., P.E.,** *Professor of Practice*
**Michael Bienvenu, Ph.D., P.E.,** *Professor of Practice*
**Anna Bernardo Bricker, Ph.D.,** *Instructor and Environmental Lab Manager*
**Arindam G. Chowdhury, Ph.D.,** *Associate Professor and Director, Laboratory for Wind Engineering Research*
**Hector R. Fuentes, Ph.D., P.E., D.E.E.,** *Professor and Associate Chair of Graduate Studies*
**Albert Gan, Ph.D.,** *Associate Professor*
**David Garber, Ph.D., P.E., T.E.,** *Assistant Professor*
**Mohammed Hadi, Ph.D., P.E.,** *Associate Professor*
**Peter A. Irwin, Ph.D., P.Eng.,** *Professor of Practice*
**Xia Jin, Ph.D., P.E.,** *Assistant Professor*
**Sylvan C. Jolibois, Jr., Ph.D.,** *Associate Professor*
**Khokiat Kengskool, Ph.D.,** *Instructor*
**Shonali Laha, Ph.D., P.E.,** *Associate Professor*
**Kingsley Lau, Ph.D.,** *Assistant Professor*
**Seung J. Lee, Ph.D.,** *Assistant Professor*
**Cora Martinez, Ph.D.,** *Instructor and Undergraduate Advisor*
**Alluri Priyanka, Ph.D., P.E.,** *Assistant Professor*
**Lakshmi Reddi, Ph.D., P.E.** *Professor and Dean, University Graduate School*
**L. David Shen, Ph.D., P.E., T.E.,** *Professor and Graduate Program Director, and Director, LCTR*
**Lambert Tall, Ph.D., P.E.,** *Professor Emeritus*
**Walter Z. Tang, Ph.D., P.E.,** *Associate Professor*
**Berrin Tansel, Ph.D., P.E.,** *Professor and Undergraduate Program Director*
**LeRoy E. Thompson, Ph.D., P.E.,** *Professor Emeritus*
**Oktay Ural, Ph.D.,** *Professor Emeritus*
**Ton-Lo Wang, Ph.D., P.E.,** *Professor and Associate Chair of Undergraduate Studies*
**Ioannis Zisis, Ph.D.,** *Assistant Professor*

***Affiliated Faculty***
**Irtishad Ahmad, Ph.D., P.E.,** *Construction Management*
**Assefa M. Melesse, Ph.D., P.E.,** *Earth and Environment*
**Fernando Miralles-Wilhelm, Ph.D., P.E.,** *Earth and Environment*

## Lehman Center for Transportation Research

**L. David Shen, Ph.D., P.E., T.E.,** *Director*

## Accelerated Bridge Construction University Transportation Center (ABC-UTC)

**(www.abc-utc.fiu.edu)**
**Atorod Azizinamini, Ph.D., P.E.,** *Director*
**David Garber, Ph.D., P.E., T.E.,** *Co-Director*

The Department of Civil and Environmental Engineering offers advanced study for the degree of Master of Science and Doctor of Philosophy. Degrees offered include: Master of Science in Civil Engineering, Master of Science in Environmental Engineering, and Doctor of Philosophy in Civil Engineering. The areas of specialty are Structures, Mechanics, Geotechnical, Construction, Transportation, Water Resources, and Environmental Engineering.

## Master of Science in Civil Engineering

The Master of Science program in Civil Engineering emphasizes course work as well as research. The student is required to specialize in a defined area of civil engineering, but may broaden knowledge through studies combining subject material from different areas of specialization and interdisciplinary related courses.

The graduate degree is offered to prepare qualified students for the professional practice of or advanced academic research in civil engineering. The degree is available in a thesis or non-thesis program. The thesis program entails a minimum of six credits for the successful completion of research and a thesis. The non-thesis program must be supported by the successful completion of a project and a report of substantial engineering content for a minimum of three credits. A student must satisfactorily complete a minimum of 30 semester credits of acceptable graduate course work.

## Master of Science in Environmental Engineering

A Master of Science in Environmental Engineering is available to students interested in graduate work in Environmental Engineering. The program is designed to expose graduate students to a wide range of knowledge on environmental engineering and on problem solving while encouraging them to pursue individual research interests. Thus, the curriculum has a common core of courses but is flexible enough to permit an interdisciplinary approach, if so desired, and allows the student to pursue his or her career goals.

The applicant should hold a Bachelor's degree in engineering, the natural sciences, or a closely related field. Students who do not meet the stated criteria may be considered for admission if they satisfy any deficiencies and complete the required prerequisites. A student must satisfactorily complete a minimum of 30 semester credits of acceptable graduate courses, including either a master thesis or an engineering project.

### Admission Policies for Master of Science Programs

A student seeking admission into Civil Engineering or Environmental Engineering graduate program must have a bachelor's degree in Civil Engineering, Environmental Engineering, or related engineering or equivalent from an accredited institution or, in the case of foreign students, an institution recognized in its own country as preparing students for further study at the graduate level. The minimum requirements for admission to the Master programs are:

1. At least a "B" average in upper level undergraduate work, and
2. A bachelor's degree in engineering, science, or a closely related field from an accredited institution, and
3. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the

iBT TOEFL or 6.5 overall on the IELTS is required, and
4. Three letters of recommendation or the forms provided by the department, and
5. A statement of objectives in which, in addition to other information, the intended concentration must be clearly stated, and
6. A resume including contact information, education and employment history, practical and research experiences (such as projects and publications), skills and other pertinent information.

Students who meet all criteria, except for requirements 1 and 2 above, may be evaluated for conditional admission. Meeting the minimum requirements does not guarantee admission to the programs.

Grades earned at an institution with non-traditional grading systems will be given every consideration and applicants will be treated equally as are students from institutions with traditional grading systems.

### Application Procedures for Master of Science Programs

A student planning to enroll in the graduate program must complete the following:
1. Submit an online Graduate Application for Admission to the Graduate Admissions Office.
2. Have a copy of the official transcripts of all previously earned college or university credits sent from the applicant's former institution(s) to the Graduate Admissions Office.
3. Submit three letters of recommendation, statement of objectives, and resume as part of the online Graduate Application for Graduate Admissions Office.
4. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.

It should be emphasized that the admission cannot be acted upon until all of the documents and credentials have been received.

Students seeking a waiver to normal admissions standards must contact the departmental main office for filing instructions and deadlines.

## Degree Requirements for Master of Science Programs

To be eligible for a Master's degree a student must:
1. Satisfy all University requirements for a Master's degree.
2. Meet all undergraduate deficiencies, and requirements as specified by the students' advisory committee.
3. Complete 30 semester hours of acceptable graduate level courses, including up to 3 credits of an Independent Study course. Supervised Research credits are not counted toward the 30 credit degree requirement.
4. Optionally, complete an acceptable thesis (minimum six credits) or engineering project (minimum three credits).
5. Successfully complete the core courses defined for the student's chosen specialty area.
6. Earn a minimum grade point average of 3.0 in all approved courses in the student's program of study.
7. Complete CGN 6939 Graduate Seminar.
8. For students who chose the thesis option, they must get approval and written evaluation of the oral defense and written thesis by their thesis committee. The committee should have, at a minimum, three graduate faculty members, and each member must complete and sign the student evaluation.
9. For students who chose the engineering project option, they must get approval and written evaluation of the oral defense and written engineering project by their project committee. The committee should have, at a minimum, three graduate faculty members, and each member must complete and sign the student evaluation.
10. For students who chose the non-thesis and non-engineering project (all-course) option, they must present a 5-page written report (in the format of a journal article) and an oral presentation (in CGN 6939) of a selected topic that demonstrates substantial professional engineering knowledge and experience. The written report and oral presentation must be evaluated and the student evaluation forms must be completed and signed by two departmental graduate faculty members, at a minimum, and then used by the CGN 6939 instructor to issue a P/F grade. The seminar will be scheduled and will be announced to students and faculty at least one week in advance in the last semester of the student's program.

### Core Courses

In order to master real-life engineering problems, engineers need to have an education with both breadth, as well as depth. Therefore, in addition to the above degree requirements, students must choose an area of technical specialization upon enrollment and satisfy the core course requirements as defined below. A proposed program of study shall be developed by a student's academic advisor together with the student and approved by the Graduate Program Director. All students are strongly encouraged to take the Research Methods for Civil Engineers course - especially those who are pursuing the thesis option. Students are also required to register for the 0-credit Graduate Seminar (CGN 6939) at least once and are encouraged to take it each Fall and Spring semesters.

## Areas of Technical Specialization:

**Environmental Engineering**

Environmental engineering students are required to take at least one course in each of the following core areas:
1. Water supply/wastewater/water quality,
2. Air quality,
3. Soil/solid/hazardous waste, and
4. Water resources (including groundwater).

Furthermore, it is advisable that students gain some expertise in environmental chemistry and in computational techniques including GIS techniques, while seeking knowledge in new areas of research and development.

Students are also required to register for the zero-credit Graduate Seminar (CGN 6936) and are encouraged to participate in it each semester.

**Water Resources Engineering**

This field involves the analysis of qualitative and quantitative water issues and the search for integrated, innovative and sustainable solutions to problems in the surface, groundwater, and atmospheric water environments.

Students pursuing a M.S. in Civil Engineering with concentration in Water Resources Engineering will follow a program of study that includes 15 credit-hours of engineering coursework emphasizing advanced knowledge and applications in either hydrology, hydraulics or hydrosystems or their combination thereof. The students will also complete a three credit-hour independent study to enrich the area of sought expertise.

Students are also required to comply with the following core requirements:

1. Take one course (3 credit-hours) among the following three background courses:
   - CWR 5305 Surface Hydrology
   - CWR 6125 Groundwater Hydrology
   - CWR 5140C Ecohydrology
2. Take one among the following applied courses:
   - CWR 5235 Open Channel Hydraulics
   - CWR 5535 Advanced Modeling Applications in Water Resources Engineering
   - CWR 6236 Engineering Sediment Transport

Students are required to take the Graduate Seminar (CGN 6939) once and are strongly encouraged to attend it while registering in the program. Students may also include up to six credit hours from other civil engineering areas or related disciplines, as long as the subjects relevantly add to the student's water resources engineering knowledge.

**Structural Engineering**

Students pursuing a M.S. in Civil Engineering with concentration in Structural Engineering will take at least twelve (12) credit hours of elective courses in structural engineering relevant to their track. A maximum of six (6) credits taken outside of the Civil and Environmental Engineering Department to enhance knowledge from related disciplines can be applied, upon approval of the academic advisor (or major professor), to graduation requirements. Furthermore, it is advisable that students gain some expertise in numerical methods.

Students in the Structural Engineering track are required to take at least six (6) credit hours of core course work as follows:

1. One course (3 credits) in design of structures from the following:
   - CES 5325 Design of Highway Bridges
   - CES 5606 Advanced Structural Steel Design
   - CES 5715 Prestressed Concrete Design
   - CES 5800 Timber Design
   - CES 6706 Advanced Reinforced Concrete Design
2. One course (3 credits) in analysis of structures from the following:
   - CES 5106 Advanced Structural Analysis
   - CES 5587 Topics in Wind Engineering
   - CES 6209 Advanced Structural Dynamics
   - EGM 5421 Structural Dynamics

**Construction Engineering**

Students pursuing a M.S. in Civil Engineering with concentration in Construction Engineering will follow a program of study that includes at least fifteen (15) credit-hours of civil engineering coursework that focuses on knowledge and applications within Construction Engineering of civil and environmental engineering infrastructure. The students will also complete a three (3) credit-hour independent study to enrich their graduate experience. Furthermore, it is advisable that students gain expertise in state-of-the-art computational methods in construction engineering.

Students in the Construction Engineering track are required to take at least six (6) credit hours of core course work from the following:

1. CCE 5035 Construction Engineering Management;
2. CCE 5036 Advanced Project Planning for Civil Engineers
3. CCE 5405 Advanced Heavy Construction Techniques

**Geotechnical Engineering**

Students pursuing a M.S. in Civil Engineering with concentration in Geotechnical Engineering will follow a program of study that includes at least fifteen (15) credit-hours of civil engineering coursework that focuses on knowledge and applications to the Geotechnical Engineering of civil and environmental engineering infrastructure. The students will also complete a three (3) credit-hour independent study to enrich their graduate experience. Furthermore, it is advisable that students gain expertise in state-of-the-art computational methods in construction engineering.

Students in the Geotechnical Engineering track are required to take at least six (6) credit hours of core course work from the following:

1. CEG 5065 Geotechnical Dynamics
2. CEG 6017 Theoretical Geotechnical Mechanics; and
3. CEG 6105 Advanced Foundations Engineering

**Transportation Engineering**

Transportation engineering is concerned with the planning, design, operation, and maintenance of the transportation infrastructure and systems. A student who chooses to specialize in transportation engineering must complete a minimum of five courses from the list below:

| | |
|---|---|
| TTE 5205 | Advanced Highway Capacity Analysis |
| TTE 5215 | Fundamentals of Traffic Engineering |
| TTE 5607 | Transportation Demand Analysis |
| TTE 5805 | Advanced Geometric Design of Highways |
| TTE 6257 | Traffic Control Systems Design |
| TTE 6506 | Mass Transit Planning |
| CGN 5320 | GIS Applications in Civil and Environmental Engineering |

Students are also required to register for the zero-credit Graduate Seminar (CGN 6936) and are encouraged to participate in it each semester.

### Independent Study Course

A student may take up to a total of three credits of independent study, which will be letter graded. If a student needs a course that will not be offered during the student's course of study, special topics courses should be set up to meet the student's needs. There will be no limit on the number of special topics courses provided that the core course requirements are satisfied.

### Grades and Credits

No course in which a grade below a 'C' is earned may be counted toward a Master of Science degree.

### Transfer Credit

The student may receive permission to transfer up to a maximum of six semester hours of graduate credit earned from another institution or up to 12 semester hours of graduate credit earned as a non-degree seeking students at FIU after admitted into one of the graduate programs in the Civil and Environmental Engineering Department. Such credits are transferable provided that: (1) the course(s) were taken at the graduate level at an accredited college or university; (2) grade(s) of 'B' or higher were earned for the courses; (3) the course(s) are judged relevant by the student's advisory committee; (4) the credits were not used toward another degree; and (5) the credit(s) were completed within six years immediately preceding the awarding of the degree.

Credits are not transferable until the student has earned 12 semester hours in the graduate programs in the Department of Civil Engineering and Environmental Engineering.

### Time Limit

All work applicable to the Master's degree, including transfer credits, must be completed within six years of first enrollment in the master's program.

## Combined BS/MS in Civil Engineering

Students who pursue a BS degree in Civil Engineering and have completed 75-90 credits and have at least a 3.3 GPA on both overall and upper division courses may apply to enroll in the combined BS/MS program in Civil Engineering upon recommendation from three CEE faculty members. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of B is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

## Combined BS in Civil Engineering/MS in Environmental Engineering

Students who pursue a BS degree in Civil Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS (Civil)/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Civil Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the

bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of "B" is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

## Combined BS/MS in Environmental Engineering

Students who pursue a BS degree in Environmental Engineering and are in their senior year and have at least a 3.3 GPA on both overall and upper division courses may apply to the department to enroll in the combined BS/MS program in Environmental Engineering upon recommendation from three CEE faculty members. To be considered for admission to the combined bachelor's/masters degree program in Environmental Engineering, students must have completed at least 75-90 credits in the bachelor's degree program in Environmental Engineering at FIU and meet the admissions criteria for the graduate degree program at FIU and meet the admissions criteria for the graduate degree program to the which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to the Graduate Admissions before the student starts the last 30 credit of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and will be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the credits specified by the program catalog, may be applied toward both degrees. In addition to the admission requirements of the combined BS/MS program, students must meet all the admission requirements of both the department and the University Graduate School.

Students enrolled in the program may count up to nine credit hours of CEE graduate courses as credits for both the BS and MS degrees. The combined BS/MS program has been designed to be a continuous program. However, upon completion of all the requirements of the undergraduate program, students will receive their BS degrees. Students in this program have up to one year to complete the master's degree after receipt of the bachelor's degree. Students who fail to meet this one year post BS requirement or who elect to leave the combined program at any time and earn only the BS degree will have the same access requirements to regular graduate programs as any other student, but will not be able to use the nine credits in both the bachelor's and master's degrees.

For each of the graduate courses counted as credits for both BS and MS degree, a minimum grade of "B" is required. All double counted courses must be at 5000 level or higher. Students enrolled in the program may count up to nine credit hours of CEE graduate courses toward the elective engineering BS requirements as well as toward the MS degree. Only graduate courses with formal lectures can be counted for both degrees. The students are responsible for confirming the eligibility of each course with the Undergraduate Advisor.

Students interested in the program should consult with the Undergraduate Advisor on their eligibility for the program. The students should also meet the Graduate Program Director to learn about the graduate program and available courses before completing the application form and submitting it to the Undergraduate Advisor. Applicants will be notified by the department and the University Graduate School of the decision on their applications.

Undergraduate students enrolled in the program are encouraged to seek employment with a department faculty to work as student assistants on sponsored research projects. The students will be eligible for graduate assistantships upon full admission into the graduate school.

## Doctor of Philosophy in Civil Engineering

### Minimum Admission Requirements

The minimum requirements for admission to the doctoral program in civil engineering are:

1. Applicants having a Master's degree in Civil Engineering or Environmental Engineering from a U.S. institution must satisfy the following requirements for admission to the doctoral program:
   a. GPA of at least 3.3/4.0 in the master's program
   b. Official GRE scores
   c. Three letters of recommendation or recommendation forms provided by the department
   d. A statement of objectives in which, in addition to other information, the intended research area must be clearly stated. (see identification of Research Area)
   e. A resume containing contact information, education and employment history, practical and research experiences (including publications), skills and other pertinent information.
2. Credentials of all other applicants including those with foreign degrees and those with B.S. degrees in other disciplines will be examined by the Graduate Program

Advisory Committee on a case by case basis. Additional credentials that will be considered include, but are not limited to, work experience, awards and recognitions, publications and presentations, and other professional experience.

3. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.
4. In addition to the departmental requirements, all students must satisfy the University's Admission and Graduate Policies and Procedures.

## Degree Requirements

**Maximum Length of Study**
The maximum length of study is seven years for students admitted with a B.S. degree and six years for students with an M.S. degree. For those students who have not completed their studies within these limits, the length of study may be extended on a yearly basis after petition by the student and approval by the student's supervisory committee. Any extension beyond nine years must be approved by the University Graduate School.

**Identification of Research Area**
There are currently three main areas of research or specialization: (1) Structural, Geotechnical, and Construction Engineering; (2) Environmental and Water Resources Engineering; and (3) Transportation Engineering. The student must contact the Department for a list of all faculty members, visit them, and be accepted by one professor to guide the dissertation research. If no such professor can be found, within 15 months of admission, the student will be dismissed from the Ph.D. program.

**Course Requirement**
The program will consist of at least 90 semester credit hours beyond the baccalaureate degree, 54 hours of which are course work and 24 hours dissertation, or at least 60 semester credit hours beyond the M.S. degree, 24 hours of which are course work and 24 hours dissertation. The remainder of the required minimum credit hours may be taken as either course work or dissertation or a combination thereof as approved by the student's advisor. Applicants who have a Master's degree in Civil and Environmental Engineering or a closely related field from an accredited institution are given a maximum of 30 transferred semester credit hours. In addition to the above requirements, the selection of courses must meet the following requirements for credits beyond the Master's degree:

1. Minimum three credits in Mathematics or Statistics
2. Minimum 18 core credits in the selected major area in Civil and Environmental Engineering
3. Any deviation from requirements 1 and 2 above must be justified in writing and approved by the CCE Graduate Program Director.
4. Complete CGN 6939.

Additional engineering courses (3000 and 4000 level) may be required as deficiencies for students coming from non-engineering majors.

All courses and dissertation topics must be approved by the student's supervisory committee. A proposed program of study shall be developed by a student's academic advisor together with the student and approved by the Graduate Program Director.

**Core Courses**
All Ph.D. students must satisfy the core course requirements defined for the MS degree programs. In addition, all doctoral students are required to take the Research Methods for Civil Engineers course before or during the first semester of dissertation credits. A student may take additional courses in the specialty as well as other areas as approved by the major advisor and the dissertation committee, provided all the core courses have been completed previously during the MS program or will be completed in the Ph.D. program. Students are also required to register for the 0-credit Graduate Seminar (CGN 6939) at least once and are encouraged to take it each Fall and Spring semesters.

**Independent Study Course**
A student may take up to a total of three credits of independent study, which will be letter graded. If a student needs a course that will not be offered during the student's course of study, special topics courses should be set up to meet the student's needs. There will be no limit on the number of special topics courses provided that the core course requirements are satisfied.

**Supervisory Committee**
The student's supervisory committee should be appointed as soon as possible and within the 15-month period after the student has been admitted to the Ph.D. program. The committee must have a minimum of four members, at least three from the Department of Civil & Environmental Engineering, and at least one from outside the department, but within FIU. All committee members should have a Ph.D. degree and must be members of the graduate faculty. The major professor must hold dissertation advisor status. The supervisory committee should meet as early as possible to review student's background, discuss student's expected research areas, provide guidance on course selection, etc.

**Residency Requirements**
The Ph.D. student should spend at least one academic year in full residency, after successfully passing his/her Comprehensive Examination (see the following description).

**Examinations**
A student must successfully complete the following written exam and oral defenses in partial fulfillment of requirements for the Ph.D. degree in Civil Engineering:

1. Qualifying Exam: The Qualifying Exam must be taken as soon as possible and no later than the semester the student completes the minimum course requirements. The exam consists of eight problems covering materials from core courses as determined by the student's supervisory committee. The exam will be open-book and the student will be given eight hours to solve all eight problems. In the event that a student fails the exam, he or she can retake it only once in the subsequent semester.
2. Proposal Defense: The proposal defense must be completed at least one year prior to the expected graduation date. In addition to the five-page proposal (brief version) required by the University Graduate School, the student must prepare a detailed proposal

that contains, at a minimum, background information, problem statement, objectives, literature review, methodology, work plan, and schedule. The proposal must be submitted to each committee member at least two weeks prior to the defense date. The defense will be given in the form of a graduate seminar that is open to all faculty, students, and visitors. A student can take the proposal defense twice.

3. Dissertation Defense: A draft dissertation must be submitted to each committee member at least six weeks prior to the date of the defense. The defense will be given in the form of a graduate seminar that is open to all faculty, students, and visitors. A student can fail this defense only once. In addition to dissertation copies to the University Graduate School, the student must deliver one final approved bound copy to the Department Chairperson, one to the major advisor, and one to each member of the supervisory committee. Students should become familiar with the University Graduate School's regulations and deadlines available on line at **http://gradschool.fiu.edu**.

## Graduate Certificate in Information Technology in Civil Engineering (ITCE)

The ***ITCE*** program brings information, communication and computing technology to the civil and environmental engineering professionals, who otherwise have little opportunity to be exposed to the rapidly changing technologies and techniques in these areas. The program will provide the opportunity to learn the basics and application techniques of these technologies in an organized, systematic, and formal setting. The program offers a set of carefully selected courses on computing and information technologies tailored to the needs of engineers in the fields of civil and environmental engineering, including structural, transportation, geotechnical, construction, and water resources engineering. The ***ITCE*** program also provides specialization opportunities for professionals interested in developing computer and information technology applications in the civil and environmental engineering fields. This program will help professional engineers (PE's) earn continuing education credits required to retain their registration. Interested students will be able to continue to earn a Master of Science in Civil Engineering degree if the admission requirements for the Masters program are met. This certificate program is open to both degree- and non-degree seeking students.

A minimum undergraduate GPA of 2.75 is required for admission. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required. To earn a graduate certificate in ITCE, the students must successfully complete the program's core and elective courses.

The ITCE curriculum consists of 18 credit hours – six courses (three core + three elective) of three credit hours each as shown.

**Core (Required) Courses:**

| | |
|---|---|
| CGN 6424 | Advanced Computing in Civil Engineering |
| CGN 6308 | Intelligent Civil Engineering Systems |
| CCE 5505 | Computer Integrated Construction Engineering |

**Electives:**

| | |
|---|---|
| CGN 5321 | Applications for Civil and Environmental Engineering |
| CES 5565 | Computer Applications in Structures |
| CGN 6325 | Advanced GIS for Civil and Environmental Engineering |
| CGN 5315 | Civil Engineering Systems |
| BCN 5784 | Construction Information Systems |
| EIN 6117 | Advanced Industrial Information Systems |
| ISM 6222 | Telecommunications Network |
| MAN 6830 | Organization Information Systems |

Additional information about this program can be found at:
URL: **www.eng.fiu.edu/cee**
Tel: (305) 348-3055
Fax: (305) 348-2802

### Academic Standard

The Department of Civil and Environmental Engineering requires that students receive no grade less than a "C" with an overall GPA of 3.0 in order to be awarded the graduate certificate.

## Course Descriptions

### Definition of Prefixes

CES-Civil Engineering Structures; CEG-Engineering General, Civil; CGN-Civil Engineering; CWR-Civil Water Resources; EES-Environmental Engineering Science; EGM-Engineering, Mechanics; EGN-Engineering, General; ENV-Environmental Engineering; TTE-Transportation and Traffic Engineering; URP-Urban and Regional Planning

**CCE 5035 Construction Engineering Management (3).** Course will cover construction organization, planning and implementation; impact and feasibility studies; contractual subjects; liability and performance; the responsibility of owner, contractor and engineer. Prerequisites: CES 3100 or equivalent and CEG 4011 or equivalent.

**CCE 5036 Advanced Project Planning for Civil Engineers (3).** Advanced techniques and methods for planning activities, operations, finance, budget, workforce, quality, safety. Utilize case studies as learning tools for students aspiring to management positions. Prerequisites: CCE 4031 or equivalent.

**CCE 5405 Advanced Heavy Construction Techniques (3).** Heavy construction methods and procedures involved in large construction projects such as bridges, cofferdams, tunnels, and other structures. Selection of equipment based on productivity and economics. Prerequisite: CCE 4001.

**CCE 5505 Computer Integrated Construction Engineering (3).** Course covers the discussion of available software related to Construction Engineering topics; knowledge based expert systems and their

relevance to construction engineering planning and management. Prerequisites: CCE 4031 or equivalent.

**CEG 5065 Geotechnical Dynamics (4).** Analytical, field, and laboratory techniques related to vibration problems of foundations, wave propagations, behavior of soils and rocks, earth dams, shallow and deep foundations. Earthquake engineering. Prerequisite: CEG 4011.

**CEG 6017 Theoretical Geotechnical Mechanics (3).** A continuum mechanics interpretation of geotechnical engineering; soil rheology; theories of yielding; failure and plastic stability. Analytical and numerical modeling of non-linear properties. Prerequisites: CEG 4012C and MAP 2302. Suggested corequisite: MAP 4401.

**CEG 6105 Advanced Foundations Engineering (3).** Computer applications involving the numerical analysis and design of complex soil-structure interactions: highway and airfield pavements, deep foundation groups and NATM tunnelling techniques. Prerequisite: CEG 4012.

**CES 5106 Advanced Structural Analysis (3).** Extension of the fundamental topics of structural analysis with emphasis on energy methods and methods best suited for nonprismatic members. Prerequisite: CES 3100.

**CES 5325 Design of Highway Bridges (3).** Structural analysis and design for highway bridge systems which includes design criteria, standards of practice and AASHTO specifications for designing super-structures and substructure elements of various types of bridges. Prerequisites: CES 4605, CES 5715, and CEG 4011.

**CES 5565 Computer Applications in Structures (3).** Discussion and application of available computer programs, techniques and equipment for the analysis, design and drafting of structures. Graduate students have to do a project. Prerequisites: CES 4605 and CES 4702.

**CES 5587 Topics in Wind Engineering (3).** The course will cover the nature of wind related to wind-structure interaction and design loads for extreme winds, tornadoes and hurricanes. Prerequisites: CES 3100 Structural Analysis and CWR 3201.

**CES 5606 Advanced Structural Steel Design (3).** Extension of the analysis and design of structural elements and connections for buildings, bridges, and specialized structures utilizing structural steel. Prerequisite: CES 4605.

**CES 5715 Prestressed Concrete Design (3).** The behavior of steel and concrete under sustained load. Analysis and design of pre-tensioned and post-tensioned reinforced concrete members, and designing these members into the integral structure. Prerequisite: CES 4702.

**CES 5800 Timber Design (3).** The analysis and design of modern wood structures. Effect of plant origin and physical structure of wood on its mechanical strength; fasteners and their significance in design. Prerequisite: CES 3100.

**CES 6209 Advanced Structural Dynamics in Civil Engineering (3).** Response of structures subjected to arbitrary forms of deterministic dynamic loading; formulation of methods to evaluate stresses and deflections due to vibrations. Prerequisite: EGM 5421.

**CES 6706 Advanced Reinforced Concrete Design (3).** The analysis and design of reinforced concrete and masonry structural systems to formalize the student's knowledge of the behavior of structural components into a final integrated structure. Prerequisite: CES 4702.

**CES 6707 Reinforced Concrete Mechanics (3).** Limit analysis of reinforced concrete. Concrete plasticity. Use and advantages of methods derived from basic mechanics. How reinforced concrete members respond to overload and fail. Prerequisite: CES 6706.

**CGN 5315 Civil Engineering Systems (3).** Application of systems analysis techniques to large scale civil engineering problems. Prerequisites: ESI 3314 or equivalent.

**CGN 5320 GIS Applications in Civil and Environmental Engineering (3).** Introduction to the basics of geographic information systems, their software and hardware, and their applications in Civil and Environmental Engineering, landscape architecture, and other related fields. Corequisites: TTE 4201 or CWR 3540 or ENV 3001.

**CGN 5870 Corrosion Control in Civil Engineering (3).** The course provides understanding of principles of corrosion phenomena with emphasis on its application to materials in civil engineering including testing methods, corrosion control, and durability. Prerequisite: Permission of the instructor.

**CGN 5874 Building Diagnostics (3).** This course will give an introduction into building diagnostics with a focus on non-destructive testing (NDT) techniques used to investigate Civil Engineering materials and structures. Prerequisites: Graduate standing, enrolled in engineering curriculum.

**CGN 5930 Special Topics in Civil Engineering (1-3).** A course designed to give groups of students an opportunity to pursue special studies not otherwise offered. Prerequisite: Permission of the instructor.

**CGN 5935 Professional Engineering (Civil) Review (4).** Prepares qualified candidates to take the P.E. written examination in the field of Civil Engineering. Reviews hydraulics, hydrology, water supply and wastewater, geotechnics, structures, concrete and steel design, etc.

**CGN 6030 Research Methods for Civil Engineers (1).** Survey and critical analysis of research in the disciplines of civil and environmental engineering. Emphasizes theory and methods of conducting advanced research, including the scientific method. Prerequisites: First-year doctoral or master standing.

**CGN 6308 Intelligent Civil Engineering System (3).** Application of artificial intelligence and other techniques to build intelligent civil and environmental engineering systems. Develop planning, design, analysis, diagnosis, control, monitoring applications through projects. Prerequisite: Permission of the instructor.

**CGN 6325 Advanced GIS for Civil and Environmental Engineering (3).** Advanced GIS concepts and techniques for civil and environmental engineering applications including LRS, temporal GIS, 3D modeling, GIS data accuracy and standards, spatial statistical analysis, and others. Prerequisites: CGN 5930 or permission of the instructor.

**CGN 6426 Advanced Computing in Civil Engineering (3).** Advanced computer modeling and programming

techniques for civil and environmental engineering applications including data modeling, engineering database design, object-oriented programming, and user interface design. Prerequisite: Permission of the instructor.

**CGN 6905 Directed Independent Study (1-3).** Individual conferences, assigned readings, and reports independent investigations selected by the student and professor with approval of advisor.

**CGN 6910 Supervised Research (1-12).** Graduate level research carried out under the supervision of a faculty member. Maximum 12 credits can be counted for Ph.D. students only. Prerequisite: Permission of the Major Professor.

**CGN 6916 Engineering Project (1-3).** Independent research work culminating in a professional practice oriented report for the requirements of the non-thesis option of the M.S. degree. Prerequisites: Fifteen graduate credits and approved project plan.

**CGN 6930 Advanced Special Topics in Civil Engineering (1-3).** A course designed to give groups of students an opportunity to pursue special studies in an advanced topic of Civil Engineering not otherwise offered. Prerequisite: Permission of the instructor.

**CGN 6939 Graduate Seminar (0).** An examination of recent technical findings in selected areas of concern. Emphasis is placed on presentations (oral and written), research activities, readings, and active discussions among participants.

**CGN 6971 Thesis (1-6).** The student following the thesis option of the Master's degree will pursue research through this course. The research work will culminate with an acceptable thesis. Prerequisite: Permission of the graduate's thesis advisor.

**CGN 7980 Ph.D. Dissertation (1-12).** Doctoral research leading to Ph.D. civil engineering dissertation. Prerequisites: Permission of the Major Professor and Doctoral Candidacy.

**CWR 5140C Ecohydrology (3).** Hydrology of ecosystems, interaction between the hydrologic cycle and vegetative processes. Prerequisite: Permission of the instructor.

**CWR 5235 Open Channel Hydraulics (3).** Theoretical treatment and application of hydraulics. Flow in open channels with special reference to varied flow, critical state hydraulic jump, and wave formation. Prerequisite: CWR 3540.

**CWR 5251 Environmental Hydraulics (3).** Application of fluid mechanics in the study of physical mixing in surface water bodies, dispersion of materials, and design of hydraulic systems. Prerequisite: Permission of the instructor.

**CWR 5305 Surface Hydrology (3).** Principles of Hydrology with a particular focus on surficial processes of interest to engineering design. Emphasizes applications to flood prevention and mitigation and stormwater management issues. Prerequisites: CWR 3201, CWR 3540 (or equivalent).

**CWR 5535C Advanced Modeling Applications in Water Resources Engineering (3).** Complex model applications in hydrology, hydraulics, hydrosystems engineering and environmental interconnections. Prerequisite: Permission of the instructor.

**CWR 6117 Stochastic Hydrology (3).** Application of probability and statistics in hydrologic engineering. Frequency analysis of extreme events. Time series analysis and stochastic modeling. Prerequisites: CWR 3201 and CWR 3540.

**CWR 6125 Groundwater Hydrology (3).** Physical properties, equations of flow/mass transport, saturated/unsaturated zone, wells, pumping tests, quality/contamination control, analytical solutions, introduction to numerical models/computer codes. Prerequisite: Permission of the instructor.

**CWR 6126 Advanced Groundwater Hydrology (3).** Finite difference/finite element/boundary integral methods, transport and fate of chemically and biologically reacting solutes, tracer tests, hydrological approaches to remedial action and monitoring. Prerequisites: CWR 6125 or permission of the instructor.

**CWR 6236 Engineering Sediment Transport (3).** Physical processes of sediment transport and deposition, land erosion, river morphology applied to engineering design, design of stable channels, scour, transport of sediment-attached pollutants.

**CWR 6625C Ecological Engineering (3).** Introduction and incorporation of the important concepts and theories of ecology into water resources engineering principles and designs. Prerequisite: Permission of the instructor.

**EES 5135 Water Quality Indicators (3).** Ecological studies of micro and macro organisms which are indicators of water quality. Emphasis of bioassays and early warning systems. Prerequisite: Permission of the instructor.

**EES 5137 Biological Monitoring of Freshwater Ecosystems (3).** The use of aquatic insects and other invertebrates to monitor changes in the aquatic environment. The ecological aspects of aquatic insects in relation to pollution stress are assessed. Prerequisites: EES 5135 or permission of the instructor.

**EES 5506 Occupational Health (3).** Effects, assessments, and control of physical and chemical factors in man's environment, including chemical agents, electromagnetic radiation, temperature, humidity, pressures, illumination, noise, and vibration. Prerequisite: Admission to graduate program.

**EES 5605 Noise Control Engineering (3).** Fundamentals of sound and noise. Health hazards and other effects. Measurement and noise control in transportation, construction, and other environments. Prerequisite: Admission to graduate program.

**EES 6506 Environmental and Human Factors (3).** Effects, assessment and control of physical and chemical factors in the natural and man-made environments, including noise, electro-magnetic radiation, air and water pollution, public and occupational health, vector control, communicable diseases. Prerequisite: Admission to graduate program.

**EES 6508 Occupational Health and Toxicology (3).** A continuation of EES 6506. Investigation of toxic

substances in air, water, and food in the industrial environment. Prerequisite: EES 6506.

**EGM 5111 Experimental Stress Analysis (3).** Course covers the necessary theory and techniques of experimental stress analysis and the primary methods employed: brittle coating, strain gauges, photo-elasticity and Moire. Prerequisites: EGM 3520, EGM 5653.

**EGM 5351 Finite Element Methods in Mechanics (3).** Matrix techniques and variational methods in solid mechanics; single element, assemblage and generalized theory; non-linear analysis; applications in structural and soil mechanics, torsion, heat conduction and hydro-elasticity, etc. Prerequisite: CES 5106.

**EGM 5421 Structural Dynamics (3).** Fundamentals of free, forced, and transient vibration of singles and multidegree of freedom structures, including damping of lumped and distributed parameters systems. Graduate students have to do a project. Prerequisite: CES 3100 and MAP 2302.

**EGM 6425 Structural Reliability (3).** Fundamentals of probability theory and stochastic processes; probabilistic modeling of structural loads and material properties; reliability analysis and design of structures; reliability-based design criteria. Prerequisite: STA 3033.

**EGM 6533 Advanced Mechanics of Materials (3).** Extension of the fundamental principles of engineering mechanics to include curved beams, warping, stability, etc. Prerequisites: CES 5106 and MAP 2302.

**EGM 6653 Theory of Elasticity (3).** An advanced course covering the concepts of stress and strain tensors, indicia notation, transformation of stresses, compatibility equations, the stress function and the closed form solution of some important continuum mechanics problems. Prerequisites: EGM 3520, MAP 2302.

**EGM 6675 Advanced Plasticity (3).** Formulation of the plastic stress-strain relationships; Prandtl-Reuss equations; yield criteria; Plane Plastic Flow and the Plane Slip Line Field Theory; limit analysis and basics of creep. Prerequisite: EGM 3520.

**EGM 6736 Theory of Elastic Stability (3).** Course will cover the beam-column problem; elastic and inelastic buckling of bars and frames; review of experimental work and design formulas; buckling of rings, curved bars and arches; bending and buckling of thin plates and thin shells. Prerequisite: EGM 3520.

**EGM 6796 Theory of Plates and Shells (3).** A course covering the concepts of thin plates with small deflections; thin plates with large deflections; thick plates; the Membrane Theory of Shells; and the General Theory of Cylindrical Shells. Prerequisite: EGM 3520.

**EGN 5439 Design of Tall Buildings (3).** The course analyzes different modern high-rise structural systems, and includes the dynamics of wind and earthquakes to efficiently design very tall buildings and their ancillary structures. Prerequisite: Permission of the instructor.

**EGN 5455 Numerical Methods in Engineering (3).** Study of procedures that permit rapid approximate solutions, within limits of desired accuracy, to complex structural analysis. Graduate students have to do a project. Prerequisite: CES 3100.

**EGN 5990 Fundamentals of Engineering (FE) Review (4).** Prepares upper level engineering students to take the Fundamentals of Engineering (FE) State Board examinations. Reviews chemistry, computers, statics, dynamics, electrical circuits, fluid mechanics, mechanic of materials, material science and thermodynamics.

**ENV 5002C Fundamentals for Environmental Engineers (3).** Laws and principles of the physical, chemical and biological phenomena that define and control the fate of chemical species in natural and engineered systems. Prerequisite: Permission of the instructor.

**ENV 5007 Environmental Planning (3).** Environmental laws and regulations, ecological principles, planning policies and processes, risk assessment, environmental impact due to growth, and environmental indicators.

**ENV 5008 Appropriate Technology for Developing Countries (3).** Appropriate environmental technologies and associated factors. Topics include water, air, soil and waste management. Low cost and energy alternatives are emphasized. Prerequisite: Permission of the instructor.

**ENV 5027 Bioremediation Processes (3).** Bio-transformation of subsurface contaminants is gaining recognition as a viable treatment tool. This course provides students with quantitative methods required to design bioremediation systems. Project required. Prerequisite: Permission of the instructor.

**ENV 5062 Environmental Health (3).** Study of the control and prevention of environmental-related diseases, both communicable and non-communicable, injuries, and other interactions of humans with the environment. Prerequisite: Permission of the instructor.

**ENV 5104 Indoor Air Quality (3).** Sources and causes of poor indoor air quality (IAQ). Protocols for IAQ investigations; problem evaluation and solution proposals. Approaches to sustainable construction; best IAQ and energy savings.

**ENV 5105 Air Quality Management (3).** Technical and regulatory aspects of air quality management. Emissions inventories, ambient monitoring, and models used to evaluate the impact of pollutants on local, regional and global air quality.

**ENV 5116 Air Sampling Analysis (3).** Practical laboratory work and theoretical aspects involved in a wide range of air sampling and analysis systems. Critical comparison and examination of methods and instrumentation. Source testing, instrumental sensitivity, applicability and remote sensing systems. Prerequisites: ENV 5105 or ENV 4101.

**ENV 5126 Particulate Air Pollution Control (3).** Particulate pollution control devices, principles, design, costs. Cyclones, electrostatic precipitators, filters, bag houses, scrubbers, noval control devices.

**ENV 5127 Gaseous Air Pollution Control (3).** Gaseous pollution control devices, principles, design, costs. Gaseous pollutants control using adsorption, absorption, incineration, and other novel control systems.

**ENV 5334 Spill Response and Hazardous Materials Transport (3).** Consequence analysis of accident scenarios covering the release and dispersion of toxic

substances during transport into air, soil, or aquifer and fast response to spills and toxics recovery. Prerequisite: Permission of the instructor.

**ENV 5335 Advanced Hazardous Waste Treatment Processes (3).** Hazardous waste site assessment, remedial investigation, design of site monitoring strategies and remediation plans. Prerequisites: CHM 1046 and CHM 1046L.

**ENV 5347 Waste Incineration (3).** Domestic and industrial waste incineration and pollutant stream control of aqueous and airborne pollutants. Design of incineration's.

**ENV 5356 Solid and Hazardous Waste (3).** Generation, transport, treatment and disposal of solid and hazardous wastes; risk assessment and treatment of contaminated media. Prerequisites: CHM 1046 and CHM 1046L.

**ENV 5406 Water Treatment Systems and Design (3).** Course emphasizes water quality, quantities, treatment and distribution systems particularly as relates to municipal water supply. Requires laboratory project. Prerequisite: Permission of the instructor.

**ENV 5512 Water and Wastewater Analysis (3).** Relevance of the main quality parameters and their measurements by wet chemistry and analytical equipment. Includes BOD, COD, TOC, CO, TSS, VSS, alkalinity, acidity, pH hardness, ammonia, TKN, NO2, NO3, PO4, etc. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512L.

**ENV 5512L Water and Wastewater Analysis Laboratory (1).** Experiments are conducted which measure gross organic pollution indicators, suspended solids, conductivity, alkalinity, acidity, pH, nitrate, nitrite, TKN, ammonia, total phosphates, chlorine residual and chlorine breakpoint. Prerequisites: ENV 5666, CHM 1046, and CHM 1046L. Corequisite: ENV 5512.

**ENV 5517 Design of Wastewater Treatment Plants (3).** Wastewater collection systems. Integration of unit operations into the planning and design of treatment plants, including sludge handling and disposal. Prerequisite: Permission of the instructor.

**ENV 5519 Chemistry for Environmental Engineers (3).** Basis for applying microbial and physicochemical principles to understand reactions occurring in natural and engineered systems including water/wastewater treatment processes. Includes laboratory project. Prerequisite: Permission of the instructor.

**ENV 5559 Reactor Design (3).** A theoretical and practical basis for reaction kinetics to understand multiphase reactions, analysis and design of batch and continuous flow reactors. Projects on analysis of reactor design and operating data.

**ENV 5613 Environmental Entrepreneurship (3).** Application of environmental engineering concepts in the development of innovative ideas, products or services; interactive experiences with environmental businesses. Prerequisites: ENV 3001 or permission of the instructor.

**ENV 5659 Regional Planning Engineering (3).** Theories of urban and regional growth; collective utility analysis; input-output models in planning; application of linear programming to regional social accounting; economic base analysis. Prerequisites: Computer Programming or permission of the instructor.

**ENV 5666 Water Quality Management (3).** Predicting and evaluating the effect of human activities on streams, lakes, estuaries, and ground waters; and the relation of human activities to water quality and protection of water resources. Prerequisite: Permission of the instructor.

**ENV 5905 Independent Study (1-3).** Individual research studies available to academically qualified students on graduate status.

**ENV 5930 Special Topics in Environmental Engineering (1-3).** Specific aspects of environmental technology and urban systems not available through formal course study. Open to academically qualified students only.

**ENV 6045 Environmental Modeling (3).** Evaluation of regional resources, environmental stresses, and considerations in regional systems; systems analysis in environmental management and its relation to decision making; modeling of air and water systems. Prerequisites: Computer programming or permission of the instructor.

**ENV 6056 Engineering Assessment of Metal Contaminants & Colloidal Transport (3).** Kinetics of metal sorption reactions, colloidal transport, assessment of metal contaminants in soil. Prerequisite: Permission of the instructor.

**ENV 6070 Green Engineering (3).** Study of green engineering principles and methodologies to enhance environmental performance of societal sectors, including regulatory framework, sustainability, P2, LCA and industrial ecology. Prerequisite: Permission of the instructor.

**ENV 6337 Hazardous Waste Site Assessment (3).** Phase I and Phase II Investigations, Environmental Testing, Assessment, Monitoring Design. Prerequisites: ENV 5335 or permission of the instructor.

**ENV 6510C Advanced Unit Operations I (3).** Theory and design of physical and chemical processes for treatment of contaminated media. Application of fluid mechanics, heat and mass transfer to design and operation of physical/chemical systems. Prerequisite: Permission of the instructor.

**ENV 6511C Advanced Unit Operations II (3).** Theory and design of biological processes for treatment of contaminated media. Application of biochemical reaction kinetics theory to design and operation of biological treatment systems. Prerequisite: Permission of the instructor.

**ENV 6511L Advanced Unit Operations II Lab (1).** Bench scale experiments for scaling-up and designing the following water and wastewater processes: sedimentation, coagulation, filtration, adsorption, oxidation and gas transfer. Prerequisite: ENV 6510. Corequisite: ENV 6511.

**ENV 6516 Advanced Treatment Systems (3).** Integration of unit operations into advanced treatment systems for contaminated media. Applications may include either conventional or innovative/emerging technologies. Prerequisite: Permission of the instructor.

**ENV 6558 Industrial Wastewater Treatment (3).** Characteristics and composition of industrial wastewaters.

Sampling techniques and analyses. Water conservation and reuse. Joint industrial-commercial collection and treatment of wastewaters. Prerequisite: ENV 6516.

**ENV 6614 Environmental Risk Assessment (3).** Characteristics of risk analysis, hazard identification, exposure assessment, consequence analysis, dose-response analysis. Prerequisite: Permission of the instructor.

**ENV 6615 Environmental Impact Assessment (3).** An examination of alternative techniques useful for analysis and environmental impacts of man's activities. Environmental impact assessment methodologies are emphasized.

**ENV 6916 Engineering Project (1-3).** Individual work culminating in a professional practice-oriented report suitable for the requirements of the M.S. degree-project option. Only three credits are applicable towards degree. Prerequisites: Completion of 20 graduate credits and approved proposal.

**ENV 6934 Advanced Special Topics in Environmental Engineering (1-3).** Specific aspects of Environmental Engineering requiring advanced engineering and research skills. A maximum of three credits are applicable towards degree. Prerequisite: Permission of the instructor.

**ENV 6935 Graduate Environmental Seminar (0).** The course consists of oral presentations made by students, guests, and faculty members on current topics and research activities in environmental systems.

**ENV 6971 Thesis (1-6).** Research for Master's thesis.

**TTE 5007 Transportation Systems in Developing Nations (3).** Transportation systems in the Developing Nations. Role of international organizations, technology transfer/choices, orientation of transport networks, socio-economic and environmental impacts. Prerequisites: Graduate standing or permission of the instructor.

**TTE 5015 Applied Statistics in Traffic and Transportation (3).** Civil and Environmental Engineering statistics methods as applied to traffic and transportation are covered. Topics include: significance tests, standard distributions, analysis of variance, and regression analysis. Prerequisite: Graduate standing.

**TTE 5100 Transportation and Growth Management (3).** Theory and principles of transportation and growth management, including the growth phenomena and regional impact planning. Design projects required. Prerequisite: TTE 4201.

**TTE 5205 Advanced Highway Capacity Analysis (3).** Parameters involved in calculating highway capacity and level of service on different highway and transportation facilities. Computer application will be also discussed. Prerequisite: TTE 4201.

**TTE 5215 Fundamentals of Traffic Engineering (3).** Speed and volume studies, stream characteristics, traffic flow theory, accident characteristics. Prerequisite: TTE 4201.

**TTE 5273 Intelligent Transportation Systems (3).** ITS functional areas, planning architecture, standards, and evaluation. Implementation of selected ITS technologies and strategies. Prerequisites: TTE 4201 or equivalent.

**TTE 5315 Highway Safety Analysis (3).** Influencing factors (roadway characteristics, vehicle characteristics, and human factors), safety data, network screening, identification and diagnosis of safety problems, selection of countermeasures, evaluation studies, accident reconstruction. Prerequisites: STA 3033, TTE 4201.

**TTE 5606 Transportation Systems Modeling and Analysis (3).** Modeling and analysis techniques in transportation. Linear Programming, queueing theory, decision making techniques. Prerequisite: TTE 4201.

**TTE 5607 Transportation Demand Analysis (3).** Travel demand analysis and forecasting. Modeling techniques including trip generation and distribution, mode split, and trip assignment. Practical applications. Prerequisite: TTE 4201.

**TTE 5805 Advanced Geometric Design of Highways (3).** Parameters governing the geometric design of highways; curve super-elevation; widening on highway curves; elements of intersection design; design of interchanges; use of AASHO design guidelines. Design project required. Prerequisites: SUR 3101C and TTE 4201.

**TTE 5835 Pavement Design (3).** Analysis and design of sub-base, base, and pavement of a roadway. Discussions of flexible pavement and rigid pavement as structural units. Boussinesq's approach. Westergaard's theory. Beams on Elastic Foundations. Prerequisites: CEG 4011 and CES 4702.

**TTE 5925 Urban Traffic Workshop (3).** Selected laboratory problems related to urban traffic. Prerequisite: TTE 4201.

**TTE 5930 Transportation Seminar (1-3).** Oral presentations made by students, guests, and faculty members on current topics and research activities in traffic and transportation engineering. Prerequisite: TTE 4201.

**TTE 6257 Traffic Control Systems Design (3).** Theory and principles of traffic control systems design, including both freeway and urban streets. Design projects required. Prerequisite: TTE 4201.

**TTE 6267 Traffic Simulation Models (3).** Traffic simulation modeling and analysis. Application of microscopic and macroscopic traffic simulation models to evaluate and optimize traffic control systems. Prerequisites: TTE 6257 or equivalent.

**TTE 6506 Mass Transit Planning (3).** Theories and principles of mass transit planning, include highway transit, rail transit and new transit modes. Design projects required. Prerequisite: TTE 5930.

**TTE 6525 Bearing Capacity of Roads and Airfields (3).** Advanced study of bearing capacity principles and theory; stress-strain behavior of pavements; constitutive modeling; and failure histories of pavement. Prerequisite: Permission of the instructor.

**TTE 6526 Airport Planning and Design (3).** Theory and principles of airport planning and design, include both general aviation and major commercial airports. Design projects required. Prerequisite: Permission of the instructor.

**TTE 6528 Airport Terminal Design and Operations (3).** Theory and practice of airport terminal design and

operations, including passenger terminal complex, cargo terminal complex, and ground transportation. Design projects required. Prerequisite: Permission of the instructor.

**TTE 6605 Planning and Design of Intermodal Facilities (3).** Theory and practice of intermodal facility planning and design, including facility location, site design and access, and intermodal considerations. Design projects required. Prerequisites: TTE 5930 or permission of the instructor.

**TTE 6650 Transportation and Land Development (3).** Theory and principles of transportation and land development, including site planning, traffic analysis, and access and site circulation. Design projects required. Prerequisite: TTE 4201.

**TTE 6701 Light Rail Planning and Design (3).** Theory and practices of light rail transit planning and design, including demand analysis, capacity evaluation, geometric design, and track design. Design projects required. Prerequisite: TTE 4201.

**TTE 6755 Port Planning and Development (3).** Theory and practice of port planning and development, including demand analysis, capacity evaluation, ground access, and port development strategy. Design projects required. Prerequisites: TTE 5930 or permission of the instructor.

**TTE 6833 Superpave Asphalt Mixture Design and Analysis (3).** Materials characterization and testing; elastic, visco-elastic and plastic behavior; fracture and fatigue, rutting and design of bituminous mixtures. Prerequisite: Permission of the instructor.

**TTE 6834 Pavement Maintenance and Rehabilitation (3).** Pavement performance assessment; criteria for pavement evaluation, measurement of pavement distress. Analysis and interpretation of pavement condition data. Formulation and evaluation of maintenance and rehabilitation alternative. Prerequisite: Permission of the instructor.

**TTE 6837 Pavement Management Systems (3).** Theory and principles of pavement management systems (PMS), including PMS at network and project level, PMS strategies, and PMS software packages used for decision making process. Prerequisites: TTE 5835 or permission of the instructor.

**URP 5312 Urban Land Use Planning (3).** Elements of the general land use plan, location and space requirements; the use of models in planning; development of the land use plan; policy plan, implementation. Prerequisite: Permission of the instructor.

**URP 5316 Environmental and Urban Systems (3).** Overview of basic issues and principles of environmental and urban planning/design systems. Emphasis will be placed on multidisciplinary linkages.

**URP 5912 Research Methods (3).** Methods of information search, data interpretation, and hypotheses formulation used in the field.

**URP 6222 Urban Regional Analysis (3).** The urban areas as a complex system; modeling the urban growth processes; statistical decision making games; modeling and simulation; cost effectiveness; application of the theory; a system-wide view of the Miami area. Prerequisite: Permission of the instructor.

**URP 6317 Advanced Environmental and Urban Systems (3).** To study the application of physical planning and design concepts and their environmental, infrastructural and social impacts.

**URP 6906 Independent Study (1-3).** Specialized individual studies in Environmental and Urban Systems. Prerequisite: Permission of the instructor.

**URP 6935 Special Topics (3).** Intensive treatment of specific subjects in the field of environmental and urban systems. Topics will vary depending upon the interest of students and faculty.

**URP 6937 Final Project (1-3).** Individual work culminating towards professional practice that also meets a degree requirement of the Master of Environmental and Urban Systems program. Prerequisite: Permission of the instructor.

# APPENDIX B: EXAMPLES OF DOCUMENTS FOR GRADUATE PROGRAM ENHANCEMENT DISSCUSSIONS

FIU | FLORIDA INTERNATIONAL UNIVERSITY

UNIVERSITY GRADUATE SCHOOL
OFFICE OF THE DEAN
*Lakshmi N. Reddi, Ph.D., P.E.*

March 11th, 2013

Dr. Atorod Azizinamini,
Professor and Chair, Civil and Environmental Engineering
EC 3677

RE: Doctoral Program Review: Civil and Environmental Engineering

Dear Atorod:

UGS has completed a thorough review of your self-study report, feedback from the doctoral student surveys, and external assessment of your program by Amr S. Elnashai. I apologize for this delay in processing the review. Changes in administration both at UGS and in your department, and new initiatives (APS, Annual Doctoral Student Evaluations) necessitated this delay to a large extent. I want to thank you for engaging your faculty and students in this review process. The department's active participation and cooperation in this process was very much appreciated both by the UGS and by the external reviewer.

The report from the external reviewer highlighted multiple strengths and potential of your doctoral program. Based on all the feedback received, UGS has identified twelve (12) specific areas of improvement for your unit to focus on during the next few academic years. These are listed below in no particular order.

1. Implement a strategic plan for the recruitment of highly qualified applicants in all areas of the doctoral program
2. Maintain a consistent level of student quality and research output
3. Expand course offerings and separate undergraduate and graduate level courses
4. Improve and diversify the mix of internal and external support for doctoral students, with emphasis on increasing the number of RAs funded by faculty grants and contracts
5. Improve communication to students at all stages of the program starting with a well-organized orientation and detailed graduate student manual
6. Improve consistency of qualifying exams
7. Expand teaching and research opportunities for graduate students
8. Implement mentoring training in the department for graduate faculty
9. Place greater emphasis on community-building activities in the program, with more frequent opportunities for new students to meet and socialize with faculty members and doctoral students in earlier cohorts
10. Discuss and develop departmental standards for qualifying exams, dissertation quality, as well as for the presentation of doctoral defenses
11. Expand training opportunities essential to succeed in academic settings: grant-writing, cover letters, job applications, teaching and research statements, IP and Tech transfer, as well as manuscript and grant reviews
12. Develop strategies for graduate students' placement in the workplace

As the next step, UGS expects the unit to engage the faculty to prioritize these twelve improvements, and develop goals and action plans organized in a span of no more than two to three years. The timetable

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should also indicate improvements that have already taken place since submission of the self-study report. The implementation timetable should be provided to UGS by **May 1, 2013**.

UGS will use Annual Program Summary (APS) meetings to work with you closely and track the unit's progress in making the improvements listed above. The APS meetings between representatives of UGS and your unit's leadership are expected to be held annually during spring semester for your program. These annual reviews will provide the necessary feedback for the program to document continuous improvement and prepare the self-study report for the next assessment cycle.

I am aware that some of the specific improvements listed above are dependent on resource allocation. Our resources are limited, and UGS is constantly engaged in finding ways to use these limited resources more effectively. It shouldn't come as a surprise that resource allocation will be increasingly driven by the unit's progress or lack of progress as evident from these cyclic reviews, APS, and annual doctoral student evaluations. UGS will have to be increasingly prudent in allocating tuition waivers, recruitment and colloquium funding, fellowships (Presidential, DYF, DEA), and critical investment funding.

I want to thank you again for your help with the review process and for all you do to improve the doctoral education in your unit.

Sincerely,

Lakshmi N. Reddi, Ph.D., P.E.
Dean, University Graduate School

Attachment

cc: Dr. L. David Shen, Graduate Program Director, Civil & Environmental Engineering
Dr. Giri Narasimhan, Associate Dean, Engineering & Computing
Dr. Amir Mirmiran, Dean, Engineering & Computing
Dr. Douglas Wartzok, Provost and Executive Vice President

**Review of the Civil and Environmental Engineering Department**

**Florida International University, Miami, USA**

**External Reviewer's Report**

***Preamble***

The Graduate College at Florida International University (FIU) invited Professor Amr Elnashai, Bill and Elaine Hall Endowed Professor and Head of the Department of Civil and Environmental Engineering at the University of Illinois, Urbana-Champaign, to review the CEE Department at FIU. He is referred to below as the Reviewer. The main purpose of the review from the viewpoint of the Graduate College is the PhD program. In detailed discussions, it was agreed not to confine the review and feedback to the PhD program in recognition of the vital inter-relationship between all activities within an academic unit. The report therefore provides feedback on all aspects of the functioning of the Civil and Environmental Engineering Department at FIU.

The material provided prior to the visit comprised a self-assessment report in 33 pages in addition to appendices and survey forms. The self-assessment report is dated September 2010. Professor Elnashai enquired with the Dean of Engineering about a 'peer group' for benchmarking and a list of 10 universities emerged. Upon examination of statistics, one university which is very substantially larger than the rest of the peer group, was dropped. After compilation of basic statistics, a site visit was arranged, where the Professor Elnashai met with a number of senior administrators, faculty and students. The itinerary of the site visit is attached. This report is the outcome from review of the self-assessment report, comparison with peers and discussions during the site visit. In final discussion with the Graduate College team, it was agreed that the most suitable structure is to breakdown the issues into Graduate Education, Research, Administration and Climate. Under each title, information is given regarding the reviewer's and the FIU community views, followed in most cases by suggestions for addressing the identified issue.

**Undergraduate and Graduate Education**

The courses in the department are robust and taught by high quality professors. The quality of enrolled students is reasonable. The professors consider that teaching 3 courses per year is affecting the available time and effort for scholarly activities, which are also a priority for FIU. The students require a wider choice in courses, particularly graduate courses that have truly advanced contents. A brief review of the curriculum has not shown clear voids, but the perception of the students must be taken into consideration. All parties have confirmed that most or all courses are attended by both undergraduates and graduates, which will inevitably lead to content that is at the level of the less knowledgeable undergraduates, thus leading to the noted frustration by graduate students. The latter concern is more emphatically held by graduate students at FIU who have taken graduate courses elsewhere. The professors consider that the quality of graduate students is too inconsistent with some being at the high end and others with very severe limitations as graduate students. A review of some of the papers published by the CEE FIU faculty indicates that some are not of international standard while other papers are of the highest possible technical rigor. The variability in both students and research output is apparent to the Reviewer. The narrowness of the course offerings seems to also be confirmed by most.

Whereas there were several less pressing issues that were gleaned by the Reviewer, the most significant concerns are as below:

i. Teaching load is higher than research universities at the top of the rankings (e.g. most of the top 10 CEE departments in the USA have a teaching commitment of 2 courses per year, in the semester system)
ii. The courses offered are very limited and are more relevant to undergraduates than graduates.
iii. The quality of students highly variable.

The above issues (a) and (b) point towards contradictory actions; reducing the teaching load will lead to a further reduction in the course offerings. It is therefore necessary to consider solutions that would address both. Examples of such action are:

i. Courses that have low enrollments should be taught once every two years; hence the professors are released to teach new and advanced courses
ii. Increase the size of the faculty by direct hiring of tenured and tenure-track professors, thus increasing the opportunities of offering more courses
iii. Start a track of Professor of the Practice to teach many of the design courses, which will both release the professors and also improve the quality of design education
iv. Hire adjunct professors on a semester basis to teach selected courses
v. Establish prestigious Teaching Fellowships that are competitively awarded to advanced PhD students. Such action will not only allow the professors to offer new courses, but will also train the advanced PhD students and prepare them for careers in academe
vi. Launch a number of online courses that the professors can record and administer on the web, with most of the work undertaken by administration staff and teaching assistants; these courses could be prepared by the professors on a voluntary basis and financial rewards be made available as extra pay

The implementation of the above measures will certainly have a positive impact on the course offering, which will in turn also help in recruitment of higher quality students.

Concerted action is needed to raise the quality of students especially in the graduate program. Graduate recruitment is complex and requires a coordinated plan of action and persistent implementation. Some measures for elevating the quality of graduate students applying to CEE at FIU and increasing the yield from offers made are listed below:

i. Advertising the graduate program through social media (e.g., facebook and others)
ii. Develop a professional recruitment video that is widely distributed and available on Youtube and the department web site
iii. Reconfiguring the MS program to offer a one-year MS degree that would appeal to a wider selection of graduate students, some of whom may stay for PhD studies once they are in the system
iv. Having a high-profile integrated recruitment event that is advertised widely and includes emphasis on the strength of the Department and the location. Even though this may be seen as a measure that helps with acceptance of offers, it also helps increase applications in subsequent years as the word spreads about the exceptionally interesting recruitment event of FIU
v. Involving the alumni of the Department in recruitment efforts, and inviting distinguished alumni to speak with those who visit campus

vi. Providing incentives to the Department in terms of return of a percentage of the tuition revenue above a threshold; such funds may be used to reward excellent teachers, top-up scholarships, and enhance the quality of the recruitment event

There are measures that address other challenges in the department, as outlined in this report that will also have a positive impact on graduate (and undergraduate) recruitment.

**Research and Scholarship**

The metrics of PhD graduation for FIU Engineering requires further consideration. In 2010, the College graduated 35 PhDs, while having a faculty of 88 professors, as report by FIU to the American Society of Engineering Education.. In the same year, there were 9 PhD graduates from Civil Engineering, while the number of faculty in the department is 16 (tenured and tenure-track). With a PhD graduation ratio versus number of faculty of about 0.5, FIU Engineering and Civil Engineering is somewhat below research-intensive universities where this ratio is often around 1.0 or higher. FIU aspires to increase its research program which is dependent on the number and quality of PhD students. One of the issues that were raised repeatedly is the lack of 'ranking' for the CEE Department. It is not clear why this is the case. The Dean and relevant FIU authorities are encouraged to seek insight into the ranking issue and address it as a matter of priority. Assuming that the measures proposed above lead to success in enhancing the number and quality of graduate students, the following recommendations are made to provide the graduate students with clear benchmarks and the best possible environment for success (at the end of each recommendation, its focus of students, faculty or both is indicated):

i. Require a research plan as early as possible in the research timeline - students
ii. Simplify the annual conference (faculty-student) form and focus on technical issues, and less on administration issues - students and faculty
iii. Provide significant teaching and global engineering opportunities for senior graduate students (teaching in the department and possibilities of spending a period of training in a university overseas) - students
iv. Substantially strength the communications between students and their faculty advisors, by having regular technical seminars, social events, lunch per semester and other mechanisms that are also reported back to the Chair, to close the communications loop - students and faculty
v. Require faculty to self-report their technical and social interaction in annual reports, and internalize the importance of mentoring and nurturing graduate students - students and faculty
vi. Organize trips for graduate students to national laboratories where they can gain an appreciation of the importance of research and advancing society's goals - students
vii. Arrange a well-advertised, high-profile career fair at FIU, focused on engineering where opportunities for graduate students in particular are available - students
viii. Reduce the teaching commitment of research-active faculty to 2 courses per year (could be coupled with increasing the teaching commitment to 4 per year for mostly-teaching faculty) - faculty
ix. Provide incentives for faculty to increase their research activity by returning part of the indirect cost to them as discretionary funds - faculty
x. Provide significant incentives for faculty to develop major research and research-teaching proposals (e.g. ERCs, STCs, GOALI, CDI, IGERT and others); provide a 'major proposal coordinator' to help the process, and matching funds above those required by the funding agency - faculty

xi. Initiate a Research Blog where all new calls for proposals are posted, and establish a support system for faculty to obtain further information and to connect them with potential interdisciplinary partners on campus and further afield - faculty
xii. Emphasize the critical importance of expanding the research portfolio by direct contact with the faculty, and circulating regularly statistics of comparisons with departments that are ahead of FIU CEE – faculty
xiii. Arrange visits for CEE faculty to NSF and other relevant funding agencies where they can be briefed on the current and future directions. This may be achieved by communicating to the funding agencies the importance of increasing the diversity in the agency's funding distribution and emphasizing the unique position of FIU as the top US Hispanic-serving institutions - faculty
xiv. Conduct a fully professional survey (e.g. run by a public policy, sociology professor who has extensive polling experience) of graduate students and faculty, with the aim of matching the students requirements with the graduate program and its faculty. Such a survey may also be used to investigate possibilities to turn research-inactive professors to a degree of research activity - faculty

**Governance and Management**

As mentioned in the opening section of this report, academic units, and indeed their colleges and campuses, are continua that cannot be assessed or managed in a discrete manner. It is therefore essential for FIU to consider leadership and management aspects of the CEE department and its relationship with the College and the FIU Campus when assessing the CEE doctoral program. The Reviewer noted features of the CEE department that may require specific assessment and action, to support the other measures recommended for the strengthening of the PhD program. Below are recommendations aimed at addressing the aforementioned features:

i. Develop a strategy for the department that is grown with the faculty, and aligned with the College and Campus strategies. This strategy then dictates actions and decisions by the department in a transparent and accountable manner
ii. Develop a coordinated global engagement strategy and implementation plan to systematically enhance the profile of CEE@FIU overseas and attract top overseas students
iii. Revive or create a CEE Alumni Association and develop data bases of contact information, profiles, financial capacity estimates and other necessary information on the alumni body
iv. Establish a departmental advancement (alumni relations, communications and fund raising) effort and launch in the short term necessary initiatives to raise the profile and connect in a meaningful and deliberate manner with the alumni
v. Launch an e-newsletter that targets the head and chairs of CEE departments in the USA, who are the voting constituency of the US News and World Report ranking system
vi. Establish a Teacher Awareness summer program for school teachers in Florida, to increase awareness of the excellence of FIU
vii. Reassess, with a view to eliminate, the process of reappointing weak P and T cases as non-tenure track faculty; the existing process is continuing to grow a divide between excellent teaching and excellent research
viii. Establish a departmental advisory committee that includes both distinguished alumni and leading CEE professors in the USA, to advise the Dean, Chair, and faculty on strategy issues, and to advocate for the program

ix. Make sure that the messages from the Campus are clear, consistent and persistent, and that the priorities are not just set, but indeed grown from the faculty, and then adhered to with little change for a number of years
x. Reassess paperwork and other administration tools in the department, college and campus and reduce as well as harmonize procedures to minimize bureaucracy
xi. Provide multiple mechanisms to hire adjunct and other faculty to take advantage of opportunities that arise in industry as well as retiring faculty from top institutions; such mechanisms may be a research professor track, and a research scientist track, as well as professor of the practice and instructor positions
xii. Provide a clear and manageable system of assessing non-traditional students, such as mature professionals and others who may be interested in pursuing graduate degrees or certificates
xiii. Establish a Curriculum Committee to continuously assess and improve content and overall offerings to the students
xiv. Establish a leadership team at the department to advise the chair and to advocate for enhancement and necessary change
xv. Assess budget and align expenditure with the strategic goals of the department; do not spend what is needed, but target spending where the best return is likely to be
xvi. Develop priority areas with the faculty and adhere to them so that each group within the department know where they stand and work within the overall strategy of the department
xvii. Improve campus management of research submission and post-award handling, and make sure that the faculty feel that their efforts are being supported not hindered
xviii. Establish and publicize a plan for hiring and number of faculty for 3-5 years, and pay meticulous attention to this plan and adherence to it

The above list is non-exhaustive and some issues may not be widely supported. The Reviewer took the decision to mention issues that came up in discussions as well as his own observations and conclusions so that the report is as comprehensive as possible.

**Concluding Remarks – Departmental Climate and Prospects of Success**

The Reviewer would like first to thank the leadership, faculty, and students of FIU who were candid in their remarks, courteous to their organization and to their colleagues and collaborative in their approach. I would have very much liked to talk with the staff as well, since they are truly the unsung heroes behind the success of academic units. The general climate in the department is positive, and there is a sense of optimism mixed with concern for the wellbeing of the enterprise, which is the way things should be. We are witnessing major realignment of resources in the country and universities, especially state schools, have to re-evaluate their future scope of operation in view of ever-decreasing State funding. Below are highlights from the meeting the Reviewer had with the students, starting with features of the CEE department that they appreciate and others that they feel could be improved. Several of the issues mentioned below were either mentioned before or were the underlying reason for recommendations listed above.

The students are concerned about bureaucracy of ordering supplies, the weakness of the geotechnical activity, their low pay compared to University of Miami students, the variety of courses offered, the relatively low level of the content of graduate courses, imbalance between water and environment research, weakness of the design classes, constraints in taking independent studies, inflexibility of curriculum, being far from the main campus with no student social space and activities, and in general excessive forms and paperwork.

The students were satisfied and praised liberally their faculty and how much they care, the accessibility of mentors, passion of the faculty about their research, laboratory infrastructure, the location of FIU, the weather, the multicultural nature of FIU, wind engineering, bridges and transportation facilities and faculty, computational facilities, international mix of students and faculty, laboratory and administration staff helpfulness, the new chair of CEE and dean of Engineering, and the seminar series.

The Reviewer's overall assessment is that the CEE department at FIU is poised for progress, and has great opportunities to rise substantially in the USA and internationally. With a new, energetic and visionary department Chair, and an world-class Dean, this Department should do very well in the next 5-10 years, provided that immediate steps are taken to address some of the issues identified above, and others that the faculty and students may add to the observations of the Reviewer.

July 29, 2013

Dear Dean Reddi

Thank you for your letter dated March 11, 2013 and sharing with us your feedback that was based on doctoral student survey, and external assessment of CEE program conducted by Amr S. Elnashai, in 2011. I also apologize in delay in responding to you. Department has made a significant improvement in its graduate program, especially at the Doctoral level. Following table summarizes the 12 points of improvement identified in your letter dated March 11, 2013 and our responses and plan of action.

**CEE Graduate Program Enhancement Schedule**

| Priority 1 | Description of improvement identified by UGS | Goal | Action Plan | Period of Development & Implementation | Progress Status |
|---|---|---|---|---|---|
| 1. | **Implement a strategic plan for the recruitment of highly qualified applicants in all areas of the doctoral program (Item 1 of UGS letter)** | Enhancement of graduate education and research output and quality | Marketing person is hired that is helping in this regard. Further, several faculties are making personal visits to various universities for recruiting purposes. These efforts have resulted in recruiting quality graduate students from such universities as Georgia Inst. Of technology and several other U.S. institutions. | 01/2013 – 08/2015 | Ongoing process |
| 2. | **Expand course offerings and separate undergraduate and graduate level courses (Item 3 of the UGS letter)** | Appropriate delivery of body of knowledge at undergraduate and graduate levels | Since 2011, the faculties have eliminated several courses that were cross listed and have offered new courses to undergraduate students only. | 01/2012 – 12/2012 | completed |
| 3. | **Improve and diversify the mix of internal and external support for doctoral students, with emphasis on increasing the number of RAs** | Increase extramural funding by faculty members that includes RAs | Since 2011 department has implemented several policies- First is offering TA to Ph.D. students | 01/2012 – Present | Policy is in place |

| | | | | | |
|---|---|---|---|---|---|
| | **funded by faculty grants and contracts (Item 4 of UGS letter)** | | only. Second, the students are supported for first year, using 50% funds from TA and 50% RA. We are also being flexible in implementing this policy. We still have several internal issues preventing complete implementation of this policy | | |
| 4. | **Place greater emphasis on community-building activities in the program, with more frequent opportunities for new students to meet and socialize with faculty members and doctoral students in earlier cohorts (Item 9 of UGS letter)** | Establish a good social environment to welcome new students and integrate them into the | We started to have a social program with graduate students in the beginning of the semester, since 2012 and this effort will continue. | 08/2012 – Present | Continuous process |
| 5. | **Maintain a consistent level of student quality and research output (Item 2 of UGS letter)** | Seek high level of student performance | Hiring new faculties and more emphasis on nationally visible research initiatives has resulted in enhancement of research productivity. This is however a continuous process and being also emphasized by enforcement of admission standards (GPAC, GPD and Faculty) and performance via student presentations and publications (Faculty) | 8/2011- Present | Continuous process |
| ***Priority 2*** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 6. | **Improve communication to students at all stages of the program starting with a well-organized orientation and detailed graduate student manual (Item 5 of UGS letter)** | Effective communication with all students. Maintain a graduate student manual. | The content of the first meeting with graduate students are scheduled to be improved and plans call for improvement in communicating the expectation and consequences to newly arrived graduate students and make the communication process a continuous one. In addition, the student manual will be revised to make it more comprehensive and user friendly. A new Graduate Program Committee (GPAC) has formed which should help the process. | 09/2013 – 12/2014 | Start in Fall 2013 |
| 7. | **Implement mentoring training in the department for graduate faculty (Item 8 of UGS letter)** | Provide graduate faculty with approaches to best guide graduate students | This item will be part agenda for faculty retreat to be held on August 2013 | 09/2013 – 12/15 | Start in Fall 2013 |
| 8. | **Expand teaching and research opportunities for graduate students (Item 7 of UGS letter)** | Provide opportunities to graduate students to have teaching and research experiences throughout their degree programs | Have all students serving as TAs or instructors, at least one term, during their degree programs. Require all students attending two quality-teaching workshops. | 01/2014 – 12/2016 | Start in Spring 2014 |
| 9. | **Discuss and develop departmental standards for qualifying exams, dissertation** | Continued enhancement of the quality of graduate | Hold a series of faculty meetings to discuss. GPAC & GPD will | 01/2014 – 12/2016 | Start in Spring 2014 |

| | | | | | |
|---|---|---|---|---|---|
| | **quality, as well as for the presentation of doctoral defenses (Item 10 of UGS letter)** | performance and research output | develop plan for faculty and administrative review. This item is part of agenda for Fall 2013 faculty retreat | | |
| 10. | **Improve consistency of qualifying exams (Item 6 of UGS letter)** | Within the scope of Item 9 | Within the scope of Item 9 | Within the scope of Item 9 | Within the scope of Item 9 |
| 11. | **Expand training opportunities essential to succeed in academic settings: grant-writing, cover letters, job applications, teaching and research statements, IP and Tech transfer, as well as manuscript and grant reviews (Item 11 of UGS letter)** | Enhance the preparation of students to successfully compete for job opportunities and pursue long-life professional lives | This item will be discussed during Fall 2013 faculty retreat | 08/14 - 07/17 | Start in Fall 2014 |
| 12. | **Develop strategies for graduate students' placement in the workplace (Item 12 of UGS letter)** | Assist students in joining the workplace | Identify FIU programs (e.g., alumni, engagement, etc) and/or develop in-unit programs | 08/14 – 07/17 | Start in Fall 2014 |

I will communicate with you, our progress, as we move forward and will appreciate any feedback that you might have. We are excited to be working with you as we enhance the quality of our graduate program, especially at the Doctoral level.

Sincerely
Atorod Azizinamini, Ph.D., P.E.
Professor and Chair
Civil and Environmental Engineering Department

Cc:
Dr. Ton-Lo Wang, Associate Chair, Undergraduate studies
Dr. Hector Fuentes, Associate Chair- Graduate program

**Recommendations for CEE Graduate Program Enhancement**

The following recommendations for graduate program enhancement were developed after a series of open faculty discussions. The recommendations include a general need statement for each discussed issue, followed by an action item, including where appropriate specific recommendations for the faculty to vote on motions that involve specific policy change. After the faculty vote, further refinements to the draft proposed policy change will be made, as needed.

**A. Doctoral Admissions and Program of Study**

Formal policy for the admission requirements for non-BSCE students into the CEE Ph.D. program, as well as, course requirements are needed. Research in CEE is continuing to require interdisciplinary work as current engineering problems and challenges are often multi-faceted in scope. In order for the department to be competitive with other universities, including other state universities, departmental policies must encourage growth in interdisciplinary research and education. Recruitment of doctoral candidates with specialized but relevant skill and knowledge sets beyond traditional CEE curriculum is needed for solicitation and successful completion of research that contains interdisciplinary work as well as new frontier research.

1. Ph.D. Admissions

**The Faculty is recommended to vote on the following motion.**

<u>Theme (not official catalog language, GPAC will develop language and courses, any exceptions to (a) and (b) will be brought by the faculty to GPAC)</u>

*For students with BS degrees in a field other than CEE, two tiers of undergraduate course pre-requisites for admission into the Ph.D. program are to be established by the CEE faculty. The first tier (Tier 1) will include minimum requirements for basic math and science and the second tier (Tier 2) will include minimum requirements of upper level undergraduate courses pertaining specifically to the CEE discipline, that is the focus of the study, including Structures, Transportation, Geotechnical, Construction, Water Resources, and Environmental.*

*a. Main body of applicants cannot be admitted if deficient in Tier 1 requirements.*

*b. Main body of applicants can be admitted if deficient in Tier 2 pre-requisites but will be required to satisfy the upper tier as a requirement for graduation.*

*c. Faculty with DAS can petition to bypass stipulation (a) for admission of exceptional student recruits with approval of GPAC.*

*d. BSCE students can be admitted directly into the Ph.D. program, only if they are fully supported by faculty with DAS.*

**Vote: Accept theme of (a), (b), and (d) (table (c)); official language further developed by GPAC, GPAC will further develop Tier definitions**

2. Ph.D. Course Requirements

In order for our doctoral students to be competitive in academia and industry, they must become experts in their area of research. Their program of study should encompass education and training relevant to their area of research

**The Faculty is recommended to vote on the following motion.**

*Set course requirements for the Ph.D. program of study should be eliminated and only a minimum number of required hours within the department should be stated, leaving the selection of courses to the combined agreement of the Major-Advisor, Committee, and Student. Remove from catalog p.495. "All Ph.D. students must satisfy the core course requirements defined for the MS degree programs. In addition,"*

Vote: Agree with removal of core course requirements in catalog for PhD

**B. Doctoral Advising**

Advising CEE Ph.D. students by Construction Management professors was approved several years ago by the CEE department. However, further clarification is needed on whether a Construction Management professor can be the sole chair of a CEE Ph.D. dissertation committee. Furthermore, not tenured and tenured earning positions within FIU such as the Professor of Practice position have restrictions on their role in doctoral advising. In both of these cases, it was found that there are FIU graduate school policies and these policies must be enforced. **There is no need for a voting on this issue.**

From Graduate Faculty Policies and Procedures…
"To be eligible to serve on thesis or dissertation committees an individual must be a member of the Graduate Faculty."
"To be eligible to serve as the chair of a dissertation committee, an individual must be a tenured or tenure-earning faculty member, be a member of the Graduate Faculty, and hold Dissertation Advisor Status"
"Graduate Faculty members holding Dissertation Advisor Status who are not tenured or tenure-earning faculty members may serve as co-chair of a dissertation committee."

From FIU Official University Policy…
"A faculty member with Dissertation Advisor Status who is not tenured or tenure-earning cannot be sole chair of a dissertation committee but may serve as co-chair."

CEE faculty maintains responsibility for the quality of dissertations for conferral of the degree.
1. OHL Faculty Advising
CEE faculty holding DAS status must be retained as co-Major Advisor for doctoral students in Construction Management, in accordance with university policies. Advising of doctoral students by CEE co-Major Advisor must be upheld and policies for dissertation preparation and defense enacted by CEE must be upheld for all doctoral students. GPAC will invite OHL professors for discussions of their concerns and experience with the CEE Ph.D. advising, lessons learned, and any steps to improve the process.
2. Professor of Practice Advising
FIU Official University Policy is strict on the ability of the Professors of Practice to act as Major Advisors. Professors of Practice are encouraged to obtain the DAS status. Once they obtain the DAS, they can act as Co-Major Advisors and work in collaboration with eligible faculty members to serve as surrogate Major Advisors. The department will encourage qualified Professor of Practice research and application for DAS status and ensure understanding of the role of the hired position.

Motion: To form committee to investigate the feasibility of university policy change with regard to Major Advisor status for Professors of Practice (Dr. Lau volunteering to lead the group)

**C. Master's Degree Course Requirement**

Specifying specific core classes for master's degree students with the thesis option should be eliminated since this specification will affect the student's ability to acquire in-depth knowledge in their areas of research. .

**The Faculty is recommended to vote on the following motion.**

*"Remove the core course specification from the Catalog and specify instead a minimum number of credits to be taken in the CEE department for master's students with the thesis option."*

**D. Qualifying Exam**

Based on the discussion, the qualifying exam procedure, developed last year will be reviewed by GPAC to determine if it needs any modifications. Faculty agreed that we need to treat the

Ph.D. students with respect and procedural protocol that might be perceived as non-necessary should be eliminated. If a faculty has a concern with the procedure, they can inform GPAC of the concern and its implications for consideration by GPAC, as they review the procedure this policy. **There is no need for a voting on this issue.**

## Summary of April 7, 2015 Ad-hoc faculty meeting, 2:00 to 4:00 p.m.

## CEE Department

## Review and Enhancement of the CEE Graduate Program

**Faculty Participated in the April 7 Meeting:** Mohammad Hadi, Kingsley Lau, Ton-Lon Wang, Omar Abdul-Aziz, Arindam Chowdhury, Hesham Ali, Berrin Tansel, Walter Tang, S.J. Lee, Priyanka Alluri, Albert Gan, Ioanis Zisis, David Garber, Hector Fuentes, Atorod Azizinamini

**Dear All**

As promised, following please find brief summary of the discussions.

### Meeting objectives:

Following paragraphs are taken from the slides that I prepared to start the discussion

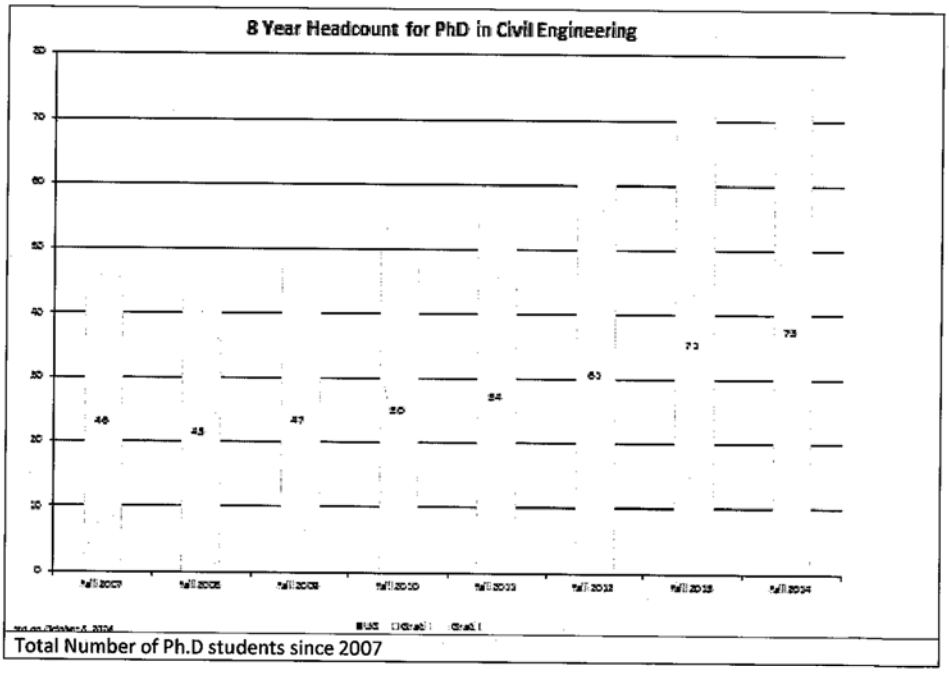
- The main objective of the meeting is to develop recommendations for faculty to vote on during regular faculty meeting.
- Summary of the meeting will be presented as majority and minority viewpoints, without voting.
- The policy to be adopted, if any changes are required, will be by the vote of faculty, during the regular faculty meeting.
- For April 7 meeting discussion will concentrate on Ph.D. program
- One meeting certainly does not provide enough time to discuss and develop recommendations, covering all aspects of the graduate program.
- An ad-hoc group will meet over summer period, to prepare a set of recommendations for Fall retreat (Atorod will moderate these meetings).

### Driving force

- Time has changed and we are seeing more multi-disciplinary type research.
- We need to accommodate different needs, under different framework

## Brief Review of Current Status of the Ph.D. Program

As shown by the graph below, the total number of our Ph.D. students has steadily increased since 2011. At the same time we have been very efficient in using our resources and still have some additional capacity to support more Ph.D. students.




Total Number of Ph.D students since 2007

## Brief Review of Results of Survey

In order to obtain Ph.D. student's viewpoint, about our program, a brief survey was conducted in early April 2015. This is not a comprehensive survey, but provides a preliminary feedback from our current Ph.D. students.

Following is summary of the questions asked in the survey and Ph.D. students' responses.

FIU

Civil and Environmental Engineering
Doctoral Program Student Survey
Spring 2015

RESULTS

***** Participation: 10 Doctoral Students *****

**Admission Process and Communication**

1. How did you decide on attending the Ph.D. program at FIU?

- Research prospects in program : 5 students
- Strong program in Transportation : 2 students
- Searching the Internet
- Funding Opportunity
- An alumni friends referral
- Expert faculty in area of interest

2. Were you satisfied with the various steps of the admission process? Please explain.

- Yes : 8 students
- Difficulties in communication and got misleading information : 2 students
- Admissions took a long time

3. Do you have any suggestions to improve any of the steps of the admission process? If so, please describe them below.

- The University needs more discipline.
- Better communication needed within the department
- The admission/funding process is not clearly given on Departmental Website. Providing further information on how to become and apply for a TA on the website would be helpful.
- The deadline for international student applications is not clearly given on the website.
- Flexible rules would be welcome.
- Process could be faster.
- No suggestions : 4 students

4. Did you attend the UGS orientation program? If you did not attend it, why?

- Yes: 10 students

If you did attend, is there anything that you expected to have been addressed?

- An explanation about submitting D forms for PhD students would be helpful
- All issues regarding education and life at FIU
- No comment: 7 students

5. Did you attend the CEE orientation program? If you did not attend it, why?

- Yes : 8 students
- No, due to health issues
- No, due to visa issues

If you did attend, is there anything that you expected to have been addressed?

- Information regarding mandatory course requirements in the program need to be stressed : 2 students
- The details of the PhD program including requirements, and constraints,
- Information regarding best time to submit D forms, additional scholarship/internship opportunities, and how a student can get involved in local civil engineering industry.

**Ph.D. Requirements**

6. In your view what improvement could be incorporated in the Ph.D. degree program policies, procedures and other applicable requirements?

- The course work needs to be revised
- All procedures and deadlines regarding D forms for PhD students need clarification
- The qualifier exam questions should not be the same as the Midterm and Final exam questions.
- Some math courses can replace subject courses by considering them as core courses, with approval from ones advisor,
- Providing a scientific writing course or workshop.
- Revision of the qualifying exam to include research challenges
- Annual evaluation should not be mandatory. The required time between the D3 form submission and graduation should be shortened
- Course requirements need to be more flexible. It should be based on ones research topics
- The qualifier should also test the research ability of students
- The Minimum GRE requirement is not clear, and needs to be updated
- Applicant research experiences should be considered.

7. Did you take the Qualifying Exam this last Friday, March 20, 2015? If you did, do you have any suggestions to improve the exam organization and environment?

- Yes : 3 students
- No : 7 students

Remarks
- It was not fair. Some students took 4 courses while others took 8 courses.
- I liked it because it was more organized than previous qualifying exams.
- The 8 hour exam was too long.
- I did not like the environment that much.

8. Are you satisfied with the level of content and quality of the courses that you have completed? Please explain.

- Yes : 9

Remarks
- There are opportunities to improve the type of courses offered by including more demanding/interesting topics in civil engineering. My observation is that the same courses are offered in a cyclic pattern without introducing new courses, with some exceptions. In some cases, the course content needs to be updated and grad courses need to be upgraded in terms of contents in comparison with the corresponding undergraduate course.
- Some courses were very good and helped build my knowledge but a few courses were not useful.
- Courses were useful
- No explanation : 6 students

9. How many years do you expect to take to complete your Ph.D. requirements and graduate?

- 2 years : 2 students
- 3 -4 years : 4 students
- 4 - 5 years : 4 students

**Career Development**

10. Are you pleased with the departmental opportunities that FIU offers you to present your research work and improve your writing and oral communication skills (e.g., graduate research days, attendance to conferences, graduate seminar, etc.)? Please explain.

- Yes : 9

Remarks
- The CEE research day and weekly graduate seminar is helpful. **However,** Department can initiate some travel funds for high achieving students to present their research and also represent FIU CEE in conferences within Florida
- These sessions give us self-confidence and improve our oral communication **but** the only problem I faced at this department is that we have very rare Americans,

who can speak well.
- The graduate seminar is helpful in developing communication skills
- Conference attendance is helpful
- It would be better if we have more opportunity to attend the lectures of guest speakers
- Graduate seminar could improve the oral and communication skills and I hope there is some writing workshops for technical reports and thesis.

- No 1,

Remarks
- We need more opportunities to improve our writing skills

11. Are you satisfied with your access to your advisor and his/her guidance?

- Yes : 10 students

Remarks:
- My advisor is helpful and knowledgeable
- I would be happy if my advisor had more time for me, but successful people are always busy

12. Other comments. Feel free to elaborate on any other items that you believe are important to ensuring that you get a top level education while pursuing your Ph.D. degree program at FIU.

- Offering new and interesting courses : 2 students
- Encouraging students to publish
- Arranging a job fair for CEE doctoral students
- Committee members should ask questions after presentation of PhD proposal or dissertation defense.
- No comment : 7 students

Results of Survey

## Brief Summary of Discussions

Meeting concentrated on discussing the Ph.D. requirements and what can be done to accommodate different needs, be more flexible and change by time.

A table was prepared that provided summary of M.S. and Ph.D. requirements for FIU, University of Central Florida, Georgia Institute of Technology and Stanford.

Following is summary of part of the information shared with faculty.

| Institution | Name of Department | Graduate Program Rank | PhD Student : Faculty Ratio | Graduate Programs Offered | PhD Program Course Requirements | PhD Program Exam Requirements |
|---|---|---|---|---|---|---|
| **FIU** | Civil and Environmental Engineering | 237 | 2.6 : 1 | 1-MS in Civil Engineering (non-thesis and Thesis), 2-MS in Environmental Engineering (non-thesis and Thesis), 3-PhD in Civil Engineering | The Doctorate consists of at least 90 semester credit hours beyond the bachelor's degree, 54 hours of course work and 24 hours dissertation, or at least 60 semester credit hours beyond the MS degree, 24 hours of course work and 24 hours dissertation. | 1-Qualifying Examination (8 problems-taken at most twice), 2-Proposal Defense Examination (Research proposal written & oral), 3-Dissertation Defense Examination |
| **UCF** | Civil, Environmental and Construction Engineering | 90 - Civil Engineering: 64-Environmental Engineering | 4.1 : 1 | 1-MS in Engineering (Thesis and Non-Thesis) 2-MSCE (Thesis and Non-Thesis), 3-MSENVE(Thesis and Non-Thesis) , 4-MSES (Thesis and Non-Thesis),5-MS Structures and Geotechnical Engineering (Thesis and Non-Thesis) 6-MS Transportation Sys. Engineering (Thesis and Non-Thesis), 7-MS Water Resources Engineering (Thesis and Non-Thesis), 8-PhD in Civil Engineering | Thirty of the 72 credit hours can be met with either a nonthesis or thesis MS in Civil Engineering. This leaves 42 credit hours of which 18 credit hours must be Dissertation Research and a minimum of 15 credit hours must be formal course work. A maximum of 9 credit hours of Doctoral Research hours can be used in the doctoral program, which could be replaced by additional formal course work | 1-Qualifying Examination (taken at most twice), 2-Candidacy Examination (Research proposal written & oral), 3-Dissertation Defense Examination |
| **Georgia Tech** | Civil and Environmental Engineering | 5 | 4.2 : 1 | 1-MS in Civil Engineering, 2-MS in Environmental Engineering, 3-MS in Engineering, Science and Mechanics, 4-MS in Engineering, 5-PhD in Civil Engineering | The PhD is primarily a research degree. The specific courses(i.e., Program of Study) to be taken are established for each student by their faculty advisory committee. Doctoral students generally take 50 to 60 credit hours of course work beyond the Bachelor's degree. All doctoral students must also complete a Minor Field of Study, consisting of at least 9 credit hours outside of CEE.undergraduate engineering degree | 1-Comprehensive Examination (written and oral - can be taken twice), 2-Doctoral Dissertation Examination |
| **UT Austin** | Civil, Architectural and Environmental | 3 (tied with Stanford ) | 5.1 : 1 | 1-MS in Engineering with Thesis, 2-MS in Engineering with Report, 3-MS in Engineering with | Although advanced course work is an integral part of the doctoral candidate's program, no specific number of courses | 1-Qualifying Examination (taken at end of 1st semester of doctoral courses), 2-English |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Engineering | | | only coursework, 4-MS in Architectural Engineering, 5-MS in Civil Engineering, 6-MS in Environmental and Water Resources Engineering, 7- PhD in Civil Engineering | is set for attainment of the degree. The real basis for developing an acceptable program is to demonstrate mastery of a selected field and the ability to conduct independent research in the field. | Proficiency Exam, 3-Mastery of the Major Examination (2nd year of doctoral courses), 4-Dissertation Defense Examination |

Table summarizing graduate program requirements for FIU, UCF. GT and Stanford

Additionally, sections of the latest graduate catalog pertaining to Ph.D. requirement were reviewed.

After general review of Ph.D. acceptance requirements and review of current requirements as stated in the graduate catelog, the discussion concentrated on two major issues.

1- Course work requirements for Ph.D. degree
2- B.S. in CE as a criterion for accepting students into Ph.D. program

Following are brief summary of the different viewpoints related to each of the above issues

## Course Work Requirements for Ph.D. Degree

Following are sections of the graduate program related to Ph.D. course requirements

**Doctor of Philosophy in Civil Engineering**

**Minimum Admission Requirements**

The minimum requirements for admission to the doctoral program in civil engineering are:
1. Applicants having a Master's degree in Civil Engineering or Environmental Engineering from a U.S. institution must satisfy the following requirements for admission to the doctoral program:
a. GPA of at least 3.3/4.0 in the master's program
b. Official GRE scores
c. Three letters of recommendation or recommendation forms provided by the department
d. A statement of objectives in which, in addition to other information, the intended research area must be clearly stated. (see identification of Research Area)
e. A resume containing contact information, education and employment history, practical and research experiences (including publications), skills and other pertinent information

Credentials of all other applicants including those with foreign degrees and those with B.S. degrees in other disciplines will be examined by the Graduate Program Advisory Committee on a case by case basis. Additional credentials that will be considered include, but are not limited to, work experience, awards and recognitions, publications and presentations, and other professional experience.
3. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.5 overall on the IELTS is required.
4. In addition to the departmental requirements, all students must satisfy the University's Admission and Graduate Policies and Procedures.

**Course Requirement**

The program will consist of at least 90 semester credit hours beyond the baccalaureate degree, 54 hours of which are course work and 24 hours dissertation, or at least 60 semester credit hours beyond the M.S. degree, 24 hours of which are course work and 24 hours dissertation. The remainder of the required minimum credit hours may be taken as either course work or dissertation or a combination

| |
|---|
| thereof as approved by the student's advisor. Applicants who have a Master's degree in Civil and Environmental Engineering or a closely related field from an accredited institution are given a maximum of 30 transferred semester credit hours. In addition to the above requirements, the selection of courses must meet the following requirements for credits beyond the Master's degree: 1. Minimum three credits in Mathematics or Statistics 2. Minimum 18 core credits in the selected major area in Civil and Environmental Engineering 3. Any deviation from requirements 1 and 2 above must be justified in writing and approved by the CCE Graduate Program Director. 4. Complete CGN 6939. |
| **Core Courses**<br>**All Ph.D. students must satisfy the core course requirements defined for the MS degree programs.** In addition, all doctoral students are required to take the Research Methods for Civil Engineers course before or during the first semester of dissertation credits. A student may take additional courses in the specialty as well as other areas as approved by the major advisor and the dissertation committee, provided all the core courses have been completed previously during the MS program or will be completed in the Ph.D. program. Students are also required to register for the 0-credit Graduate Seminar (CGN 6939) at least once and are encouraged to take it each Fall and Spring semesters. |
| Brief summary of some of the requirements for Ph.D. degree |

Every faculty present, shared their opinion on course work requirement, specifically the requirement that states, **"All Ph.D. students must satisfy the core course requirements defined for the MS degree programs"**.

## Majority viewpoint

- Almost all faculties present stated that we should eliminate the core course requirement from Ph.D. course requirements.
- Leave the selection of the courses that Ph.D. student should take, to major advisor, student and the Ph.D. advisory committee.
- Very early on, the Ph.D. advisory committee should form, meet and establish the course work requirement.
- The only course requirements should be the number of credit hours, as currently required by the Graduate school
- No mandatory course requirement, such as math or core course, should be specified
- Students should be allowed to take courses from outside the department from other disciplines and majors in the university

## Minority Viewpoint

- It was difficult to recognize any view point that opposed the opinion expressed by majority viewpoint.
- Opinions were expressed, implying, as demanding some level of requirements, since we are providing students with Ph.D. in Civil and Environmental Engineering. Therefore there has to be some differences in terms of course work requirements
- We need to compare our requirements against our peer institutions. Stanford and GT are not our peer institutions

## B.S. in CE as a criterion for accepting students into Ph.D. students

The response to this question demonstrated more differences of opinion, among the faculty present, than the first question.

### Majority Viewpoint

- Allow students with degrees, other than B.S. in CE, to be accepted in the CEE Ph.D. program
- We have traditionally done this for years. In particular it was pointed out that the graduate catalog allow this by providing the following statement

> 2. Credentials of all other applicants including those with foreign degrees and those ***with B.S. degrees in other disciplines*** will be examined by the Graduate Program Advisory Committee on ***a case by case basis.***

- Those with advanced degrees in CEE and having B.S. in other disciplines would be eligible to take P.E. Therefore, there is no need to require a B.S. in CE before entering graduate degree program in CEE.

### Minority Viewpoint

- One of the reasons for requiring a Ph.D. candidate to have a B.S. in Civil Engineering is related to the requirement for obtaining P.E. license. There was a debate on whether this statement is true or not and it was decided to check and validate this statement.
- There should be a difference between someone getting a Ph.D. in Civil Engineering and those getting Ph.D. in other areas
- A table was provided to faculty that provided list of deficiency courses that one have to take before getting admitted to Ph.D. program, with emphasis on Structure.

## Summary

In summary while almost everyone agreed on eliminating the core course requirement for Ph.D. students, there were differences of opinion on B.S. requirements.

## Next Step

Chair will send a doodle to establish the date and time for the next meeting. Over the summer months, several meetings will be held to develop set of recommendations to be presented to the faculty during Fall retreat for voting.

CEE Graduate Program Enhancement
August 12, 2015
Meeting Minutes

**Introduction**

- University is looking to expand the graduate program (center for graduate program), our discussion is timely
- EE has already begun refinement of their graduate program
- Develop recommendations for only 2 or 3 main issues to present for vote at the faculty meeting
- Chair of Biomedical engineering perspective (at 9:30am)

**Discussion on Meeting**

- Conduct of meeting: select important points and develop these for vote at main faculty meeting
- New topics recommended for addressing:
    - Full utilization of TA in Department (using college resources to advantage of department) → New Item
    - Formula for fair distribution of graduate students → New Item
- Process for Evaluation
    - What is existing situation?
    - Why is it a problem?
    - How can we fix it?
- Topics to Focus on This Meeting
    - Admission requirements for PhD (pre-requisites, BS requirements, etc.)
    - DAS

**Biomedical Engineering Perspective on Admission without a BME Background**

Discussion:

- Divide applicants into 3 different categories based on background (Engineering, Science, Other); each category has different requirements
- Different number (and type) of remedial courses are required upon arrival of student
- If low GPA, require good performance in three BME graduate courses (as a non-degree seeking student) prior to admission
- This process is only undertaken when there is a faculty mentor desiring the student
- This is a guide, not requirements
- Students may take remedial courses simultaneously with research and BME courses
- Students are fully admitted into the program and graduation is conditional on passing the remedial courses and maintaining their GPA
- Students need to pay for remedial courses themselves

    - Way around this: BME allows students to prove passing the remedial courses by auditing courses
- Remedial courses are all taken as pass/fail; these courses do not count for their graduate transcript
- GPD works with advisor and student to develop the plan and expectations for remedial coursework
- Remedial courses taken outside of FIU are accepted (accept from other universities and community colleges)
- International admission requires an engineering background (i.e. this process is only undertaken for US students)
- No professional licensing program in BME so this is not addressed
- Department provides full support for PhD students (27 students in the PhD program for 10 faculty members; about 3 students per advisor)

Points for Faculty Meeting:

- BME currently admits students with diverse backgrounds
- Students are broken into six categories (based on background and grades), deficiency courses are dependent on the category
- Audit and pass/fail credits from FIU and other US universities count to satisfy deficiency courses

**Core Course Requirements for PhD Program**

Discussion:

- Graduate program should be accommodating the research program
- Core course requirement should be eliminated
    - Advisor has the final say on the courses that the student takes
    - There should be a minimum requirement
- There should be flexibility enough for as many as needed to be taken outside of the department
    - PhD program is more geared towards research/academia and not professional, therefore the core courses are not as essential
    - MS and BS should keep their requirements as they are professional focused degrees
- For PhD out of 8 courses, minimum 5 courses in department and field, 3 or 4 courses can be taken outside the department
- "Raise the Bar" program from ASCE → programs are not preparing engineers ready to compete globally
- Develop language to improve the official catalog (being careful of the implications of wording) (**ACTION ITEMS**)

Points for Faculty Meeting:

- **Goal:** To eliminate core course requirements for PhD, allowing for more flexibility
- **Accomplished by:**
    - Only specify the percentage in department course requirements past both BS and MS (50% in department courses)
    - All courses should be chosen with guidance of Advisor and Committee
- **For Vote**:
    -
- What should be modified in Course Requirements and Core Courses
-
- For Vote:
- Remove on p.495 - "All PhD students must satisfy the core course requirements defined for the MS degree programs. In addition,"
- Add on p. 495 "PhD students are required to take 24 credits beyond the MS level. Up to 9 (of 24 hours) may be taken outside the department. Selection of courses outside the department must be decided on my advisor and committee."
-
- On p. 491, 492 - Remove the lists of courses in the "Areas of Technical Specialization" section
- Add more general language: "Complete 15 credit hours within the desired area of technical specialization."

**Qualifying Exam**

Discussion:

- The Recommended Protocols were developed for ABET certifications
- Procedures were developed to help with the proctoring of the exam (this should be kept in mind with any modifications made to the procedures)
- Computers should not be allowed for the examination
- GPAC should review the document with test protocol and procedure to administer **(ACTION ITEM)**

Points for Faculty Meeting:

- Qualifying Exam Procedure is fine as developed by GPAC and previously approved by faculty
- No items for vote

**DAS Status for OHL Faculty**

Discussion:

- PhD students in OHL currently require a co-major advisor from CEE

- Upper administration is pushing to accommodate them
- OHL does not have a PhD degree, so they require CEE PhD
- CEE should be the house for construction management
- As co-major advisor, CEE faculty do not have ability to do anything
    - Written proposal not sent in advance
    - Dissertation not given beforehand
    - Major advisor answers questions and protects student
- Process/procedure needs to be developed for OHL PhD students (**ACTION ITEM**)
- Recommendation: in person, 1-on-1 oral examination by the co-major advisor in CEE, two-weeks before final defense; PhD student must pass that in order for the final defense to occur
- CEE is penalized for poor performance by OHL PhD students (example was dissertation fellowship for OHL counting against CEE)
- OHL should come to GPAC and GPAC should help to assign CEE as co-major advisor
- Meeting between OHL faculty and GPAC (and other potential co-major advisors)to hear their concerns (**ACTION ITEM**)
- CEE should make an effort to hire construction faculty
- OHL is developing a program in concrete materials (sponsored by Titan America)

Points for Faculty Meeting:

- Current situation:
    - OHL does not have a PhD program so CEE allows OHL students to gain PhD in CEE
    - OHL PhD students need to have a co-major advisor from the CEE department
- GPAC will set up a meeting with construction management to hear their comments on the current arrangement between OHL and CEE
- No items for vote

**DAS Status for Professor of Practice**

Discussion:

- The purpose of Professor of Practice is both research and teaching
- Current policy:
    - Only full-time staff (with a primary appointment and tenure or tenure-track) with DAS status can be sole chair of a dissertation committee
    - Non-tenure or non-tenure earning faculty, if their “primary appointment” is at FIU, is eligible for DAS status
    - Non-tenure earning faculty can serve as co-major advisor if they have DAS status
- Comments of Dr. Ali were read → professor of practice should also be included in decision making processes and discussions

- Department will support Professor of Practice research and application for DAS status
- Professors of Practice are not equal with tenure-earning professor lines; the difference in roles, responsibilities, and rights needs to be better defined; develop definition of Professor of Practice (**ACTION ITEM**)

Points for Faculty Meeting:

- The role of the Professors of Practice is undefined (officially), but are evaluated based on both research and teaching
- Professors of Practice can apply for DAS status and (once granted) become co-major advisor
- Professors of Practice will be supported by the department
- No item for votes

**Admitting Non-CEE Backgrounds into PhD in CEE**

Discussion:

- **Existing situation (p. 495, point 2):** "Credentials of all other applicants including those with foreign degrees and those with B.S. degrees in other disciplines will be examined by the Graduate Program Advisory Committee on a case by case basis."
- Requirements should be specialty specific:
    - Transportation has the best arguments for relaxed undergraduate requirements
    - In structural engineering (for example), all graduate courses require prerequisites
- PhD designates a focused degree (which may not cover the breadth of traditional CEE), should allow for flexibility in admissions
    - Example: NDT group at University of Illinois; students may come out with PhD in CEE and have primarily a background in EE or ME
- Department could benefit from having diversity in backgrounds
- BS in CEE from ABET university is required for PE license
    - Ensure that students coming in without a BS in CEE know that they will not be able to get their PE
- Deficiency courses:
    - Similar to BME Admissions Guide
    - Based on specialty and student background
- Difference between meeting the demands of research and admitting people into the CEE PhD program
    - Research needs could be met by collaborating with outside departments
        - e.g. student can get an MS in Electric Engineering while working on a CEE funded project
    - PhD in CEE still has engineering attached

- Certain BS degrees that are natural for CEE overlap
    - Mechanical Engineering (Wind), Chemical Engineering (Environmental), Engineering Physics, etc.
- Deficiency Courses:
    - First Tier: agreed that basic courses are required for CEE (e.g. calculus, physics, chemistry, etc.)
        - Basic math and science courses should be required (this is engineering)
        - Fundamental engineering courses
    - Second Tier: discipline specific
        - Option 1: discussion between advisor, student, and GPAC
        - **Option 2**: each discipline will develop their own deficiency course requirements (these course lists have already been developed by each subgroup), leave language in that exceptional cases can bypass some of these courses with approval of GPAC
        - Option 3: require the prerequisites for graduate courses as the deficiency courses
        - (**University of South Florida** has the best example of deficiency definitions)
    - Remember, the students are not even fully admitted until after the deficiencies are covered (only for the engineering level, Tier 1); for Tier 2, students can be admitted but need to finish the deficiency courses to graduate

### Points for Faculty Meeting:

- Current language currently allows for non-B.S. in CEE students to be admitted to the program with approval of GPAC
- Only non-B.S. in CEE students with a mentor
- Deficiency courses are required: (admit students, but require courses for graduation)
    - Tier 1 = basic math and science courses are required before admission
        - Calculus I, II, & III
        - Differential Equations
        - Physics I & II
        - Chemistry I
        - Statics
        - Dynamics
        - Mechanics of Materials ← debated
    - Tier 2 = each discipline will develop their own deficiency course requirements (these course lists have already been developed by each subgroup)
        - Leave language in that exceptional cases can bypass some of these courses with approval of GPAC

- **For Vote**:
    - Should they be admitted before or after completing their deficiency courses?

**Admitting B.S. in CEE students without M.S. Degree**

Discussion:

- It is illegal to bar a student from getting an MS along the way
    - Students would come admitted in PhD program and leave after they have the MS requirements
    - USF is currently rejecting MS degrees to BS students admitted into PhD program
- One thought: students can be admitted directly from BS into the PhD program as long as the student is fully supported
    - In this case, the student cannot immediately apply for any fellowships

Points for Faculty Meeting:

- **For Vote**: B.S. in CEE students can be admitted directly into the PhD program if they have 100% support

**Department of Civil & Environmental Engineering**
**Fall 2015 Faculty Retreat**
**Graham Center Faculty Club, FIU Modesto Maidique Campus**
Friday, August 21, 2015, 9am to 4:30pm

**Meeting Minutes**

**Introduction and Chairs Report (9:20am to 10:50am)**

ABET passed with 6 year accreditation

- One concern (laboratory space for material and geotechnical)

Wall of Wind will be designated a federal research center (one of six in nation)

- FIU beat both Iowa State and Texas Tech
- University of Florida was awarded the other center
- $5 million funding for 5 years

Movement of faculty

- Omar moving on to WV
- 2 Vacancies to be filled: will be looking to fill Omar's position and one other position to help with the UTC competition upcoming in March
- May also be looking to add construction faculty

FIU Beyond Possible 2020 and Implications on CEE Department

- 30 out of 50 states are evaluating their state universities based on performance (Florida is one of them)
- There are 10 criteria being used by Florida to evaluate our performance, FIU has an additional 10 criteria
- In 2015, FIU was #3 (UF was #1, USF #2)
    - FIU received $11 million additional
    - Bottom 3 lost money from budget
    - Other than UF and USF, the rest of the pack is close
- Focus of this plan is on research; goal is to be a Carnegie Tier 1 program
- Preeminent Program
    - CEE is in prime position to get Preeminent Program
    - This would allow for additional faculty lines
    - TA money allocation is given based on research productivity
    - Graduate School is now under the ORED
- Performance Criteria
    - Retention Rates: 2-year and 6-year
    - Graduation Rates

        - Helping undergraduate students graduate
    - PhD student graduation (funding is based on number of PhD students and number of PhD students funded from outside source versus TA)
    - Number of Patents
        - Faculty are encouraged to apply for patents and starting a startup companies
        - FIU only had 2 patents in 2014
    - Research Funding
    - Mode of Delivery (focus of FIU future will be in online delivery)
        - Goal is to reach 40% online

### Online Programs

- All specialties encouraged to look into fully online program
    - Environmental already has approval and is moving forward
    - Structures is looking into MS in Structures and Bridge engineering
    - Transportation is encouraged to look into a fully online program
- Faculty are encouraged to structure their FEEDS classes so that portions can be used for online courses
- Proposed goal to have completely online MS by Fall 2017

### Undergraduate Teaching

- Faculty are encouraged to teach undergraduate courses
- Faculty assignments may be changed in upcoming semesters so that best faculty are teaching undergraduate level courses

### Development on UGS

- UGS is now under the ORED

### Restructuring in School of Engineering → School of Infrastructure and Sustainability

- Discussion are ongoing to form a School of Infrastructure and Sustainability with subset departments of OHL and CEE
- School would bring the two departments together rather than keeping them in competition

### Discussion on Retention Rates

- 700 undergraduate students in CEE, we have 30% 6-year graduation rate

1. *Problem*: Transfer students are coming in who have low performance in math and physics courses
    - Transfer students can transfer in with a low GPA in math and physics courses
    - CEE is not involved in the admissions process for transfer students (this is done through the admissions office)

- Students who go to any community college in Florida are guaranteed admission to a student
- Could identify "at-risk" students up front and point them to another major
- Look at the admission criterial of most successful programs among the science disciplines

2. *Problem*: Students are taking gateway courses too late and are unable to pass them
   - Statics is taken too late (Junior year for many); engineering cannot be done in 3 semesters
   - Bottle-neck courses are causing students to stall and drop out of program
     - Statics, dynamics, mechanics of materials
     - Teach courses in department
     - Setup tutoring program or support system for these courses
   - Students are unable to pass the FE exam / FE course (50% pass rate) → need help with the FE class
3. *Problem*: School's resources are insufficient to support the students
   - Tutoring Center
     - There is a center, but the space is small, tutors are few (only 2 tutors), and short hours of availability
   - Learning Assistants
     - Every professor is able to request for a learning assistant for their classes
     - New initiative by university
4. *Problem*: Lab courses are disconnected from the core course
   - Students have a difficulty connecting lab and real life concepts to those that are covered in class
   - Faculty encouraged to work in real world, hands-on examples to their class
   - Research projects should be supported by undergraduate students
5. *Problem*: Students are unsure of expectations in courses
   - Blackboard can be used to communicate all expectations and information to the students

**Action Items**

- Formation of two committees
  1. Fully online degree programs
  2. Address the Beyond Possible concerns
- Dr. Martinez to develop list of tasks to be done with regard to retention rates

**Visit from Provost (11:30am to 12pm)**

- 20 Critical Performance Indicators → roadmap for the next 5 years
  - statplan.fiu.edu

    - Strive to get 2nd year retention to 90%
    - Top 10 are undergraduate education related
    - Bottom 10 are research related
- Planned growth
    - Online
    - Partnering with local high schools (dual enrollment, especially with math classes)
    - Reorganizations within Academic Affairs
    - Instructional Innovation Institute (hybrid classes will get the same support as FIU Online)
- Long-Term Goals
    - Carnegie Very High Research Ranking
    - Florida Pre-Eminent Research University (online UF and FSU are right now)
        - 33 patents per year is the goal
        - Allows tuition to be raised
- Support of Patents
    - Start-Up FIU: Setting up a division to support start-up company formation
    - Office of Innovation and Economic Development: help with patenting
- Online and Hybrid Courses
    - Mode of Delivery → goal is 40% online, 30% hybrid, 30% in-person
        - Provide different modes of delivery for all high demand courses
    - Literature shows that hybrid courses are the most effective
        - Hybrid aim is 50% online, 50% off-line
    - $1,500 stipend for faculty doing hybrid classes in the spring
    - In 5 years, the majority of undergraduate degrees will be offered online
    - FIU model → same faculty are going to be developing and teaching courses on all levels
        - Different than UF that has a completely separate entity (UF Online) than the in person (UF); different faculty
- Research Concerns within University Faculty
    - Research Committee under ORED - Bjork Reynold (chair of this committee)
    - Looking into roadblocks for research faculty
    - Eliminating roadblocks for patenting
- Interdisciplinary school structure
    - Private industry are willing to support new schools and innovative programs
- Learning Assistants
    - This originated through Arts and Sciences
    - Applications go through the department level (through the chair)
    - Laird Kramer with STEM institute would coordinate

**Graduate Program Enhancement (11am to 11:30am; 1pm to 3:30pm)**

A. Doctoral Admissions and Program of Study

1. PhD Admission
    - Discussion
        - GPAC will develop lists of deficiency courses for both levels
        - Discussion on (c) → should a student be admitted to the program without Tier 1 courses?
        - The language of the catalog should be geared toward the applicant (DAS and GPAC may be inappropriate for the catalog)
        - Seems to be agreement on (a), (b) and (d)
        - Language of any proposed changes to the catalog needs to be considered against other university policies
        - Language in the catalogue now is flexible and allows for all backgrounds to be admitted
        - Question raised on (d) → admitting BSCE students would extend the length of PhD students
            - If student is supported by the research grant alone, why shouldn't a faculty be able to bring them in
        - There should be a way to help students with taking the remedial courses (BME allows auditing of classes)
        - A "qualifying exam" (to test background knowledge) may a bypass to "deficiency courses"
    - Vote
        - "Accept theme/spirit of (a), (b), and (d) and Table (c) (official language will be further developed by GPAC; GPAC will develop further Tier definitions as well)"
            - Motion carries: 11 yes and 2 no
        - GPAC will develop three different options for language of (c) to vote on at next meeting
2. PhD Course Requirements
    - Discussion
        - Should we add a required number of courses for graduation?
            - This was left flexible for now to allow GPAC to develop further
            - GPAC will develop further language to clarify this
    - Vote
        - "Agree with removal of core course requirements in catalog for PhD; GPAC to develop official language"
            - Motion carries: 13 yes and 1 no

B. Doctoral Advising

- Discussion
  - Professors of Practice
    - Position is not defined by the state system
    - They are not able to vote or serve on faculty senate
    - Could Professors of Practice have similar advising capacity as OHL faculty?
  - Motion (Dr. Lau): to form a committee to investigate the feasibility of university policy change with regard to Major Advisor status for Professors of Practice
    - Dr. Lau offered to lead the committee
    - No vote needed, Dr. Lau will look into these requirements
  - If the School of Infrastructure does happen, GPAC will need to be more accommodating to OHL

C. Master's Degree Course Requirement
- Discussion
  - As CE, we still need to meet the minimum number of courses specified by ASCE
  - Only PhD students should really be supported anyway
- Vote
  - "Remove the core course specification from the Catalog and specify instead a minimum number of credits to be taken in CEE department for master's students with the thesis option"
    - Motion carries: 9 yes and 2 no

D. Master's Degree Course Requirement
- No Discussion

**Development of Fully Online Programs (3:45pm to 4pm)**

- Tracks are going to be encouraged to develop online programs
  - Environmental has 1 course complete
    - They need to develop the 2 initial courses
  - Structures plans to develop MS in Bridge Engineering and MS in Structures
  - Transportation encouraged to consider developing program
- Online programs and courses should be cutting edge
- Dr. Bricker developed one fully-online course (she may share with faculty depending on permission)
  - Dr. Bricker had the opportunity to teach the course and try it out on an actual class
  - Students gave positive feedback

**Meeting Adjourn**

- Dr. Tansel motions, Dr. Ali seconds, passed unanimously

*Approved by CEE Faculty on December 11, 2014*

**Recommended Protocols for PhD Degree Program Examinations**
**Department of Civil & Environmental Engineering (CEE)**
**Approved by CEE Faculty on December 11, 2014**

All these examinations must be administered under the leadership of the Major Professor (MP). In the case of a Committee that has a Co-Major Professor, the Co-Major Professor should equally shareresponsibility in the administration of the examinations. Communication amongst the MP and the Committee and between the MP and the student should be documented for future reference. These protocols have been approved by the Department of Civil & Environmental Engineering (CEE) Graduate Program Advisory Committee (GPAC) and are strongly recommended for implementation by all CEE fulltime regular faculty members in their role as Major Professors or Graduate Faculty serving on dissertation committees. The protocols supplement all applicable University Graduate School (UGS) policies and procedures; they focus on operational aspects of the qualifying exam, proposal defense and dissertation defense.

***Qualifying Exam (****"breadth of knowledge")*

1. Timing
An official day in both November (fall term) and March (spring term), for all eligible doctoral students to take the qualifying exam, will be announced at the start of each term by the CEE department. The examination is not offered during the summer term. The MP and PhD student should timely decide on taking the exam either in the fall term or spring term.

2. Exam Planning
The MP should report the list of students, who are scheduled to take the examination, to the CEE main office on the last day of the second week of classes of each fall and spring term. The MP and the Student's Supervisory Committee select the core courses to then develop eight problems. The Committee should meet, under the leadership of the MP, to determine the core courses and the eight problems that will effectively test *the breadth of knowledge* of the student. The courses must be coursework that has been approved by the MP and student's supervisory committee and fully completed, including the course requirements defined for the MS degree programs. The MP then informs the student about the courses (by official code and title) and materials that he/she must prepare for.

3. Exam Format

3.1 Identification of coursework

Given preference to those faculty members, who instructed or instruct the selected courses and are also Committee members, the MP requests 6-7 problems; the MP may prepare 2 or 1 problem(s) in connection with 2 course(s) or 1 course that he/she was or is the instructor for. Problems should aim at assessing the ability of the student to synthesize and evaluate knowledge, under predictable and unpredictable situations for real processes and systems. The exam questions should not be problems to test basic background knowledge, comprehension or simple applications that should have been mastered at the BS degree level. Each problem should be drafted, so that the student is able to complete it in 50 minutes.

3.2 Exam packet

On the day prior to the examination day, each MP will turn in a sealed package with 8 envelopes to the designated *Lead Proctor* of the examination; each envelope should contain one problem statement. 3.3. Administering the exam

The *Lead Proctor* will be a CEE tenured faculty member. The *Lead Proctor* will be fully responsible for administering the open-book examination, managing time and collecting the exam back in the envelopes and packages, which should be returned to each MP at the end of the examination. The examination schedule will cover 4 problems in the morning (8AM – 12M), 1 hour for lunch (12M-1PM) and 4 problems in the afternoon (1PM-5PM). Unless otherwise directed by the MP and the Student's Supervisory Committee, students should bring their texts and notes (these in a binder; no loose material allowed), an approved calculator by the National Council of Examiners for Engineering and Surveying (NCEES) and needed supplies (e.g., pencils No. 2, eraser, and ruler).

4. Grading

The MP will coordinate the grading of the exam by those instructors, who provided problems, using FIU letter grading criteria (A, A-, B+, B, B-, etc.). The MP averages the grade using the number of points of each letter grade and provides a final average grade. A passing grade should be minimum B and no more than two problems should be graded lower than C; otherwise, the student fails the exam. The MP should then report the final result to the student, instructors who provided problems, and the Committee members. Results should be available as promptly as possible but within two weeks of the date of the exam.

5. D-2 Form

If the student has completed all coursework requirements, the student should be able to prepare and process the D-2 form; if course requirements are still pending, the student must meet the requirements before processing the D-2 form, as it is required by the University Graduate School.

***Proposal Defense (****"depth of knowledge")*

Once the PhD student has processed the D-2 form, he/she can enroll in dissertation credits, but can take any additional needed coursework in support of his/her research and dissertation. The MP and the PhD student should plan to hold the proposal defense on a day, at least, one year prior to the expected graduation date. The student should then prepare a detailed proposal, which should once approved by the MP be the basis to prepare a quality MS Power Point presentation or equivalent, as needed. The proposal should then be submitted to each one of the committee members, at least, two weeks in advance to the scheduled day of the defense. Based on the approved detailed proposal, the PhD student should then produce a 5-page proposal to be also shared with the Committee members for their input; this proposal is required by the UGS and is presented with the D-3 form. The PhD student should make a room reservation, with equipment that supports the audio-visual needs of the presentation, and rehearse the presentation a number of times (2-3 minimum). The presentation should be scheduled for a two-hour period (or else depending of MP's or Committee's expectations). The presentation should be announced, at least, throughout the FIU Engineering Center, and open to anyone interested. Faculty and students are specially welcome and encouraged to attend it. The following protocol should be, at a minimum, followed during the defense: 1. MP introduces the PhD student and asks audience and the Committee to hold all questions until the student ends the presentation 2. PhD student makes the presentation and ends it welcoming questions. 3. MP coordinates a question/answer (Q/A) interaction with the student, starting with 3-5 questions from the audience and then with each one of the Committee members. 4. Once the Q/A interaction ends, the MP thanks the audience for attending and asks everyone, including the candidate, to leave the room and the Committee to stay. The MP asks the PhD candidate to be within close proximity to the presentation room. 5. The Committee members will assess and then discuss the defense and decide on whether the student passes (i.e., becoming a candidate) or fails the exam. The decision should also include feedback on the proposal and oral presentation. 6. The MP and Committee members will complete and sign the *PhD Dissertation Proposal Defense Survey*. 7. The MP will then request the PhD student to return to the presentation room. 8. Upon the return of the student to the presentation room, the MP, on behalf of the Committee, announces the decision to the student, highlighting the Committee's feedback. 9. If the student passes the defense, the MP, followed by each committee member, congratulates the candidate (e.g., a hand shake is appropriate). If the student fails, the MP should instruct the student on a 2nd but last opportunity to defend, which is at the discretion of the MP. 10. The MP collects all the *PhD Proposal Dissertation Proposal Surveys* from all Committee members and after keeping copies for him/herself, turn them in to the departmental office for proper documentation (i.e., SACS).

***Dissertation Defense***

In full compliance with all requirements and deadlines that are defined by the UGS, the Major Professor and the PhD candidate, with input by all Committee Members, should agree on a month, day and time to hold the dissertation defense. The PhD candidate must then choose a day (i.e., six weeks prior to the date of the defense), when he/she will provide a draft of the dissertation to all the Committee members. The PhD candidate will also have to submit the D-5 form to the UGS earlier than 3 weeks before the date of the defense or by the official UGS deadline (if any). The PhD candidate should prepare an oral presentation of excellent quality to be made within 40 to 50 minutes. The defense is an open event but FIU students and faculty should be particularly welcome and encouraged to attend. The following protocol is recommended to conduct the defense: 1. MP introduces the PhD candidate and asks audience and Committee to hold all questions until the student ends the presentation 2. PhD candidate makes the presentation and ends it welcoming questions. 3. MP coordinates a question/answer (Q/A) interaction with the candidate, starting with 3-5 questions from the audience and then with each one of the Committee members. 4. Once the Q/A interaction ends, the MP thanks the audience for attending and asks everyone, including the candidate to leave the room and the Committee to stay. The MP asks the PhD candidate to be within close proximity to the presentation room. 5. The Committee members will then assess and discuss the defense and decide on whether the candidate passes or fails the exam. The decision should also include the Committee feedback on the dissertation write-up and oral presentation. 6. The MP and committee members will complete and sign the *PhD Dissertation Defense Survey*. 7. The MP will then call the PhD candidate to return to the conference room. 8. Upon the return of the candidate to the presentation room, the MP, on behalf of the Committee, announces the decision to the candidate, highlighting the Committee's feedback. 9. If the candidate passes the defense, the MP, followed by each committee member, congratulates the candidate (e.g., a hand shake is appropriate). 10. The MP collects all the *PhD Dissertation Defense Surveys* and, after keeping copies for him/herself, turn them in to the departmental office for proper documentation (i.e., SACS). *Approved by CEE Faculty on December 11, 2014*

***Grievances***

*All grievances will be processed under Policy 380.947 "Graduate Student Academic Grievance Guidelines and Procedure" of May 1, 2010.*

***Record of Approval:***

***The CEE Graduate Advisory Committee (GPAC) unanimous approval of the Recommended Protocols took place on November 10, 2014, by attending voting members Drs. L. David Shen (Chair), B. Tansel, M. Hadi and K. Lau. Dr. H. R. Fuentes represented, as non-voting member, Dr. A. Azizinamini, Chairperson of the Department of Civil & Environmental Engineering. The***

***GPAC-approved Recommended Protocols were presented as a motion in the CEE Regular faculty meeting of December 11, 2014. The motion was moved by Dr. B. Tansel and seconded by Dr. K. Lau. The motion was unanimously approved.***

# APPENDIX C: GRANT SUPPORT

July 2013-June 2014

| | | | | | |
|---|---|---|---|---|---|
| AWD000000003552 | Technical and Research Support for ITS and Traffic Engineering Projects (LOA#2) | 7/3/2013 | Florida Department of Transportation | Florida Department of Transportation | $200,000.00 |
| AWD000000003399 | Guidelines for Bus Transit Stops in Highway Construction Work Zones | 7/24/2013 | Florida Department of Transportation | U.S. Department of Transportation | $2,823.27 |
| AWD000000001870 | Handbook on Transit Planning and Operations | 8/22/2013 | University of South Florida | U.S. Department of Transportation | $86,394.00 |
| AWD000000001870 | Handbook on Transit Planning and Operations | 8/22/2013 | University of South Florida | U.S. Department of Transportation | $130,000.00 |
| AWD000000003674 | Extraction of Basic Roadway Information for Non-State Roads in Florida | 8/31/2013 | Florida Department of Transportation | U.S. Department of Transportation | $120,000.00 |
| AWD000000003737 | STRIDE Internship-Amauris Ramirez | 9/12/2013 | University of Florida | University of Florida | $7,427.00 |
| AWD000000002992 | Condition Assessment of the First Fort Bowie and Condition Assessment of the Second Fort Bowie - Fort Bowie National Historic Site | 9/17/2013 | University of Vermont | National Park Service | $20,510.00 |
| AWD000000003912 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $3,000.00 |
| AWD000000003913 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $3,000.00 |
| AWD000000003467 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $5,000.00 |
| AWD000000003916 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $5,000.00 |
| AWD000000003915 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $7,500.00 |
| AWD000000003914 | 2013 Dwight D. Eisenhower Transportation Fellowship Program at Florida International University | 9/18/2013 | U.S. Department of Transportation | U.S. Department of Transportation | $10,000.00 |
| AWD000000003886 | Florida Public Hurricane Loss Model Project Model Enhancements to Estimate Losses from Storm Surge and Flooding 2013-2014 | 9/20/2013 | Florida Office of Insurance Regulation | Florida Office of Insurance Regulation | $13,309.79 |
| AWD000000003672 | Feasibility of a Web-Based System for Police Report Review and Information Recording | 9/25/2013 | Florida Department of Transportation | U.S. Department of Transportation | $90,000.00 |
| AWD000000003886 | Florida Public Hurricane Loss Model Project Model Enhancements to Estimate Losses from Storm Surge and Flooding 2013-2014 | 9/30/2013 | Florida Office of Insurance Regulation | Florida Office of Insurance Regulation | $119,788.08 |
| AWD000000003790 | Decision Support Systems for Transportation System Management and Operations (TSM&O) | 10/14/2013 | Florida Department of Transportation | U.S. Department of Transportation | $210,290.00 |
| AWD000000003957 | Iraq Science Fellowship Program | 10/30/2013 | Civilian Research & Development Foundati | Civilian Research & Development Foundati | $5,000.00 |
| AWD000000003843 | Investigation of Open Graded Friction Course Raveling in SE Florida | 10/31/2013 | Florida Department of Transportation | Florida Department of Transportation | $62,650.25 |
| AWD000000003617 | Dynamic Traffic Control Interventions for Enhanced Mobility and Economic Competitiveness | 11/19/2013 | University of Florida | U.S. Department of Transportation | $68,200.00 |
| AWD000000003762 | FHWA DTA Training Workshop Scope | 11/30/2013 | SAIC | U.S. Department of Transportation | $34,163.94 |
| AWD000000003618 | Signal Timing Optimization with Consideration of Environmental and Safety Impacts | 12/13/2013 | University of Florida | U.S. Department of Transportation | $64,000.00 |
| AWD000000004160 | ITS RESEARCH, COMPUTER, AND MISCELLANEOUS SUPPORT (WO 462-02) | 12/19/2013 | Florida Department of Transportation | Florida Department of Transportation | $75,000.00 |
| AWD000000003180 | Incorporation of 2007-2011 Rural NTD Data into Florida Transit Information System (FTIS) | 1/13/2014 | National Rural Transit Assistance Progra | Federal Transit Administration | $99,136.00 |
| AWD000000003345 | Tier 1 University Transportation Center U.S. DOT Strategic Goal Focus Area: State of Good Repair | 1/22/2014 | U.S. Department of Transportation | U.S. Department of Transportation | $1,414,100.00 |
| AWD000000002341 | STRIDE Internal Steering Committee | 2/7/2014 | University of Florida | U.S. Department of Transportation | $6,998.97 |
| AWD000000002341 | STRIDE Internal Steering Committee | 2/7/2014 | University of Florida | U.S. Department of Transportation | $24,661.03 |
| AWD000000004308 | Pedestrian Safety Campaign Support and Data Collection of Driver and Pedestrian Behavior at Rectangular Rapid Flashing Beacon Locations | 2/17/2014 | Florida Department of Transportation | Florida Department of Transportation | $30,000.00 |
| AWD000000003803 | Investigating the Value of Time and Value of Reliability for Managed Lanes | 2/20/2014 | Florida Department of Transportation | U.S. Department of Transportation | $150,000.00 |
| AWD000000004237 | MDX Regional Informed Traveler Program (ITP) Analysis | 2/28/2014 | Miami-Dade Expressway Authority | Miami-Dade Expressway Authority | $265,261.00 |
| AWD000000002293 | Tier I University Transportation Center (UTC) Program Support | 3/10/2014 | Georgia Institute of Technology | U.S. Department of Transportation | $131,848.00 |
| AWD000000002293 | Tier I University Transportation Center (UTC) Program Support | 3/10/2014 | Georgia Institute of Technology | U.S. Department of Transportation | $85,000.00 |
| AWD000000002293 | Tier I University Transportation Center (UTC) Program Support | 3/10/2014 | Georgia Institute of Technology | U.S. Department of Transportation | $50,000.00 |
| AWD000000002293 | Tier I University Transportation Center (UTC) Program Support | 3/11/2014 | Georgia Institute of Technology | U.S. Department of Transportation | $82,456.00 |
| AWD000000002293 | Tier I University Transportation Center (UTC) Program Support | 3/11/2014 | Georgia Institute of Technology | U.S. Department of Transportation | $80,696.00 |
| AWD000000002036 | Regional Establishment Survey | 3/17/2014 | Cambridge Systematics | New York Metropolitan Transportation Cou | $25,296.00 |
| AWD000000003937 | Wall of Wind Testing of Photovoltaic Systems | 3/31/2014 | Georgia Institute of Technology | U.S. Department of Energy | $97,931.00 |
| AWD000000004361 | Updating and Improving Methodology for Prioritizing Highway Projects on the Strategic Intermodal System (SIS) | 4/9/2014 | Florida Department of Transportation | U.S. Department of Transportation | $150,000.00 |
| AWD000000004476 | A Synthesis of the "State-of-the-Practice for Advancing Planning and Operations Integration Opportunities within Transportation Agencies" | 4/10/2014 | Florida Department of Transportation | U.S. Department of Transportation | $40,000.00 |
| AWD000000004411 | Examining the Value of Travel Time Reliability for Freight Transportation to Support Freight Planning and Decision-Making | 4/10/2014 | Florida Department of Transportation | U.S. Department of Transportation | $150,000.00 |
| AWD000000004394 | ITS RESEARCH, COMPUTER, AND MISCELLANEOUS SUPPORT (WO 462-03) | 4/21/2014 | Florida Department of Transportation | Florida Department of Transportation | $75,000.00 |
| AWD000000004550 | Development and Implementation of Puerto Rico Strategic Highway Safety Plan | 4/22/2014 | Advanced Transportation Engineering Cons | CSA Architects & Engineers LLP | $82,426.60 |
| AWD000000004568 | Long Term Aging of Asphalt Binders used with Reclaimed Asphalt Pavement | 4/30/2014 | Florida Department of Transportation | Florida Department of Transportation | $100,000.00 |
| AWD000000004669 | Managing Florida's Fracture Critical Bridges | 5/21/2014 | Florida Department of Transportation | Florida Department of Transportation | $84,108.26 |
| AWD000000004641 | Development of 2015 Florida Transit Information System (FTIS) | 5/29/2014 | Florida Department of Transportation | Florida Department of Transportation | $53,635.00 |
| AWD000000003345 | Tier 1 University Transportation Center U.S. DOT Strategic Goal Focus Area: State of Good Repair | 6/27/2014 | U.S. Department of Transportation | U.S. Department of Transportation | $1,402,200.00 |
| AWD000000003945 | State of Good Repair Performance Measures: Assessing Asset Condition, Age, and Performance Data | 6/27/2014 | University of South Florida | U.S. Department of Transportation | $339,760.00 |
| AWD000000004704 | Non-Destructive Testing of Ringling Bridge Tendons Using Magnetic Based Methods | 6/30/2014 | Florida Department of Transportation | Florida Department of Transportation | $35,127.90 |
| AWD000000004704 | Non-Destructive Testing of Ringling Bridge Tendons Using Magnetic Based Methods | 6/30/2014 | Florida Department of Transportation | Florida Department of Transportation | $221,274.44 |

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| AWD000000004829 | Development of SW 8th Street Adaptive Signal Control Evaluation Plan and Initial Data Processing and Validation | 7/29/2014 | Florida Department of Transportation | Florida Department of Transportation | $20,397.10 |
| AWD000000003886 | Florida Public Hurricane Loss Model Project Model Enhancements to Estimate Losses from Storm Surge and Flooding 2013-2014 | 8/11/2014 | Florida Office of Insurance Regulation | Florida Office of Insurance Regulation | $133,772.99 |
| AWD000000004844 | Technical and Research Support for ITS and Traffic Engineering Projects (LOA #5) | 8/19/2014 | Florida Department of Transportation | Florida Department of Transportation | $300,000.00 |
| AWD000000004489 | Siloxanes in Biogas: Formation and Effect on Biogas Quality and Energy Costs | 9/30/2014 | University of Florida | Florida Department of Environmental Prot | $40,000.00 |
| AWD000000002425 | Long-Term Aging of Recycled Binders | 10/15/2014 | Florida Department of Transportation | U.S. Department of Transportation | $30,812.22 |
| AWD000000004914 | National Accelerated Bridge Conference | 10/17/2014 | U.S. Department of Transportation | U.S. Department of Transportation | $137,590.00 |
| AWD000000004457 | Dwight David Eisenhower Transportation Fellowship Program | 10/17/2014 | U.S. Department of Transportation | U.S. Department of Transportation | $7,500.00 |
| AWD000000004924 | FSUTMS Portal Improvements and Maintenance | 11/20/2014 | URS Corporation | Florida Department of Transportation | $58,149.00 |
| AWD000000004825 | FITSEVAL Testing and Utilization Support | 11/21/2014 | URS Corporation | Florida Department of Transportation | $13,912.00 |
| AWD000000004899 | Framework for Multi-Resolution Analyses of Advanced Traffic Management Strategies | 11/21/2014 | Florida Department of Transportation | Florida Department of Transportation | $300,000.00 |
| AWD000000005128 | Development of a Test Method for Assessing the Performance of Vehicular Traffic Signal Assemblies During Hurricane Force Winds | 12/8/2014 | Florida Department of Transportation | U.S. Department of Transportation | $261,161.95 |
| AWD000000004842 | CAREER: Robust Modeling and Predictions of Stream Water Quality and Ecosystem Health in Complex Urban-Natural Environments | 1/12/2015 | National Science Foundation | National Science Foundation | $500,000.00 |
| AWD000000005266 | ITS RESEARCH, COMPUTER, AND MISCELLANEOUS SUPPORT (WORK ORDER 462-04) | 1/20/2015 | Florida Department of Transportation | Florida Department of Transportation | $150,000.00 |
| AWD000000005128 | Development of a Test Method for Assessing the Performance of Vehicular Traffic Signal Assemblies During Hurricane Force Winds | 1/23/2015 | Florida Department of Transportation | U.S. Department of Transportation | $7,024.05 |
| AWD000000005048 | Technical Assistance to Avail with Uploading VOTRAN Stop Data into ATSIM | 1/30/2015 | Avail Technologies Inc | Avail Technologies Inc | $5,000.00 |
| AWD000000005218 | Utilization of Connected Vehicle Data to Support Traffic Management Decisions | 2/18/2015 | Florida Department of Transportation | U.S. Department of Transportation | $300,000.00 |
| AWD000000005409 | 2015 Data Update and Maintenance for Rural INTDAS System | 3/18/2015 | TransAction Associates Inc | Federal Transit Administration | $18,141.00 |
| AWD000000005548 | NSF I-Corps: "Innovative Hurricane Damage Mitigation Systems" | 3/26/2015 | National Science Foundation | National Science Foundation | $10,000.00 |
| AWD000000005308 | Corrosion Evaluation of Novel Coatings for Steel Components of Highway Bridges: Phase II | 3/31/2015 | Florida Department of Transportation | U.S. Department of Transportation | $298,587.00 |
| AWD000000005532 | 2015/2016 Water-Use Consumption Data Gathering | 3/31/2015 | Miami-Dade County Water and Sewer | Miami-Dade County Water and Sewer | $77,343.00 |
| AWD000000004932 | Development of Life-Cycle Assessment (LCA) and Life-Cycle Cost Analysis (LCCA)for Pavement-type Selection for SR 836 Extension from NW 137th Avenue to SW Kendall Area (Project Number 83618) | 4/14/2015 | Miami-Dade Expressway Authority | Miami-Dade Expressway Authority | $109,765.69 |
| AWD000000003345 | Tier 1 University Transportation Center U.S. DOT Strategic Goal Focus Area: State of Good Repair | 4/22/2015 | U.S. Department of Transportation | U.S. Department of Transportation | $1,402,200.00 |
| AWD000000005451 | Quantifying the Accuracy of the Enhanced Interchange Safety Analysis Tool (ISATe) Crash Prediction Tools on Florida Freeways | 4/23/2015 | Florida Department of Transportation | Florida Department of Transportation | $75,000.00 |
| AWD000000005548 | NSF I-Corps: "Innovative Hurricane Damage Mitigation Systems" | 5/8/2015 | National Science Foundation | National Science Foundation | $40,000.00 |
| AWD000000005721 | Development of 2016 Florida Transit Information System (FTIS) | 5/22/2015 | Florida Department of Transportation | U.S. Department of Transportation | $114,507.00 |
| AWD000000005804 | FITSEVAL Testing and Utilization Support | 5/27/2015 | URS Corporation | Florida Department of Transportation | $3,539.00 |
| AWD000000005686 | SW 8th Street Adaptive Signal Control Evaluation Plan - Phase 1 | 6/1/2015 | Florida Department of Transportation | Florida Department of Transportation | $64,430.91 |
| AWD000000005687 | Selection of Signal Timing Plans based on System Performance Measurement | 6/1/2015 | Florida Department of Transportation | Florida Department of Transportation | $60,582.11 |
| AWD000000002341 | STRIDE Internal Steering Committee | 6/10/2015 | University of Florida | U.S. Department of Transportation | $7,000.00 |
| AWD000000005864 | Precision of Florida Texture Meter | 6/24/2015 | Florida Department of Transportation | Florida Department of Transportation | $100,052.99 |
| AWD000000003345 | Tier 1 University Transportation Center U.S. DOT Strategic Goal Focus Area: State of Good Repair | 6/30/2015 | U.S. Department of Transportation | U.S. Department of Transportation | $923,700.00 |

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| AWD000000004568 | Long Term Aging of Asphalt Binders used with Reclaimed Asphalt Pavement | 7/22/2015 | Florida Department of Transportation | Florida Department of Transportation | $81,575.33 |
| AWD000000005945 | FITSEVAL Training, Review and Coordination with FDOT District 5 | 7/24/2015 | URS Corporation | Florida Department of Transportation | $10,198.00 |
| AWD000000005792 | STRIDE Summer Internship 2015 | 7/31/2015 | University of Florida | U.S. Department of Transportation | $4,350.00 |
| AWD000000005873 | Statewide Training of SafetyAnalyst in Florida | 7/31/2015 | University of Florida | U.S. Department of Transportation | $20,000.00 |
| AWD000000005794 | Technical and Research Support for ITS and Traffic Engineering Projects: Task Work Order # 662-10 | 9/4/2015 | Florida Department of Transportation | Florida Department of Transportation | $125,000.00 |
| AWD000000005795 | Technical and Research Support for ITS and Traffic Engineering Projects: Task Work Order # 662-11 | 9/4/2015 | Florida Department of Transportation | Florida Department of Transportation | $75,000.00 |
| AWD000000005746 | Professional Services to the Illinois State Highway and Toll Authority through AECOM | 9/29/2015 | AECOM | Illinois State Toll Highway Authority | $32,000.00 |
| AWD000000005972 | Statewide Analysis of Bicycle Crashes | 9/29/2015 | Florida Department of Transportation | Florida Department of Transportation | $150,000.00 |
| AWD000000005579 | Framework to Support Transportation Agency ITS Infrastructure and ITS Legacy Decisions with Consideration of Connected Vehicle Deployment and Autonomous Vehicle and Automated Vehicle Initiatives | 9/30/2015 | National Academy of Sciences | U.S. DOT Federal Highway Administration | $99,000.00 |
| AWD000000006058 | District Four ITS Research and Technical Support: Task Work Order # 463-05 | 9/30/2015 | Florida Department of Transportation | Florida Department of Transportation | $150,000.00 |
| AWD000000005217 | NHERI Experimental Facility 2015-2019 | 9/30/2015 | National Science Foundation | National Science Foundation | $821,555.00 |
| AWD000000005217 | NHERI Experimental Facility 2015-2019 | 9/30/2015 | National Science Foundation | National Science Foundation | $42,280.00 |
| AWD000000006102 | Transit Stop Inventory Model (ATSIM) Enhancements | 10/12/2015 | Florida Department of Transportation | U.S. Department of Transportation | $23,934.00 |
| AWD000000003345 | Tier 1 University Transportation Center U.S. DOT Strategic Goal Focus Area: State of Good Repair | 10/14/2015 | U.S. Department of Transportation | U.S. Department of Transportation | $923,700.00 |
| AWD000000005553 | Bus Stop Management System | 10/30/2015 | Triangle Transit | Triangle Transit | $32,525.00 |
| AWD000000006176 | Travel reimbursement (scholarship) services for the 2015 SHRP 2 ABC Conference in December 2015 | 10/30/2015 | American Assoc State Highway & Transp Of | American Assoc State Highway & Transp Of | $75,000.00 |
| AWD000000005814 | Evaluation of Video Analytic Technologies | 11/20/2015 | Gannett Fleming Inc | Florida Department of Transportation | $24,994.03 |
| AWD000000006288 | Miami-Dade Water and Sewer Department Graphics and Data Support Services (Manuel) | 11/20/2015 | Miami-Dade County Water and Sewer | Miami-Dade County Water and Sewer | $50,750.00 |
| AWD000000006289 | CD 1.08 CDWWTP- Dewatering Facility (South District) :<br><br>Miami-Dade Water and Sewer Department Graphics and Data Support Services (Ernesto) | 11/20/2015 | Miami-Dade County Water and Sewer | Miami-Dade County Water and Sewer | $50,750.00 |
| AWD000000006332 | National Accelerated Bridge Conference- December 2015 | 11/30/2015 | U.S. DOT Federal Highway Administration | U.S. DOT Federal Highway Administration | $58,597.00 |
| AWD000000002341 | STRIDE Internal Steering Committee | 12/8/2015 | University of Florida | U.S. Department of Transportation | $997.03 |
| AWD000000002341 | STRIDE Internal Steering Committee | 12/8/2015 | University of Florida | U.S. Department of Transportation | $6,998.97 |
| AWD000000006369 | Dwight David Eisenhower Transportation Fellowship Program- Andres McEwen | 12/10/2015 | U.S. Department of Transportation | U.S. Department of Transportation | $2,000.00 |
| AWD000000006370 | Dwight David Eisenhower Transportation Fellowship Program - Mario Rojas | 12/10/2015 | U.S. Department of Transportation | U.S. Department of Transportation | $2,000.00 |
| AWD000000006117 | Incorporating Transit Service Decisions into Express Lane Programs | 12/21/2015 | Florida Department of Transportation | U.S. Department of Transportation | $159,720.27 |
| AWD000000005997 | FIUs Hurricane Loss Reduction for Housing in Florida | 12/31/2015 | Florida Division of Emergency Management | Florida Division of Emergency Management | $282,388.78 |
| AWD000000005997 | FIUs Hurricane Loss Reduction for Housing in Florida | 12/31/2015 | Florida Division of Emergency Management | Florida Division of Emergency Management | $132,940.69 |
| AWD000000005128 | Development of a Test Method for Assessing the Performance of Vehicular Traffic Signal Assemblies During Hurricane Force Winds | 1/5/2016 | Florida Department of Transportation | U.S. Department of Transportation | $192,655.94 |
| AWD000000006306 | Guidelines for the Evaluation of Ramp Signaling Deployments in a Real-Time Operations Environment | 1/27/2016 | Florida Department of Transportation | U.S. Department of Transportation | $200,000.00 |
| AWD000000005164 | Creating Broward County Dashboard and Production of Monthly Report for Broward and Palm Beach Counties | 2/23/2016 | Metric Engineering | Florida Department of Transportation | $6,595.14 |
| AWD000000006355 | Susceptibility of Bridge Steel and Concrete Components to Microbiological Influenced Corrosion (MIC) and Microbiological Influenced Deterioration (MID) in Florida | 3/28/2016 | Florida Department of Transportation | Florida Department of Transportation | $200,000.00 |
| AWD000000006651 | Safe and Accessible Pedestrian Facilities Inventory Model (SAPFIM) | 3/28/2016 | Florida Department of Transportation | U.S. Department of Transportation | $100,000.00 |

# APPENDIX D. PUBLICATIONS SINCE 2013

## FACULTY

Alluri, P.

1. Gan, A., Liu, K., and Alluri, P. (2016). "An Integrated System for Rural National Transit Database (NTD)," Transportation Research Record No. 2539: Journal of the Transportation Research Board, In Press.
2. Alluri, P., Gan, A., and Haleem, K. (2016). "Safety Impacts of Converting Two-Way Left-Turn Lanes to Raised Medians and Associated Design Concerns," Journal of the Transportation Research Forum, In Press.
3. Saha, D., Alluri, P., and Gan, A. (2016). "A Random Forests Approach to Prioritize Highway Safety Manual (HSM) Variables for Data Collection," Journal of Advanced Transportation, Vol. 50, pp. 522-540.
4. Alluri, P., Haleem, K., Gan, A., and Mauthner, J. (2016). "Safety Performance Evaluation of Cable Median Barriers on Freeways in Florida," Traffic Injury Prevention Journal, 17(5), pp. 544-551.
5. Alluri, P., Saha, D., and Gan, A. (2016). "Minimum Sample Sizes for Estimating Reliable Highway Safety Manual (HSM) Calibration Factors," Journal of Transportation Safety and Security, 8(1), pp. 56-74.
6. Alluri, P., Gan, A., Diaz, A., and Steiner, R. (2015). "Safety Impacts of Access Management Features near Roundabouts," Transportation Research Record No. 2517: Journal of the Transportation Research Board, pp. 28-36.
7. Haleem, K., Alluri, P., and Gan, A. (2015). "Analyzing Pedestrian Crash Injury Severity at Signalized and Non-Signalized Locations," Accident Analysis and Prevention Journal, Vol. 81, pp. 14-23.
8. Alluri, P., Gan, A., Haleem, K., and Mauthner, J. (2015). "Safety Performance of G4 (1S) W-beam Guardrails versus Cable Median Barriers on Florida's Freeways," Journal of Transportation Safety and Security, 7(3), pp. 208-227.
9. Saha, D., Alluri, P., and Gan, A. (2015). "Prioritizing Highway Safety Manual's Crash Prediction Variables Using Boosted Regression Trees," Accident Analysis and Prevention Journal, Vol. 79, pp. 133-144.
10. Tang, L., Gan, A., and Alluri, P. (2014). "Automatic Extraction of Number of Lanes from Geo-Rectified Aerial Images," Transportation Research Record No. 2460: Journal of the Transportation Research Board, pp. 86-96.
11. Suksawang, N., Alluri, P., Gan, A., Meneses, K., Cevallos, F., Haleem, K., and Saha, D. (2014). "Use of Movable Bus Stop Loading Pads: Feasibility and Design Alternatives," Journal of Public Transportation, 17(4), pp. 157-173.
12. Haleem, K., Gan, A., Alluri, P., and Saha, D. (2014). "Identifying Safety Practices and Needs of Local Transportation and Law Enforcement Agencies," Journal of the Transportation Research Forum, 53(1), pp. 83-99.
13. Lu, J., Haleem, K., Alluri, P., Gan, A., and Liu, K. (2014). "Developing Local Safety Performance Functions versus Calculating Calibration Factors for SafetyAnalyst Applications: A Florida Case Study," Safety Science, Vol. 65, pp. 93-105.
14. Wang, T., Gan, A., and Alluri, P. (2013). "Estimating Annual Average Daily Traffic for Local Roads for Highway Safety Analysis," Transportation Research Record No. 2398: Journal of the Transportation Research Board, pp. 60-66.
15. Lu, J., Haleem, K., Alluri, P., and Gan, A. (2013). "Full versus Simple Safety Performance Functions: A Comparison Based on Urban Four-Lane Freeway Interchanges in Florida," Transportation Research Record No. 2398: Journal of the Transportation Research Board, pp. 83-92.
16. Stanford, M., Benson, L., Alluri, P., Martin, W., Klotz, L., Ogle, J., Kaye, N., Sarasua, W., and Schiff, S. (2013). "Evaluating Student and Faculty Outcomes for a Real-World Capstone Project with Sustainability Considerations," Journal of Professional Issues in Engineering Education and Practice, 139(2), pp. 123-133.

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1. Ala N, Power EH, Azizinamini A. "Predicting the service life of sliding surfaces in bridge bearings", ASCE Journal of Bridge Engineering. Feb 2016, Vol. 21, No. 2, 04015035.
2. Ala N, Power EH, Azizinamini A. "Experimental Evaluation of High-Performance Sliding Surfaces for Bridge Bearings", ASCE Journal of Bridge Engineering. Feb 2016, Vol. 21, No. 2, 04015034.
3. Ala N, Azizinamini A. "Experimental study of seamless bridge transition system for US practice", ASCE Journal of Bridge Engineering, Feb 2016, Vol. 21, No. 2, 04015046.

4. Ala N, Azizinamini A. “Proposed design provisions for a seamless bridge system: Cases of flexible and jointed pavements”, ASCE Journal of Bridge Engineering. Feb 2016, Vol. 21, No. 2, 04015045.
5. Sherafati, A., and Azizinamini, A., “Flexible pile head in jointless bridges: experimental investigation”, ASCE Journal of Bridge Engineering, Apr 2015, Vol 20, No.4, 04014071.
6. Gull JH, Mohammadi A, Taghinezhad R, Azizinamini A. “Experimental Evaluation of Repair Options for Timber Piles Using Full Scale Test Specimens”, In Transportation Research Board 94th Annual Meeting, 2015, No. 15-4018, pp 124-131.
7. Azizinamini A., “Simple for Dead Load-Continuous for Live Load Steel Bridge Systems”, AISC Engineering Journal, Jan 2014, Vol. 51, No. 2, pp 59-81.
8. Lampe N, Mossahebi N, Yakel A, Farimani R, Azizinamini A., “Development and Experimental Testing of Connections for the Simple for Dead Load-Continuous for Live Load Steel Bridge System”, AISC Engineering Journal, Jan 2014, Vol. 51, No. 2, pp 83-108.
9. Farimani, F., Javidi, S., Kowalski, D. and Azizinamini, A., “Numerical Analysis and Design Provision Development of Simple for Dead – Continuous for Live Bridge System”, AISC Engineering Journal, Jan 2014, Vol. 51, No. 2, pp 109-126.
10. Yakel, A., and Azizinamini, A., “Field Application Case Studies and Long-Term Monitoring of Bridges Utilizing the Simple for Dead-Continuous for Live Bridge System”, AISC Engineering Journal, Jan 2014, Vol 51, No.3, pp 155-175.
11. Javidi, S., Yakel, A., and Azizinamini, A., “Experimental Investigation, Application and Monitoring of Simple-made-continuous Bridge Connection for Modular Bridge Construction Method”, AISC Engineering Journal, Jan 2014, Vol 51, No.3, pp 177-198.
12. Sherafati A, Farimani R, Azizinamini A., “Effect of concrete slab on shear capacity of composite plate girders under positive moment”, ASCE Journal of Bridge Engineering, Oct 2013, Vol. 18, No. 2, pp 89-98.

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1. Mooneghi, M.A., Irwin, P., Gan Chowdhury, A. (2016). “Partial Turbulence Simulation Method for Predicting Peak Wind Loads on Small Structures and Building Appurtenances.” Journal of Wind Engineering and Industrial Aerodynamics, 157, pp. 47–62. http://dx.doi.org/10.1016/j.jweia.2016.08.003
2. Smith, D., Masters, F., Gan Chowdhury, A. (2016). “Investigating a Wind Tunnel Method for Determining Wind-Induced Loads on Roofing Tiles.” Journal of Wind Engineering and Industrial Aerodynamics, 155, pp. 47-59. http://dx.doi.org/10.1016/j.jweia.2016.05.006
3. Mintz, B., Mirmiran, A., Suksawang, N., Gan Chowdhury, A. (2016). “Full-Scale Testing of a Precast Concrete Supertile Roofing System for Hurricane Damage Mitigation.” ASCE Journal of Architectural Engineering, pp. B4016002-1-12.
   DOI: 10.1061/(ASCE)AE.1943-5568.0000209
4. Mooneghi, M.A., Irwin, P., Gan Chowdhury, A. (2016). “Towards Guidelines for Design of Loose-Laid Roof Pavers for Wind Uplift.” Wind and Structures, 22(2), pp. 133-160.
   DOI: http://dx.doi.org/10.12989/was.2016.22.2.133
5. Habte, F., Mooneghi, M.A., Gan Chowdhury, A., Irwin, P. (2015). “Full-Scale Testing to Evaluate the Performance of Standing Seam Metal Roofs under Simulated Wind Loading.” Engineering Structures, 105, pp. 231–248.
   http://dx.doi.org/10.1016/j.engstruct.2015.10.006
6. Mintz, B., Gan Chowdhury, A., Mirmiran, A., Suksawang, N., Kargarmoakhar, R. (2015). “Design, Development, and Testing of a Composite Roofing System.” ASCE Journal of Composites for Construction, pp. 04015052-1-11.
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7. Meyer, D., Gan Chowdhury, A., Irwin, P. (2015). “Investigation of Wind-Induced Dynamic and Aeroelastic Effects on Variable Message Signs.” Wind and Structures, 20(6), pp. 793-810. DOI: http://dx.doi.org/10.12989/was.2015.20.6.793
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   DOI: 10.1061/(ASCE)ME.1943-5479.0000372

9. Kargarmoakhar, R., Gan Chowdhury, A., Irwin, P. (2015). “Reynolds Number Effects on Twin Box Girder Long Span Bridge Aerodynamics.” Wind and Structures, 20(2), pp. 327-347. DOI: http://dx.doi.org/10.12989/was.2015.20.2.327

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11. Habte, F., Gan Chowdhury, A., Yeo, D., Simiu. E. (2014). “Wind Directionality Factors for Non-Hurricane and Hurricane-Prone Regions.” ASCE Journal of Structural Engineering, pp. 04014208-1-9. DOI: 10.1061/(ASCE)ST.1943-541X.0001180
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13. Baheru, T., Gan Chowdhury, A., Pinelli, J-P., Bitsuamlak, G. (2014). “Distribution of Wind-Driven Rain Deposition on Low-Rise Buildings: Direct Impinging Raindrops versus Surface Runoff.” Journal of Wind Engineering and Industrial Aerodynamics, 133, pp. 27-38. http://dx.doi.org/10.1016/j.jweia.2014.06.023
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15. Mooneghi, M.A., Irwin, P., Gan Chowdhury, A. (2014). “Large-Scale Testing on Wind Uplift of Roof Pavers.” Journal of Wind Engineering and Industrial Aerodynamics, 128 pp. 22-36.
http://dx.doi.org/10.1016/j.jweia.2014.03.001
16. Warsido, W., Bitsuamlak, G., Barata, J., Gan Chowdhury, A. (2014). “Influence of Spacing Parameters on the Wind Loading of Solar Array.” Journal of Fluids and Structures, 48, pp. 295-315.
http://dx.doi.org/10.1016/j.jfluidstructs.2014.03.005
17. Li. R., Gan Chowdhury, A., Bitsuamlak, G., Gurley, K. (2014). “Wind Effects on Roofs with High-Profile Tiles: An Experimental Study.” ASCE Journal of Architectural Engineering, pp. B4014002-1-11. DOI: 10.1061/(ASCE)AE.1943-5568.0000156
18. Fu, T-C., Gan Chowdhury, A., Bitsuamlak, G., Baheru, T. (2014). “Partial Turbulence Simulation and Aerodynamic Pressures Validation for an Open-Jet Testing Facility.” Wind and Structures, 19(1), pp. 15-33. DOI: http://dx.doi.org/10.12989/was.2014.19.1.015
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