

FLORIDA ATLANTIC UNIVERSITY

SELF-STUDY REPORT FOR ACADEMIC PROGRAMS IN THE DEPARTMENT OF CIVIL, ENVIRONMENTAL AND GEOMATICS ENGINEERING

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FAU DEPARTMENT OF CIVIL, ENVIRONMENTAL
& GEOMATICS ENGINEERING

College of Engineering & Computer Science
Florida Atlantic University

Florida Atlantic University
Academic Program Review
Self-Study Report Department of
Civil, Environmental and Geomatics Engineering
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The Department of Civil, Environmental and Geomatics Engineering (CEGE) offers the following programs:

1. **CIVIL ENGINEERING (CIP: 140801)**
 - Bachelor of Science in Civil Engineering
 - Master of Science in Civil Engineering

2. **GEOMATICS ENGINEERING (CIP: 143801)**
 - Bachelor of Science in Geomatics Engineering

3. **ENVIRONMENTAL ENGINEERING (CIP: 141401)**
 - Bachelor of Science in Environmental Engineering

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Department Overview

The Civil Engineering program at Florida Atlantic University started in 1988 as a Master of Science degree under the Department of Ocean Engineering. The Department of Civil Engineering was founded on July 1, 2001, as the result of the vision of a number of educators and prominent leaders in the local civil engineering community. The Bachelor of Science in Civil Engineering (BSCV) program was founded at the same time. The Department was formed around four active senior faculty members (each averaging over 25 years of experience) from the Department of Ocean Engineering. Before joining the Department of Civil Engineering, they were faculty members of the Ocean Engineering undergraduate program, the Master of Science in Civil Engineering program maintained by the Department of Ocean Engineering, and the Ocean Engineering doctoral program. A Department Chair was recruited at the inception. The BSCV program has been evaluated three times by ABET accreditation site visits in Fall 2003, Fall 2008 and Fall 2014, respectively, and each time, it received a full six-year accreditation.

The College of Engineering and Computer Science has offered the Master of Science (MS) in Civil Engineering since 1988. The MS program was originally offered in the Department of Ocean Engineering, and it was transferred to the Department of Civil Engineering at the creation of the Department in July 2001. The program has been growing steadily as the number of faculty members has grown from the original 5 to 15.5.

The Florida Board of Governors approved FAU's Bachelor of Science in Geomatics Engineering (BSGE) program for implementation in the Fall of 2007. This approval was the result of the vision and energy of prominent professionals in the local surveying and mapping community and the strong interest and support of the land surveying, civil engineering, and construction firms and professionals in south Florida. Their exceptionally high level of interest and concern arose from the large amount of development and construction in the area, from the shortage of trained professionals in geomatics engineering, and from a 2005-change in Florida Statutes requiring that individuals seeking licensure in Florida as professional surveyors and mappers be graduates of a four-year baccalaureate program in the discipline. There being no such academic programs in south Florida at the time, the professional community turned to the FAU College of Engineering and Computer Science for assistance. This was the motivating factor behind the establishment of the BSGE program. Since the initial ABET accreditation visit in the Fall of 2011, the BSGE program has undergone major changes in terms of its operation and its faculty. Due to the closure of the Florida Atlantic University Treasure Coast Campus in 2012, the headquarters of the BSGE program was moved to the main campus at Boca Raton, and laboratory facilities were moved to the Jupiter Campus, 30 miles north of Boca Raton to accommodate students living in St. Lucie, Martin and Okeechobee counties. After one tenure-track Assistant Professor resigned due to a personal reason in the Summer of 2012, the program comprised of a part time visiting professor as the director, one tenure track Assistant Professor and one instructor. One more tenure track Assistant Professor was hired in Fall 2013, and the Program Director retired in the same semester. In Fall 2014, the original tenure-track Assistant Professor took a faculty position in Fresno, California and the full-time instructor retired. Another tenure track Assistant Professor was hired in the same semester. In 2015, the Bachelor of Science in Geomatics Engineering received a full six-year accreditation.

Due to the overwhelming demand from industry and research community, the BS Environmental Engineering (BSEV) program at Florida Atlantic University was established in Fall 2016 with 10 students. In its second semester, 20 students have declared the major with more than 30 students in the pre-professional program having shown intention to major in the program. Since no meaningful data is available yet after only one full semester of operation, only the program objectives and curriculum are presented in this report for the BSEV.

All four CEGE programs support the College of Engineering and Computer Science strategic goals, specifically:

Goal 1: Access to and production of degrees diversity. The BSCV, BSGE and BSEV programs supplement the educational opportunities within the University and the community.

Goal 2: Meeting statewide professional and workforce needs. Civil, geomatics and environmental engineering disciplines are in very high demand for the state of Florida and provide ample employment opportunities within the private and the public sector. In addition, the mere fact that Florida is prone to natural disasters such as flooding, droughts, hurricanes, wildfires and climate change impact creates a special need for civil, geomatics and environmental engineering.

Goal 3: Building world class academic programs and research capacity. Civil, geomatics and environmental engineering are growing alongside each other and becoming well-respected programs, to enhance the Department's research capabilities. The programs bring at least two or three awards annually. For instance, the civil engineering program at FAU won the 2012 National Council of Examiners for Engineering and Surveying (NCEES) Award (\$25,000 Grand Prize Winner) for faculty/student participation in the design of the City of Dania Nanofiltration Facility that is the first water treatment plant in the world to receive a LEED Gold certification. The programs also create new opportunities for engineering collaboration with science disciplines, i.e. chemistry, biology, geology, biomedical, etc.

Goal 4: Meeting community needs and fulfilling unique institutional responsibilities. By providing graduates trained in civil engineering, geomatics engineering and environmental engineering, the Department is responding to the statewide need for STEM disciplines and particularly to those related to the natural and the built environment and infrastructure issues.

This program supports the FAU strategic plan, specifically:

Goal I: Enrich the educational experience. Expanding the breadth and scope of FAU's STEM initiatives by increasing the number of students, programs, scholarships and degree awards in STEM disciplines.

Goal II: Inspire research, scholarship and creative activity. Attracting, retaining, and increasing new research, scholarship and creative activities, and supporting the undergraduate research initiative.

Goal III: Increase FAU's community engagement. Expanding our successful and positive collaborations with the local public utilities, regulatory agencies, and private sector consulting firms in FAU's service area to foster externally funded research programs and provide opportunities for experiential learning for our students.

Goal IV: Leverage momentum toward achieving FAU's strategic goals by being good stewards of its human, technological, physical and financial resources. Retaining students with interest in civil, geomatics and environmental engineering careers to pursue their undergraduate studies in the field of civil, geomatics and environmental engineering.

Furthermore, FAU's current Strategic Plan calls for an Ocean Science and Engineering/Environmental Sciences pillar and a Sensing and Smart Systems pillar of the University that will move FAU toward national prominence. The civil, geomatics and environmental programs are a perfect complement to that pillar. The FAU strategic plan also lists a set of 6 goals in which the civil, geomatics and environmental engineering programs help the University build on existing strengths in the following ways:

- **Boldness:** Build a geographically-diverse population of students who excel in focused academic areas and engage in enriching activities that drive them to timely graduation at FAU. These programs contribute to the main pillar of ocean science and engineering/environmental sciences and the sensing and smart systems pillar as well as providing timely graduation.
- **Synergy:** Connect the most talented faculty, staff, and students via the pillars and platforms. These programs contribute to the main pillar of ocean science and engineering/environmental sciences and the sensing and smart systems pillar as well as providing opportunities for undergraduate research and inquiry.
- **Place:** Deep engagement with South Florida's global communities
- **Quality:** Continuously assessed programs. These programs are offered with ABET's continuous improvement model for excellence and are run with a resilient, lean organizational structure that capitalizes on existing world class faculty and staff.
- **Brand:** A world-class undergraduate program in civil, geomatics and environmental engineering communicates FAU's excellence and key internal stakeholders to a global audience of external constituency groups.
- **Strategy:** These programs allow FAU to become more competitive for public and private funding opportunities.

The Florida Board of Governor's Strategic Plan (2012-2015)

Goal 1: Access to and production of degrees. Increasing access to and production of professional degrees in the state of Florida.

Goal 2: Meeting statewide professional and workforce needs. Helping to meet critical needs in science/engineering/technology fields that deal with the infrastructure design and construction of the natural and the built environment.

Goal 3: Building world-class academic programs and research capacity. Helping to increase the externally funded research, patents, and broad external recognition of our academic and research programs.

Goal 4: Meeting community needs and fulfilling unique institutional responsibilities. Promoting the FAU mission statement of promoting academic and personal development, discovery, and lifelong learning through excellence and innovation in teaching, outstanding research and creative activities, public engagement and distinctive scientific and cultural alliances, all within an environment that fosters inclusiveness. Furthermore, the program addresses the community's acute need for environmental engineering graduates and professionals.

1. Bachelor of Science in Civil Engineering Academic Program Review

A1. Mission and Purpose of the Program

The Florida Atlantic University Bachelor of Science in Civil Engineering (BSCV) delivers an effective, efficient and consistent education serving the technological needs of society, especially with regards to the constructed environment in southeast Florida. FAU civil engineering produce a diverse population of competent engineers, each possessing a superior technical foundation and a vigorous liberal education. The FAU Bachelor of Science in Civil Engineering creates new opportunities for the communities and industries in southeast Florida and beyond.

The FAU Bachelor of Science in Civil Engineering creates an environment that supports individual and group success through continuous improvement. The FAU Civil Engineering faculty focuses on learning and research—our core competencies—and has a commitment to excellence in educating competent, licensed civil engineers. The FAU Civil Engineering students are active learners motivated to serve society. The FAU Civil Engineering administrators and staff are stewards of our self-governance, our roles within the University, and our support processes within the community.

Through individual dedication, FAU Civil Engineering contributes to our group success. We value ethical behavior, critical thinking, innovation, individual responsibility, thoughtful risk taking, teamwork, and leadership. We also value a balanced, holistic approach to our lives, in which the well-being of each member of our community has primacy. In this way, we feel our actions educate at least as well as our words.

B1. Date and Description of the Last External Review

The last external review by ABET was in 2014-2015. The program is fully-accredited to September 30, 2021. From the 2015 ABET review, the following finding and recommendations were made of the program:

Program Strengths

- i) Every faculty member in the Department of Civil, Environmental and Geomatics Engineering including the department chair, associate department chair, and former department chair—expressed great satisfaction with the strong and persistent collegiality of the department faculty. With these feelings that “we are in this *together*” and “*we can depend on each other*” are certainly desirable, few departments have this level of collegiality and partnership. The result is that the department has thrived with direct benefits to the students in an era of remarkable growth and financial stress.
- ii) The students in the program are highly diverse in age, race, gender, and experience almost 100 percent of the students have transferred into the program from other schools to complete bachelor degrees. The extent of this diversity is remarkable. The program takes advantage of

this diversity in various ways to enhance the learning of all students, thus taking a potential problem and turning it into an advantage.

Program Weakness

Program Criteria: Program criteria for civil engineering programs require that the program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply knowledge of four technical areas appropriate to civil engineering; conduct civil engineering experiments and analyze and interpret the resulting data; design a system, component, or process in more than one civil engineering context; explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure. The curriculum satisfies all of these requirements with one exception: the curriculum does not include “at least one additional area of basic science” beyond calculus-based physics and chemistry. Therefore, the program lacks strength of compliance to ensure that the quality of the program will not be compromised.

The weakness was resolved through a due-process response by the Department of Civil, Environmental and Geomatics Engineering. The program has since revised its curriculum to include an additional required 4-credit basic science elective effective for all students graduating after summer 2015. Students must choose either GLY2010C Physical Geology/Evolution of the Earth, or BSC1010 Biological Principles, with BSC1010L Biological Principles Lab, as part of the required curriculum. The faculty approved the proposed change on October 17, 2014. The college Undergraduate Programs Committee approved the proposed change on October 22, 2014. The University Undergraduate Programs Committee approved the proposed change on November 7, 2014. The University Senate approved the proposed change on December 5, 2014. The program provided three degree-audit forms reflecting the new curriculum change for students currently in the program.

C1. Instruction

C1.1. Establishment of Goals for Student Learning (SLOA)

For graduation, students must obtain a grade of “C” or better in all required courses including General Education Requirements, Mathematics & Sciences courses, Engineering Fundamentals courses and Professional Core courses. Students must obtain a 2.0 GPA in all Civil Engineering courses attempted.

The Department of Civil, Environmental and Geomatics Engineering (CEGE) maintains a flowchart listing all required program coursework. This flowchart and a program plan (flight plan) are reviewed with each student on a regular basis by the undergraduate advisor. The students are required to meet with their academic advisor each semester before registration for classes. Failure to maintain satisfactory progress in the program will initiate a review process by the Department.

Civil engineering faculty and industry members of the Department Advisory Council evaluate

students on content knowledge, communication skills, and critical thinking skills. Possible outcomes for a student who receives an unsatisfactory evaluation include repeating course, tutoring or additional coursework. The most recent learning outcomes plan was updated since Fall 2016 and the three outcomes - Content Knowledge, Communication and Critical Thinking are briefly outlined below:

CONTENT KNOWLEDGE (Declarative Knowledge and Technical Skills):

Students will recognize and apply concepts, principles and theories in core Civil Engineering courses (structures; geotechnical; transportation; and water resources/environmental engineering):

EGN 3311 Statics
EGN 3331 Strength of Materials
CGN 3501C Civil Engineering Materials
ENV 3001C Environmental Science and Engineering
CEG 3011C Soil Mechanics
CWR 3201C Applied Hydraulics
CES 3102C Analysis of Structures
TTE 3004C Introduction to Transportation Engineering

COMMUNICATION (Written Communication, Oral Communication, Team/ Collaborative communication)

Students will:

- Describe the interrelatedness of contemporary issues in a global and society context with civil engineering solutions;
- Communicate effectively in writing;
- Convey technical material through oral presentations;
- Function effectively in multidisciplinary teams for the following courses:
EGN 1002 Fundamentals of Engineering
CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

Students are required to write technical reports to be evaluated by the faculty members teaching EGN 1002 Fundamentals of Engineering. Students in the design sequence, CGN 4803C Civil, Geomatics and Environmental Engineering 1 and CGN 4804C Civil, Geomatics and Environmental Engineering 2, will present oral and written reports to the faculty and the industry members of the Department Advisory Council (DAC). Students receiving unsatisfactory evaluations by the faculty and DAC industry members will be required to restart the sequence in the following semester.

CRITICAL THINKING (Analytical Skills, Creative Skills, Practical Skills):

Students will:

- Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design;
- Identify, formulate and solve novel civil engineering problems;
- Design and conduct scientific and engineering experiments including analysis and interpretation of data;
- Deliver engineering results that meet performance standards for cost, safety, and quality;
- Describe the ethical and professional responsibilities of the civil engineer;
- Make and defend ethical judgments in keeping with professional standards.

All civil engineering courses contain a critical thinking component. The following courses have more in depth critical thinking components and design content:

CWR 4202 Hydrologic Engineering
 CEG 4012 Foundation Engineering
 CES 4605 Structural Steel Design
 TTE 4005 Transportation Planning & Logistics
 CES 4702 Reinforced Concrete Design
 ENV 4514 Water and Wastewater Treatment System
 CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
 CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

The critical thinking skills that students obtained from the above group of courses will be evaluated by the faculty members who teach the design sequence, CGN 4803C Civil, Environmental and Geomatics Engineering 1 and CGN 4804C Civil, Environmental and Geomatics Engineering 2. Again, students receiving unsatisfactory evaluations will be required to restart the sequence in the following semester.

Specifically,

Outcome 1. An ability to apply knowledge of engineering fundamentals, experimental methodologies, and modern engineering tools to identify and formulate engineering solutions.

Assessment Method:

In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score based on assignments, laboratory reports, exams, projects, and other assessments. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester.

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to identify, formulate, and solve engineering problems.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

These forms are appraised by an external evaluator during the ABET accreditation visit and routinely evaluated by the Department Advisory Council, consisting of industry partners.

Implementing Strategy: Students will have a working knowledge of math, science and engineering fundamentals and the ability to plan and execute an engineering design to meet an identified need in the following civil engineering areas: structural engineering, geotechnical engineering, transportation engineering, and water resources/environmental engineering, specifically with respect to the following engineering core courses:

- CEG 3011C Soil Mechanics
- CES 3102C Analysis of Structures
- CGN 3501C Civil Engineering Materials
- CWR 3201C Applied Hydraulics
- ENV 3001C Environmental Science and Engineering
- TTE 3004C Introduction to Transportation Engineering

Criterion for success:

The content knowledge that students obtained will be evaluated by the faculty members who teach the courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score for course-specific student learning outcomes a, e, h, j, and k, as stated in the assessment method. The course composite score for each outcome is based on assignments, laboratory reports, exams, projects, and other assessments. The composite scores for the 6 targeted courses is compiled and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

Outcome 2. An ability to communicate and function effectively on multi-disciplinary teams.

Assessment Method:

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to function on multi-disciplinary teams.
- An ability to communicate effectively.

Implementing Strategy:

Graduates will also be able to communicate ideas and results to diverse audiences using their knowledge of written, oral and graphical communication, function effectively on teams using their knowledge of team dynamics, team communication, social norms, and conflict management with respect to the following Writing Across the Curriculum (WAC) courses:

- CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

Criterion for success:

The communication skills that students obtained will be evaluated by the faculty members who teach the design courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score based on assignments, presentations, reports, exams, projects, and other assessments. The benchmark student success is 3.5. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester. Industry leaders and members of the Department Advisory Council assist the faculty evaluating students' achievement in the senior design project on communication skills using a faculty approved rubric.

Outcome 3. An ability to apply their discipline-specific knowledge to successfully execute a design with multiple realistic constraints using applicable design codes and standards, conduct experiments, analyze and interpret data, understand professional and ethical responsibility, and recognize the need for engaging in life-long learning.

Assessment Method:

The faculty evaluates critical thinking by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability .
- An understanding of professional and ethical responsibility.
- A recognition of the need for and an ability to engage in life-long learning.

Implementing Strategy:

Although all civil engineering courses contain a critical thinking component, the following design courses have more in depth components:

- CEG 4012 Foundation Engineering
- CES 4605 Structural Steel Design
- CES 4702 Reinforced Concrete Design
- CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental and Geomatics Engineering Design 2
- CWR 4202 Hydrologic Engineering
- ENV 4514 Water and Wastewater Treatment Systems
- TTE 4005 Transportation Planning & Logistics

Criterion for success:

The critical thinking skills that students obtained will be evaluated by the faculty members who teach the design courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score based on assignments, laboratory reports, exams, projects, and other assessments. The benchmark student success is 3.5. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester.

C1.2. Continuous Program Improvement

The faculty have developed and implemented a sophisticated continuous improvement process, as shown in Figure C1.1. It starts with the program educational objectives, student outcomes, and program curriculum with input from the Department Advisory Council (DAC). Right before students complete a course in the curriculum, students and faculty conduct a direct assessment of student performance using students' portfolios, exams, homework, laboratory reports, design projects, and other assessments. At the same time, students provide their perception of their personal level of achievement with respect to the course outcomes. Faculty members also provide their own assessment when they complete the Continuous Improvement Worksheet (CIW) at the end of the semester. With these assessments in hand, each faculty member has a complete picture of the achievement level of course outcomes. Changes will be made the next time the course is offered if there is a deficiency identified. Any student outcome that consistently receives a score below 3.5 in three assessments would prompt an immediate action from the faculty. Proposed changes are brought to the faculty and Department Advisory Council if necessary for approval. The Department of Civil, Environmental and Geomatics Engineering promptly informs the DAC of any change in the continuous improvement process (Figure C1.1).

C1.3. Review of Lower Level Prerequisite Courses in Compliance with State-approved Prerequisites

Florida Atlantic University has formulated policies and developed curricula to comply with the State Board of Education on "College-Level Communication and Computation Skills," also known as the Gordon Rule. This rule requires students entering college or university study for the first time to successfully complete, with grades of "C" or higher, 12 credits of writing and 6 credits of mathematics as a requirement for admission to the upper division. The 12 writing credits must be distributed as follows: 6 credits of English coursework (ENC 1101 College Writing 1 and ENC 1102 College Writing 2) and 6 credits of additional coursework in which the student is required to demonstrate college-level writing skills through multiple assignments. Students transferring from out-of-state institutions who think they may have completed Gordon Rule equivalent courses with grades of "C" or better must obtain a letter from the previous institution that demonstrates they have fulfilled the writing or computation criteria listed above. Both CEGE capstone design courses are approved as WAC.

C1.4. Limited Access

FAU Bachelor of Science in Civil Engineering is not a limited access program.

C1.5. Admissions Criteria

The minimum University admissions requirements are listed below:

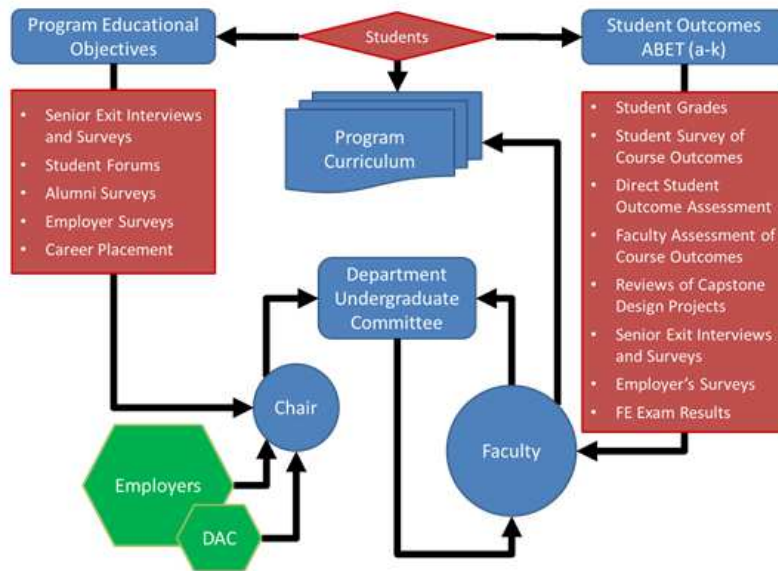


Figure C1.1 Continuous Improvement Process

Required High School Units

Additional weight is given to all courses clearly marked as Honors, Advanced, Gifted, Advanced Placement, Advanced International Certificate of Education or International Baccalaureate. The following units of study in high school are required for admission:

- English (3 with substantial composition) – 4 units
- Mathematics (Pre-Calculus and above) – 4 units
- Natural sciences (2 with lab) – 3 units
- Social Sciences – 3 units
- Foreign Language (of the same language) – 2 units
- Academic Electives – 2 units
- Total – 18 units
- GPA>3.25

The University has provisions for admitting students holding a General Equivalency Diploma (GED) and completing nontraditional programs of study. No additional admission requirements are imposed by the College of Engineering and Computer Science or the Department of Civil, Environmental and Geomatics Engineering.

Additional Admission Requirements of the College of Engineering and Computer Science

All entering freshmen interested in engineering and computer science degrees will be directly admitted to the FAU College of Engineering and Computer Science Pre-Professional Engineering Program. To be admitted to one of the engineering or computer science degree programs, students must satisfy the following requirements first:

- 1) Students must meet all University admission requirements.

- 2) In each core course, students must obtain a minimum grade of “C” and have a GPA in the core courses of 2.5 or greater. Calculation of the core GPA will be based on the highest grade received in each of the core courses. Advanced placement credit scores 4 or above will be given credit for the appropriate course(s). A score of 5 is equivalent to an “A” and a score of 4 is equivalent to a “B”.

C1.6. Enrollment Information

The number of majors enrolled in the Bachelor of Science in Civil Engineering (annual headcount) is reported in Table B4b in the IEA Report. The total number of undergraduate enrollment in the years 2012-2017 is shown in Table C1.1.

Table C1.1 Student Enrollment (IEA)

	Civil Engineering					College Total	University Total
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2016-2017	2016-2017
Bachelors	246	242	209	250	222	2,391	29,081

The headcount fluctuates from 200 to 250 students in any given year. The annualized state-fundable FTE produced in/out of Department or College is given in Table C1.2.

Table C1.2 Annualized State-Fundable FTE Produced In/Out of Department or College (IEA)

Course Level	FTE produced by students who are:	2013-2014	2014-2015	2015-2016
Lower Division Undergraduate	Majors within the department	7.7	4.6	7.4
	Majors outside the department, but within the college	8.1	11.3	7.0
	Majors outside the college	2.2	1.8	0.9
	Total	17.9	17.7	15.3
Upper Division Undergraduate	Majors within the department	78.5	75.7	81.5
	Majors outside the department, but within the college	15.7	16.4	15.2
	Majors outside the college	2.6	3.5	2.3
	Total	96.9	95.6	99.1

C1.7. Average Class Size and Student /Faculty Ratio

The data given in IEA is for both BSCV and BSGE programs.

Table C1.3 Average class size, combined with BSGE (IEA)

Course Type			2013-2014	2014-2015	2015-2016
Lecture /Seminar	Sections Offered	#	64	66	46
		# Enrolled	1,569	1,541	1,361
		Avg Section Enrollment	24.5	23.3	29.6
	Sections Faculty-Taught	#	59	60	44
		%	92.2	90.9	95.7
Lab	Sections Offered	#	6	5	
		# Enrolled	24	37	
		Avg Section Enrollment	4.0	7.4	
	Sections Faculty-Taught	#	6	3	
		%	100.0	60.0	
Other Course Types	Sections Offered	#	3	4	8
		# Enrolled	7	19	54
		Avg Section Enrollment	2.3	4.8	6.8
	Sections Faculty-Taught	#	3	4	7
		%	100.0	100.0	87.5

Table C1.4 shows the student/faculty ratio for the academic years 2013-2015. The calculation is not based on full-time equivalent students.

Table C1.4 Average Student/Faculty Ratio, combined with BSGE (IEA)

	Civil, Environmental and Geomatics			College Total	University Total
	2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
Undergraduate	17	17.1	18.2	30.5	36.2

C1.8. Curriculum including duration of program and comparison to peer programs

The BSCV program consists of 128 credits spread over a four-year period in semesters. Thus, one year of academic work is equivalent to 32 credit hours. The BSCV program curriculum consists of three components:

- General Studies (24 credits)
- Mathematics and Basic Sciences (33 credits)
- Engineering Topics (71 credits)
 - Engineering Fundamentals (21 credits)
 - Professional Core (44 credits)
 - Technical Electives (6 credits)

The BSCV curriculum consists of three components; namely, general studies (24 credits), basic mathematics and science (33 credits), and engineering topics (71 credits) consisting of engineering fundamentals (21 credits), and professional core (50 credits), as shown in Table C1.5.

Table C1.5 BSCV Curriculum (FAU Catalog)

Basic Mathematics and Sciences		
Calculus with Analytic Geometry 1 (1), (4)	MAC 2311	4
Calculus with Analytic Geometry 2 (1), (4)	MAC 2312	4
Calculus with Analytic Geometry 3	MAC 2313	4
Engineering Mathematics 1	MAP 3305	3
Probability and Statistics for Engineers	STA 4032	3
General Chemistry 1 (1)	CHM 2045	3
General Chemistry Lab 1 (1)	CHM 2045L	1
General Physics for Engineers 1 (1)	PHY 2048	3
General Physics 1 Lab	PHY 2048L	1
Physics for Engineers 2 (1), (5)	PHY 2044	3
General Physics 2 Lab	PHY 2049L	1
Basic Science Elective (1):		
Physical Geology/Evolution of the Earth or	GLY 2010C	4 or
Biological Principles and Biological Principles Lab	BSC 1010, 1010L	4
Total		34

Engineering Fundamentals		
Fundamentals of AutoCAD	CGN 2327	3
Fundamentals of Engineering	EGN 1002	3
Computer Applications in Engineering 1	EGN 2213	3
Statics	EGN 3311	3
Dynamics	EGN 3321	3
Strength of Materials	EGN 3331	3
Fundamentals of Surveying	SUR 2101	2
Fundamentals of Surveying Lab	SUR 2101L	1
Total		21

Professional Core (6)		
Soil Mechanics (7)	CEG 3011C	3
Foundation Engineering	CEG 4012	3

Analysis of Structures (7)	CES 3102C	3
Structural Steel Design	CES 4605	3
Reinforced Concrete Design	CES 4702	3
Civil Engineering Materials (7)	CGN 3501C	3
Undergraduate Research in Civil Engineering 1	CGN 3910	1
Civil, Environmental and Geomatics Engineering Design 1 (2), (7)	CGN 4803C	3
Civil, Environmental and Geomatics Engineering Design 2 (2), (7)	CGN 4804C	3
Applied Hydraulics (7)	CWR 3201C	3
Hydrologic Engineering	CWR 4202	3
Environmental Science and Engineering (7)	ENV 3001C	3
Water and Wastewater Treatment Systems	ENV 4514	3
Introduction to Transportation Engineering (7)	TTE 3004C	3
Transportation Planning and Logistics (7)	TTE 4005C	3
Total		43

Technical Electives, 6 credits from the list below (8)		
Construction Project Management	CCE 4031	3
Pavement Design	CEG 4126	3
GIS Application in Civil Engineering	CGN 4321	3
Advanced Hydraulic Systems	CWR 4223	3
Stormwater Modeling and Management	CWR 4307	3
Introduction to Terrestrial Laser Scanning	SUR 4150C	3
Transportation Operations and Logistics Management	TTE 4105	3
Total		6

Nationally, many universities, at their core, have designed civil engineering programs over four year duration to provide a combination of mechanics, hydraulics, geotechnical (using knowledge of the earth's crust to solve construction problems), materials science, environmental and water resources, and statistical analysis. Students learn to apply mathematics and scientific knowledge (particularly physics) to real-life situations and problems that arise from creating and maintaining infrastructure taking into account environmental, financial, legal and ethical considerations. Design project work is central to the BSCV program, and the students complete design projects within a team environment, as this is considered a key skill for anyone pursuing a career in civil engineering.

The FAU Bachelor of Science in Civil Engineering (BSCV) program is comparable to an ABET accredited Bachelor of Science in Civil Engineering (BSCE) degree programs offered by state universities in Florida (SUS) and in the nation.

Curriculum Relative to Comparison Schools

- Florida International University (FIU)
- University of Central Florida (UF)
- Utah State University (Utah State)
- Clemson University (Clemson)
- New Mexico State University (NMSU)

Table C1.6 Curricula Comparison (Institutions’ websites)

	FAU	FIU	UCF	Utah State	Clemson	NMSU
General Study	24	24	24	26	21	34
Basic Math and Science	34	38	39	39	35	34
Engineering Fundamentals	21	20	17	15	18	18
Professional Core	43	37	42	36	48	44
Technical Elective	6	9	6	12	6	6
Total	128	128	128	128	128	136

The FAU BSCV program has a total of 128 semester hours. The first two years provide students with building blocks necessary to be successful civil engineers, including proficiency in calculus, engineering mechanics, physics, and chemistry. During the junior year, students receive a broad introduction to the fundamental areas of civil engineering (structures, hydraulics, geotechnical, transportation, environmental, construction materials, and construction engineering and management). Design experiences are integrated throughout the curriculum, culminating in the senior year with a major capstone design project. In addition, during the senior year, students can select from available emphasis areas that serve to strengthen their undergraduate background.

C1.9. Internships, Practicum, Study Abroad and Field Experience

Engineering Cooperative Education

The College of Engineering and Computer Science’s Cooperative Education program enables qualified students to gain paid, professional work experience in business and industry prior to graduation. Co-op students either alternate periods of full-time work and study or work half time while pursuing their degrees.

The College of Engineering and Computer Science launched its Innovation Leadership Honors Program (ILHP) specifically to address these new requirements. ILHP offers a comprehensive, coordinated program incorporating leadership, innovation and entrepreneurship within the engineering and computer science curriculum, placing FAU at the forefront of engineering

education. The ILHP also provides students with invaluable practical experience and access to industry leaders. Civil Engineering students are strongly encouraged to gain practical experience through participation in internships.

C1.10. Pedagogy/Pedagogical Innovations

The College of Engineering and Computer Science offers a variety of graduate and undergraduate technical elective courses to help meet the needs of students who require more flexibility in their coursework. Internet courses can be completed in their entirety from any location with the appropriate technology. These courses use a hybrid combination of online resources (chat rooms, threaded discussions, interactive web pages, etc.) to support instruction.

Course Access/Content Delivery: FAU currently uses Canvas, a virtual learning environment and course management system. Lecture recordings are posted 2-4 hours upon completion of the live lectures.

C1.11. Institutional Contributions

The faculty in the department contribute in the following ways:

1. Many of civil engineering courses are taken by students in other colleges, departments, programs as well as non-degree engineers working in the engineering industry in Florida.
2. BSCV students have the opportunity to work in engineering research conducted by the civil engineering faculty on behalf of Federal, state, counties, cities and engineering organization.
3. Several research centers within the department allows undergraduate students to present engineering research in the national and international engineering community.

C1.12. Student Profiles, Scholarly Activities

Table C1.7 Student gender and ethnicity diversity (IEA)

Category	Gender	2013-2014	2014-2015	2015-2016
American Indian/Alaskan Native	Female	1	1	1
	Male	1	2	1
	Total	2	3	2
Asian or Pacific Islander	Female		3	4
	Male	10	8	10
	Total	10	11	14
Black (Not of Hispanic Origin)	Female	9	6	8
	Male	47	41	48
	Total	56	47	56
Hispanic	Female	17	10	17
	Male	47	36	43
	Total	64	46	60
White (Not of Hispanic Origin)	Female	15	12	20
	Male	74	72	80
	Total	89	84	100

Non-Resident Alien	Female	7	6	5
	Male	12	11	10
	Total	19	17	15
Not Reported	Female	1	1	1
	Male	1	0	2
	Total	2	1	3
Total	Female	50	39	56
	Male	192	170	194
	Total	242	209	250

C1.13. Advising Procedures

The Advising System. First year students are typically advised in their first 30 credits by the University Advising Services. Advising materials for the BSCV program are provided to the University Advising Services annually or when changes affect the civil engineering curriculum. Freshmen are also welcome to seek advising in the College of Engineering & Computer Science from engineering academic advisors employed by the Division of Engineering Student Services and Advising (DESSA).

The College of Engineering & Computer Science has centralized advising through the Division of Engineering Student Services and Advising (<http://www.dessa.fau.edu/eng-advising>). DESSA advises students in seven bachelor degree programs including civil engineering. There is a corresponding non-degree program for each bachelor degree program. The non-degree programs are Pre-Professional Engineering programs for students who have not met the minimum entrance requirements for one of the bachelor degree programs. Once those requirements are met, the student is admitted into one of the bachelor degree programs. Each engineering academic advisor specializes in at least two degree programs and is capable of advising all degree programs within the College, as needed. All advisors and staff members reside in Engineering East Building, Room 102, which also houses the Division of Engineering Student Services and Advising. There are currently two directors, an associate director, an academic programs coordinator, four professional advisors, and two program assistants.

DESSA advises students who have earned thirty or more college credit hours. All students must see an engineering academic advisor at least once each semester. During the initial visit, the engineering academic advisor interviews the student to get valuable information about the student's academic history. The student is informed about the degree requirements, and an individualized plan of study is created. After the initial visit, an engineering academic advisor evaluates a student's performance and progress in their degree program. The student's plan of study is modified by the engineering academic advisor, as necessary. Students who are identified as at-risk or are having difficulties progressing must meet with an engineering academic advisor multiple times during the term. During these meetings, strategies are developed that help the student reach academic success. A plan of study and an estimate of the expected date of graduation are developed and created for each student. The plan of study is presented in the

form of a degree program flowchart, an excel spreadsheet, or a copy of a degree audit. Each student in the College is closely monitored until all degree requirements have been met.

C1.14. Retention Rates

An important measure of the retention rate is the progress rate. Progress rate shown below indicates students that were retained after 1 year, 2 years and 3 years with a cumulative GPA over 2.0.

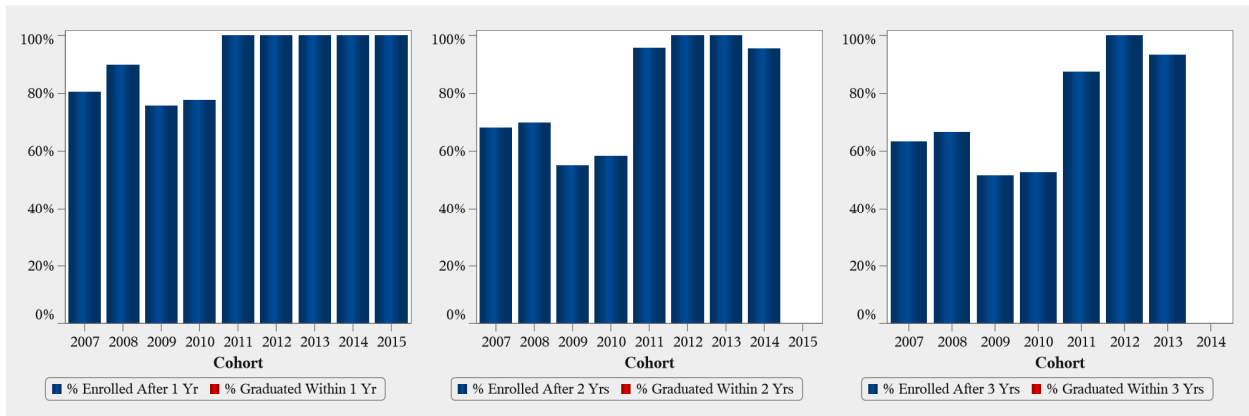


Figure C1.2 Retention Rate, 2007-2015 (IEA)

The retention rates increase after 2011 is due to the inception of the pre-professional program. Students must fulfil requirements for Calculus 1 and Physics 1 in order to move on to the major of Civil Engineering.

C1.15. Degrees Completions

Students can graduate in Fall, Spring and Summer. Since Senior Design series are no offered in summer, the majority

Table C1.8 Degree Completion, 2012-2017 (IEA)

	Civil Engineering					College Total
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2016-2017
Bachelor Degrees	59	55	42	54	57	390

C1.16. Graduation Rates

Graduation rates showcase the number of students who graduate after a specified time. Certain cohorts may show no graduation. This reflects that this group has yet to graduate in X amount of years.

Graduation Rate by Year

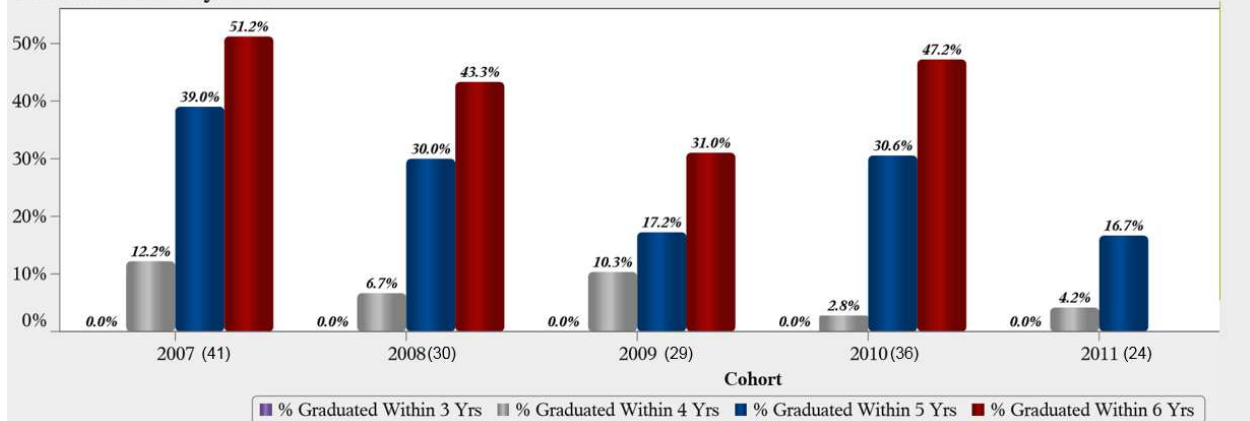


Figure C1.3 Graduation Rate, 2007-2011 (IEA)

For the cohorts of 2010 and 2011, the four year graduate rates were significantly lower than the the previous cohorts. The 2011 cohort’s 5 year graduation rate is alarmly low. It may be the result of the high employment rate in the industry.

To increase retention and graduation rate, The Department is in the process to revise the BSCV curriculum with the following three considerations:

- Increase the number of technical electives;
- Relax unnecessary prerequisites and corequisites;
- Provide studetns with early exposure to civil engineering.

C1.17. Licensure Rates

The licensure rates of the students graduating from the FAU BSCV program in the Fundamentals of Engineering (FE) and Professional Engineering (PE) examinations compare reasonably with the national pass rates since 2013 are given in Table C1.9.

Table C1.9 Licensure Rates (NCEES)

FE Exam since 2013				PE Exam since 2013			
FAU			National	FAU			National
Taker	Passing	Pass Rate	Pass Rate	Taker	Pass	Pass Rate	Pass Rate
178	75	42%	71%	137	77	56%	64%

It is notice that FAU BSCV requires taking FE before graduation. It may not be true for other BSCV programs in the country. Therefore, it is difficult to draw useful conclusions from the comparison in the above table. It makes more sense to make comparison of the FAU BSCV’s own passing rates from time to time.

C1.18. Placement Rates

The only placement data was published for 2012-2013 by the Florida Department of Education as follows:

Table C1.10 Job Placement within 6 months of graduation, 2012-2013 (FLDE)

Graduates	Employed	Full Time Employed	Full Time Average Annual Salary	Graduate School
53	43 (81%)	38 (72%)	\$52,432	9 (17%)

The placement rate for FAU BSCV graduates for 2012-2013 was the 2nd highest and the average annual salary was the highest among 9 civil engineering programs in the State University System (SUS). Given the fact that 2012-2013 was in the economic down turn, the placement rates for the last few years should be even better.

C1.19. Student Recruitment

The FAU College of Engineering and Computer Science Middle School and High School programs enable potential students to interface with the different areas of the College to find out their interests, and inspire them to consider majors in engineering and computer science. Also, the college offers the following two summer programs which are designed to motivate the high achieving high school students to consider engineering career path.

Summer Engineering Technology Program

The College offers a middle school Summer Engineering Technology program for high-achieving 7th thru 9th grade students. Students learn how to think critically in a fun and academically stimulating environment. Enrollment opens in the spring and classes are held over the summer.

Engineering Scholars Program

Engineering Scholars Program - a three-credit, dual-enrollment program in engineering and computer science for high achieving high school students in Broward and Palm Beach counties. Enrollment opens in the spring and classes are held over a three-week period in the summer.

2. Master of Science in Civil Engineering Academic Program Review

The College of Engineering and Computer Science has offered the Master of Science in Civil Engineering (MSCV) since 1988. The MSCV program was originally offered in the Department of Ocean Engineering, and it was transferred to the Department of Civil Engineering when it was created in July 2001. The program has been growing steadily as the number of faculty members has grown from the original 5 to now 15.5 faculty.

A2. Mission and Purpose of the Program

The mission and purpose of the Master of Science in Civil Engineering program is to meet the advanced civil engineering educational needs of recent graduates of undergraduate engineering programs, practicing engineers, and those non-engineering professionals wishing to redirect and advance their career paths. Graduates of the program possess the following attributes or educational outcomes: knowledge in civil engineering and related subjects significantly beyond the baccalaureate level; an ability to independently conduct research or a significant practice-oriented project in civil engineering; and an ability to communicate their ideas and results in written, oral and graphical forms.

Students complete their MSCV degree either through the thesis option or the non-thesis option. For the thesis option, students develop and defend a comprehensive original work that contributes to the understanding of an engineering research topic. For the non-thesis option, students develop a report for which the concepts and methodologies are practice-oriented and solve a practical engineering problem.

B2. Last External Reviews

There was no previous external review for this program.

C2. Instruction

C2.1. Outcome Assessment

Outcome 1. An ability to apply knowledge in civil engineering and related subjects significantly beyond the baccalaureate level.

Assessment Method:

- Thesis option: Successful completion of oral defense and other thesis requirements to meet all University, College, and Department obligations. Thesis is approved by all members of the supervisory committee. An assessment tool has been developed for this purpose.
- Non-thesis option: Successful completion of a practice-oriented project report that meets all Department requirements and is approved by the advisor and at least one other faculty reader, including a successful presentation. An assessment tool has been developed for this purpose.

Implementing Strategy:

A properly supervised program of study (which includes coursework and a thesis or practice-oriented project) is developed for each student within two semesters of admission to the MSCV program. The program is approved by the supervisory committee for thesis option students and by the advisor for non-thesis option students, as are any subsequent modifications.

Criterion for success:

80% of students achieve a score on the faculty supervisory committee assessment tool of 4.0 or better for this outcome.

Outcome 2. An ability to communicate their ideas and results in written, oral, and graphical forms.

Assessment Method:

- Thesis option: Successful completion of oral defense and other thesis requirements to meet all University, College, and Department obligations. Thesis is approved by all members of the supervisory committee. An assessment tool has been developed for this purpose.
- Non-thesis option: Successful completion of a practice-oriented project report that meets all Department requirements and is approved by the advisor and at least one other faculty reader, including a successful presentation. An assessment tool has been developed for this purpose.

Implementing Strategy:

There are two options through which MSCV students complete their degrees – the thesis option and the non-thesis option. For thesis option students, a thesis is completed. The thesis is a comprehensive original work that contributes to the understanding of an engineering problem. For non-thesis option students, a practice-oriented project report is completed. The practice-oriented project applies concepts and methodologies to the solution of a practical engineering problem. Graduate students are encouraged to attend scholarly conferences and publish research articles to enhance FAU's reputation in the field.

Criterion for Success:

75% of students achieve a score on the faculty supervisory committee assessment tool of 4.0 or better for this outcome.

Outcome 3. An ability to independently conduct research or a significant practice-oriented project in civil engineering.

Assessment Method:

- Thesis option: Successful completion of oral defense and other thesis requirements to meet all University, College, and Department obligations. Thesis is approved by all members of the supervisory committee. An assessment tool has been developed for this purpose.

- Non-thesis option: Successful completion of a practice-oriented project report that meets all Department requirements and is approved by the advisor and at least one other faculty reader, including a successful presentation. An assessment tool has been developed for this purpose.

Implementing Strategy:

There are two options through which MSCV students complete their degrees – the thesis option and the non-thesis option. For thesis option students, a thesis is completed. The thesis is a comprehensive original work that contributes to the understanding of an engineering problem. For non-thesis option students, a practice-oriented project report is completed. The practice-oriented project applies concepts and methodologies to the solution of a practical engineering problem.

Criterion for success:

80% of students achieve a score on the faculty supervisory committee assessment tool of 4.0 or better for this outcome.

C2.2. Limited Access

The MSCV is not a limited access program.

C2.3. Admissions Criteria

All students must comply with the College and Departmental admission requirements. Students with non-engineering bachelor's degrees must meet additional admission requirements. All applications are reviewed on a case-by-case basis. Students are normally admitted to the MSCV program if they:

1. Possess a baccalaureate degree in civil engineering or a closely related engineering field. Students with foreign credentials are required to have a general evaluation of their credentials. Foreign credentials are evaluated by an independent evaluation service that is a member of the National Association of Credential Evaluation Services (NACES).
2. Have achieved a 3.0 (on a 4.0 scale) grade point average in the last 60 credits of undergraduate work.
3. Have achieved scores of at least 145 (verbal) and 150 (quantitative) on the Graduate Record Examination (GRE). The GRE scores cannot be more than five years old and must be completed before admission to the program.
4. Have demonstrated proficiency in both written and spoken English. Students from non-English-speaking countries are required to take the Test of English as a Foreign Language (TOEFL) and achieve a score of 550 or 213 (computer-based).
5. Agree to abide by the graduate admission requirements of the University as published in the University Catalog.

Students with a bachelor's degree in a non-engineering discipline may satisfy the undergraduate engineering requirements and earn an MS in Civil Engineering. Students must correct deficiencies in their programs of study by taking, in addition to their regular graduate

engineering courses, certain undergraduate engineering courses appropriate to the MSCV degree objective. Four or five such courses are typically required of students with a BS degree in science, and 10 to 12 courses for students without a degree in science. The program of study is individually tailored to each student's academic background, graduate engineering degree objective and relevant experience. It is expected that full-time students with appropriate preparation and background in math, science and engineering will complete the undergraduate courses phase of the program in one year. Students without an engineering degree must satisfy the following eligibility requirements: a cumulative GPA of 3.00; completion of at least two semesters of college calculus with grades of "B" or better; satisfaction of departmental minimum GRE score requirements; and a letter of recommendation from their potential thesis advisor. The following remedial coursework is required: EGN 3311 Statics; EGN 3331 Strength of Materials; 2 civil and/or environmental engineering courses in a relevant area as determined by the graduate supervisory committee; and any other course dictated by the graduate supervisory committee.

To encourage undergraduates to pursue an MSCV degree, the Department offers a combined BS/MS degree program. This program allows students to complete both the BSCV and MSCV degrees in five years. Students first complete the undergraduate degree from which 9 credits of approved graduate-level course work may count towards the MSCV degree requirements. To be eligible for admission in BS/MS program, students must have at the end of their junior year: a cumulative GPA of 3.25 or higher (FAU and transfer courses); a total institution GPA of 3.25 or higher (FAU courses); and formally apply to the program by completing the admissions process at least one semester prior to beginning the MSCV portion of the program. The GPA must be maintained until graduation with the BS degree. The GRE is not required for the BS/MS program.

C2.4. Enrollment Information

The number of students who have applied, been admitted, and then ultimately enrolled in the MSCV program are given in Table C2.1. The five year averages for each category are 48 applied, 24 admitted and 18 newly enrolled. As illustrated in Figure 1, there is a distinct upward trend in MSCV applications, admissions and new enrollments over the past couple of years.

Table C2.1 Number of MSCV students applied, admitted and newly enrolled, 2012-2017 (IEA)

Academic Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Average
Applied	35	54	38	60	52	48
Admitted	21	23	19	31	25	24
New Enrollment	13	18	15	23	21	18

The number of MSCV students enrolled in the fall and spring semesters over the past five years is given in Table C2.2. On average, a total of 27 MSCV students enroll in the fall semester and 30 students in the spring semester. There has been a slight increase in the number of graduate classes and class size the past couple of years.

Table C2.2 Number of MSCV students enrolled each fall and spring semester (IEA)

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Average
Fall	3	11	7	13	6	27
Spring	25	30	31	33	32	30

As illustrated in Table C2.2, there is a slight upward trend in the number of students enrolled in the program over the past three years. This is consistent with the small increase in newly enrolled students over the same time period.

The BS-MS program was designed to attract in-house undergraduate students to the graduate program. To be qualify, a student must have accumulative GPA of 3.25 or better. The major advantage that students gain from this program is the GRE waiver and three graduate classes doubly counted for BSCE and MSCE. Table C2.3 shows the number of students admitted to the program and number of MSCE degree completions during 2011-2017.

Table C2.3 BS-MS Admissions and degree completions, 2011-2017 (IEA)

	2011-2012	2012-2013	2013-2015	2014-2015	2015-2016	2015-2016	Total
Admitted	6	3	11	7	13	6	46
Graduated	6	3	2	7	3	3	24

C2.5 Average Class Size and Faculty/Student Ratio

The number of graduate classes and the enrollment per class are given in Table C2.4. Over the past five years, a total of 15 graduate classes are taught in the department with an average class size of approximately 8 students per class. There has been a slight increase in the number of graduate classes and class size the past couple of years.

Table C2.4 Number of graduate classes per year and average class size, 2012-2017 (IEA)

Academic Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Average
# of Grad Classes	10	15	16	17	17	15
Enrollment / Year	75	109	115	146	139	117
Enrollment / Class	7.5	7.3	7.2	8.6	8.2	7.8

As illustrated in Figure C2.1, the most typical graduate class size is between 5 and 10 students, and the least typical class size is greater than 15 students. Class sizes between 1 and 5 students occur approximately as equally as class sizes between 10 and 15 students.

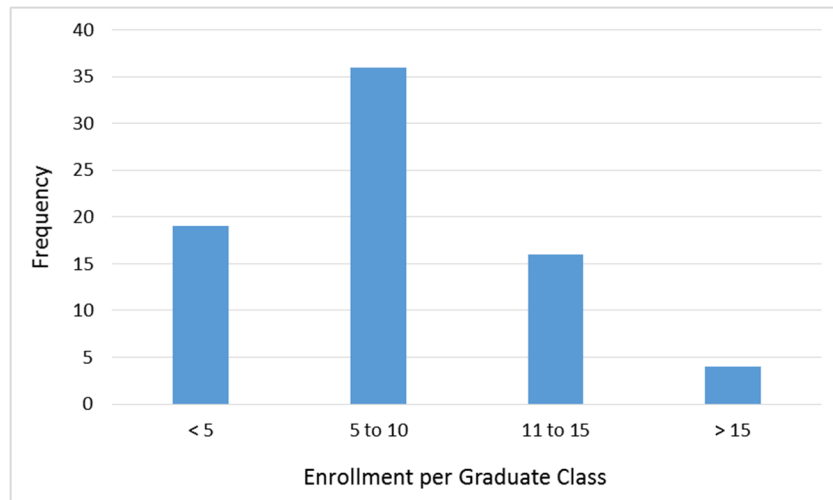


Figure C2.1. Distribution of enrollments per graduate class

The average number of enrolled MSCV students per year and the student/faculty ratios over the past five years are given in Table C2.5. The average number of MSCV students is 29 and this number has slightly increased to approximately 31 over the past couple of years. Based on the 14 faculty members who teach graduate levels courses, the average student/faculty ratio is 2.1.

Table C2.5 Average number of MSCV students each year and faculty/student ratio (IEA)

Academic Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Average
MS Students	24	27	32	31	31	29
Student/Faculty	1.7	1.9	2.3	2.2	2.2	2.1

(Based on 14 faculty members teaching graduate courses).

C2.6. Curriculum including duration of program and comparison to peer programs

All students complete their MSCV degree in one of three areas of concentration:

1. Structural /Geotechnical Engineering
2. Transportation/Geomatics Engineering
3. Water Resources /Environmental Engineering

A minimum of 2 core courses is required in each concentration. No more than 3 credits of Directed Independent Study may be applied toward the MSCV degree. All courses must be part of an approved Plan of Study.

Core Courses in Structural/Geotechnical Engineering

- CES 6124 Soil Stabilization and Geosynthetics
- CES 6106 Advanced Structural Analysis
- CES 6325 Bridge Design

CES 6585 Structural Dynamics
CES 6715 Prestressed Concrete
EOC 6430 Coastal Structures

Core Courses in Transportation/Geomatics Engineering

TTE 6651 Sustainable Public Transportation
TTE 6815 Highway Engineering
TTE 6272 Intelligent Transportation Systems
TTE 6508 Maritime Freight Operations
TTE 6259 Traffic Signal Systems

Core Courses in Water Resource/Environmental Engineering

ENV 6418 Water Supply and Treatment
ENV 6507 Wastewater Engineering
CWR 6818 Water Resource System Engineering
CWR 6125 Groundwater Flow
CWR 6235 Open Channel Hydraulics
CWR 6525 Dynamic Hydrology

For students in the combined BS/MS degree program, up to 6 credits of approved graduate-level course work may count towards both degree objectives provided the student has met the minimum 120 credits for the BS degree, and the student has taken a minimum of 30 credits at the 5000 level or higher for the MSCV degree. Students complete the BS degree first and not simultaneously.

Thesis Option (Minimum 30 credit hours)

6 credit hours of CGN 6971 Master's Thesis and 24 credit hours of approved coursework with the following constraints: minimum 15 credit hours at the 6000 level; minimum 12 credit hours of CEGE courses; and maximum of 9 credits of CEGE courses at the 5000 level may be applied toward the degree. Students must successfully complete the thesis and defend their work during an oral examination with the Supervisory Committee.

Non-Thesis Option (Minimum 33 credit hours)

3 credits of CGN69XX Master's Project and 30 credits of approved coursework with the following constraints: minimum of 18 credit hours at the 6000 level; minimum of 21 credit hours in CEGE courses; maximum of 9 credit hours of CEGE courses at the 5000 level; and a maximum of 3 credits of CEGE courses at the 4000 level. Students must successfully complete the thesis a practice-oriented project and defend their work at a seminar with the Supervisory Committee.

Table C2.6 MSCV Curriculum Comparison

Curriculum	Number of Credits				
	FAU	George Mason	Old Dominion	University of Louisville	Portland State
Core Courses	6	6	12		
Electives	18	18	21	24	36
Thesis	6	6	6	6	6-9
Total Credits	30	30	30	30	45

C2.7. Internships, Practicum, Study Abroad, Field Experiences

At the graduate level, very few of our students are involved in these types of activities. Part-time MSCV degree students usually work for companies and government entities in which learning opportunities and experiences of this type are part of their job. Students performing research in the field gain experiences outside of the classroom or laboratory.

C2.8. Pedagogy/Pedagogical Innovations

The Department offers all of its graduate courses as live lectures with video capture technology that automatically uploads each lecture to Canvas (previously Blackboard). Graduate courses are also taught in the late afternoon and early evening to allow working professionals to attend the live lectures after work. The Department provides an innovative approach to completing the MSCV degree by providing careful course sequencing with the BS/MS program that allows students to complete both the BSCV and MSCV degrees in the most efficient way possible.

C2.9. Scope of Institutional Contributions

The faculty in the Department contribute in the following ways:

- 1) Many of our faculty serve on supervisory committees for graduate students in other programs.
- 2) Several MSCV students work collaboratively with the Ph.D. students in OME and are supervised by faculty in CECE with collaboration from faculty in OME.

The Department offers an innovative Graduate Certificate program in Transportation Engineering. Since transportation engineering is an interdisciplinary field of study, the certificate program integrates many aspects of engineering with computer science, quantitative methods, and technological innovations associated with traffic operations, safety, intelligent transportation, supply chain and management operations. The program is practice-oriented and designed to assist engineers, planners, researchers and technical professionals in developing their careers in the transportation field.

Admission to the Graduate Certificate program in Transportation Engineering is open to all prospective students and industry professionals who hold a bachelor's degree in Engineering or a related field. Prospective students must have a 3.0 GPA to ensure equivalency to graduate standing. Students enrolled in the certificate program are classified as non-degree-seeking students. Credits earned in non-degree status may be applied to the MSCV degree program if a

student is later admitted to the program. However, only up to one-third of the non-degree credits with a grade of "B" or higher can be transferred to satisfy the MSCV degree requirements.

To satisfy the Transportation Engineering certificate program requirements, students must complete four courses from the following list with a minimum 3.0 GPA.

- TTE 5501 Transportation System Analysis
- TTE 6272 Intelligent Transportation Systems
- TTE 6507 Transportation and Supply Chain Systems
- TTE 6508 Maritime Freight Operations
- TTE 6526 Airport Planning and Design
- TTE 6815 Highway Engineering

C2.10. Student Profile

The ethnicity of MSCV students enrolled in the fall semester over the past five years is given in Table C2.7. On average, the MSCV students are 7% Asian, 11% Black or African American, 15% Hispanic or Latino, 22% Nonresident Alien, and 41% White. According to data collected by the American Society for Engineering Education, the national average for MSCV degree students in all fields of engineering in 2015 were 15% Asian, 4% Black or African American, 8% Hispanic or Latino, 47% Nonresident Alien, and 60% White. Comparison with this information indicates that the MSCV program at FAU has double the percentage of African American and Hispanic students than the typical Master of Science in engineering degree programs nationally. However, the MSCV program does have approximately half the percentage of Asian and Nonresident Aliens students than the national average.

Table C2.7 Ethnicity of students in the MSCV program

Fall Semester	2012	2013	2014	2015	2016	Average
Asian	2	3	2	1	0	2
Black or African American	3	2	5	3	4	3
Hispanic or Latino	3	4	5	2	7	4
Two or More Races	1	1	1	0	1	1
Nonresident Alien	4	4	5	10	7	6
White	9	10	14	13	11	11
Total	22	24	32	29	30	27

The gender of MSCV students enrolled in the fall semester over the past five years is given in Table C2.8. On average, the MSCV students are 30% female and 70% male. According to data collected by the ASEE, the national average for MSCV degree students in civil engineering in 2015 was 35% female and 65% male. The MSCV program at FAU compares closely to the national average with regard to gender.

Table C2.8 Gender of students in the MSCV program

Fall Semester	2012	2013	2014	2015	2016	Average
Female	5	10	9	8	8	8
Male	17	14	23	21	22	19
Total	22	24	32	29	30	27

C2.11. Advising Procedures

Students are expected to meet with their faculty advisor on a regular basis and make progress towards completion of their degree. All MSCV students must develop and submit a Plan of Study before the second semester of study. Students pursuing the Thesis Option are expected to form a thesis committee in consultation with their faculty advisor and successfully defend their thesis in their last semester. Students pursuing the Non-Thesis Option also meet with their faculty advisor on a regular basis to develop a project report that is appropriate for the degree.

Students are expected to maintain a GPA of 3.0 or higher throughout their course of study. Students with a GPA below this minimum are required to complete an Academic Progression Plan specifying the courses and grades needed to correct the deficiency and submit the form to the Graduate College. Student may be dismissed from the program if they fail to meet the requirements of the Academic Progression Plan. In the semester of intended graduation, students must submit an Application for Degree, and if needed, submit a revision to the Plan of Study to the Graduate College.

C2.12. Licensure Rates

Not Applicable to the MSCV degree

C2.13. Placement Rates/Employment Profile

The department tracks job placement rates and other employment data as it is made available by graduate of the program. Most MSCV students find a job shortly after graduation, or they already have an engineering job while pursuing the degree. Other MSCV graduates continue to their doctorate programs.

C2.14. Retention Rates

Data is unavailable.

C2.15. Graduation Rates

Data is unavailable.

C2.16. Degrees Awarded

The number of MSCV degrees awarded in the past five years is given in Table C2.9. On average, a total of 10 students graduate with a MSCV degree each year.

Table C2.9 Number of MSCV degrees completed each year (IEA)

MS Degree	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Average
Completed	9	8	12	9	13	10

As illustrated in Table C2.9, there appears to be a slight upward trend in degree completion. However, with an average of 29 enrolled students each year the percentage of those graduating is below the national average for MSCV degrees awarded in STEM fields.

C2.17. Student Recruitment

Recruitment occurs as faculty members with research funding search for graduate students nationally and internationally through discipline-specific channels. The MSCV program has a limited number of teaching assistantships (typically 10 academic year stipends with tuition waivers) to offer to the top applicants. Applicants must meet or exceed the minimum GRE and GPA standards, and be deemed good prospects to receive financial support.

The recruitment grant program sponsored by the Graduate College at FAU provides funds that can be used to advertise to prospective students at academic conferences. Students are recruited primarily by having accurate and up-to-date information about the MSCV program on the departmental website and by faculty who visit universities domestically and internationally. MSCV information is sent to engineering community to attract practitioners to the MSCV degree at FAU. The department also recruits FAU undergraduate students at the annual Graduate School Fair and through personal interactions with students who conduct research with faculty while they are undergraduates.

C2.18. Ph.D. Tracks in Mechanical and Ocean Engineering

The CEGE Department had written agreement with the Department of Ocean and Mechanical Engineering to embed a Ph.D. in Civil and Sustainable Infrastructure tracks in their programs. Following requirement of Ph.D. programs in Ocean and Mechanical Engineering, students registered for those tracks are supervised by CEGE faculty. Three Ph.D. students have graduated from those tracks. There are 7 students currently registered in the Ph.D. tracks.

3. Bachelor of Science in Geomatics Engineering Academic Program Review

A3. Mission and Purpose of the Program

The Bachelor of Science in Geomatics Engineering program functions within a larger framework that includes the Department of Civil, Environmental and Geomatics Engineering, the College of Engineering & Computer Science, and Florida Atlantic University. Our mission statement serves and complements the missions of all three.

Geomatics Engineering Mission and Values

The Bachelor of Science in Geomatics Engineering program strives to deliver a quality educational experience in surveying, mapping, and emerging geomatics technologies throughout the FAU service area and beyond and makes a significant contribution to the needs of a growing southeast Florida community. Program faculty focus on student-centered learning methodologies that requires students to be active, responsible participants in their own learning. This program values ethical behavior, critical thinking, innovation, individual responsibility, thoughtful risk taking, teamwork, and leadership.

B3. Date and Description of Last External Review

The last external review by ABET was in 2014. The program is fully-accredited to September 30, 2021.

Program Strength

1. The program's broad curriculum design reflects Florida's Professional Surveyors and Mappers licensure regime, which utilizes a very broad definition of "surveyor," one of the most comprehensive in the U.S. The program criteria require coverage in only one of six areas, but all areas are offered in the program. The resulting breadth of the program is a significant strength and provides the students with numerous career paths from which to choose.
2. The program is unusual in that its coursework is offered simultaneously on two campuses approximately 40 miles apart. The students are expected to complete coursework at each campus in addition to utilizing distance-learning technologies. Students and faculty members alike commented on the effectiveness of these logistical factors, even recognizing them as strength in terms of exposure to a diverse environment and technology that will serve them well in their careers.

C3. Instruction

C3.1. Outcome Assessment

The following goals for student learning have been established as follows (see attached copy of SLOA):

For graduation, students must obtain a grade of "C" or better in all required courses including General Education Requirements, Mathematics & Sciences courses, Engineering Fundamentals

courses and Professional Core courses. Students must obtain a 2.0 GPA in all Geomatics Engineering courses attempted.

The program maintains a flowchart listing all required coursework. This flowchart and a program plan (flight plan) are reviewed with each student on a regular basis by the Undergraduate advisor. The students are required to meet with their advisor each semester before registration for classes. Failure to maintain satisfactory progress in the program will initiate a review process by the program faculty. Geomatics engineering faculty and professional members of the Program Advisory Council (PAC) evaluate students on content knowledge, communication skills, and critical thinking skills. Possible outcomes for a student who receives an unsatisfactory evaluation include repeating course, tutoring or additional coursework.

CONTENT KNOWLEDGE (Declarative Knowledge and Technical Skills):

Students will recognize and apply concepts, principles and theories in core Geomatics Engineering courses (surveying, geographic information systems, remote sensing, photogrammetry, and legal and business practices).

SUR 2034 Introduction to Geomatics

SUR 2101/L Fundamentals of Surveying with Lab

GIS 3015 Introduction to Maps and GIS with Lab

SUR 3643 Surveying Data Analysis

SUR 3530 Introduction to Geodesy

SUR 4331 Digital Photogrammetry Principles and Applications with Lab

SUR 3205 Engineering and Construction Surveying with Lab

SUR 3141 Automated Surveying with Lab

SUR 3463 Land Subdivision and Platting with Lab

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for each class in the Continuous Improvement Worksheet (CIW) at the end of the semester. A score less than 4.0 will result in an improvement strategy to be implemented in the following semester.

COMMUNICATION (Written Communication, Oral Communication, Team/ Collaborative Communication)

Students will:

- Describe the interrelatedness of contemporary issues in a global and society context with Geomatics Engineering solutions.
- Communicate effectively in writing.
- Convey technical material through oral presentations.
- Function effectively in multidisciplinary teams for the following courses:
EGN 1002 Fundamentals of Engineering,
CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

Geomatics engineering students are required to write technical reports to be evaluated by the faculty members teaching EGN 1002 Fundamentals of Engineering. Students in the design sequence, CGN 4803C Civil, Environmental and Geomatics Engineering 1 and CGN 4804C Civil, Environmental and Geomatics Engineering 2, will present oral and written reports to the faculty and the industry members of the Program Advisory Council (PAC). Students receiving unsatisfactory evaluations by the faculty and PAC members will be required to restart the sequence in the following semester.

CRITICAL THINKING (Analytical Skills, Creative Skills, Practical Skills):

Students will

- Use modern engineering techniques, skills, and tools, including computer-based tools for analysis and design;
- Identify, formulate and solve novel Geomatics engineering problems;
- Design and conduct scientific and engineering experiments including analysis and interpretation of data;
- Deliver engineering results that meet performance standards for cost, safety, and quality;
- Describe the ethical and professional responsibilities of the geomatics engineer;
- Make and defend ethical judgments in keeping with professional standards

All geomatics engineering courses contain a critical thinking component. The following courses have more in depth critical thinking components:

GIS 4035 Remote Sensing of the Environment

GIS 4043 Principles of Geographic Information Environment Systems

SUR 4536 Satellite Positioning with Lab

SUR 4403 Legal Aspects of Surveying

CGN 4803C Civil, Environmental and Geomatics Engineering Design 1

CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

The critical thinking skills that students obtain from the above group of courses will be evaluated by the faculty member who teaches the design sequence, CGN 4803C Civil, Environmental and Geomatics Engineering 1 and CGN 4804C Civil, Environmental and Geomatics Engineering Design 2. Again, students receiving unsatisfactory evaluations will be required to restart the sequence in the following semester.

Specifically,

Outcome 1. An ability to apply knowledge of engineering fundamentals, experimental methodologies, and modern engineering tools to identify and formulate engineering solutions.

Assessment Method:

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to identify, formulate, and solve engineering problems.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice – specifically: Graduates will have an advanced understanding of the following areas of Geomatics Engineering: 1) Surveying, including but not limited to, boundary and land surveying, subdivision and plat creation, control surveys, and construction surveys; 2) geographic information systems (GIS), 3) photogrammetry and remote sensing; 4) mapping, to include but not limited, to topographic maps, cadastral maps, and land use maps; 5) geodesy, and; 6) Global Navigation Satellite Positioning Systems (GPS, GLONASS, etc.) (k). These forms are appraised by an external evaluator during the ABET accreditation visit and routinely evaluated by the Program Advisory Council, consisting of industry partners.

These forms are appraised by an external evaluator during the ABET accreditation visit and routinely evaluated by the Program Advisory Council, consisting of industry partners.

Implementing Strategy:

Students will have a working knowledge of math, science and engineering fundamentals and the ability to plan and execute an engineering design to meet an identified need in the following geomatics engineering areas: 1) Surveying, including but not limited to, boundary and land surveying, subdivision and plat creation, control surveys, and construction surveys, 2) geographic information systems (GIS), 3) photogrammetry and remote sensing 4) mapping, to include but not limited, to topographic maps, cadastral maps, and land use maps, 5) geodesy, and 6) Global Navigation Satellite Positioning Systems (GPS, GLONASS, etc.), specifically with respect to the following engineering core courses:

- SUR 2034 Introduction to Geomatics Engineering
- SUR 2101 Fundamentals of Surveying
- SUR2101L Fundamentals of Surveying Lab
- SUR4331 Digital Photogrammetry Principles and Applications
- SUR4331L Digital Photogrammetry Principles and Applications Lab
- SUR3141 Auto Surveying and Mapping
- SUR3141L Auto Surveying and Mapping Lab
- SUR3530 Geodesy
- SUR3205 Engineering Construction Surveying
- SUR3205L Engineering Construction Surveying Lab

Criterion for success:

The content knowledge that students obtained will be evaluated by the faculty members who teach the courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score for course-specific student learning outcomes a, e, h, j, and k, as stated in the assessment method. The course composite score for each outcome is based on assignments, laboratory reports, exams, projects, and other assessments. The composite scores for the 6 targeted courses is compiled and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

Outcome 2. An ability to communicate and function effectively on multi-disciplinary teams.

Assessment Method:

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to function on multi-disciplinary teams
- An ability to communicate effectively

Implementing Strategy:

Graduates will be able to communicate ideas and results to diverse audiences using their knowledge of written, oral and graphical communication, function effectively on teams using their knowledge of team dynamics, team communication, social norms, and conflict management with respect to the following Writing across the Curriculum (WAC) courses:

- CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

Criterion for success:

The communication skills that students obtained will be evaluated by the faculty members who teach the design courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty and members of the geomatics engineering industry provide a composite score for course-specific student learning outcomes d and g as stated in the assessment method. The course composite score for each outcome is based on based on assignments, presentations, reports, exams, projects, and other assessments. The composite scores for the two targeted courses is compiled, and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

Outcome 3. An ability to apply their discipline-specific knowledge to successfully execute a design with multiple realistic constraints using applicable design codes and standards, conduct experiments, analyze and interpret data, understand professional and ethical responsibility, and recognize the need for engaging in life-long learning.

Assessment Method:

The faculty evaluates critical thinking by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to design and conduct experiments and to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- An understanding of professional and ethical responsibility.
- A recognition of the need for and an ability to engage in life-long learning.

Implementing Strategy:

Although all geomatics engineering courses contain a critical thinking component, the following design courses have more in depth components:

- SUR2034 Introduction to Geomatics Engineering
- SUR2101 Fundamentals of Surveying
- SUR2101L Fundamentals of Surveying Lab
- SUR4331 Digital Photogrammetry Principles and Applications
- SUR4331L Digital Photogrammetry Principles and Applications Lab
- SUR3141 Auto Surveying and Mapping
- SUR3141L Auto Surveying and Mapping Lab
- SUR3530 Geodesy
- SUR3205 Engineering Construction Surveying
- SUR3205L Engineering Construction Surveying Lab

Criterion for success:

The critical thinking skills that students obtained will be evaluated by the faculty members who teach the courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provide a composite score for course-specific student learning outcomes b, c, f, and i, as stated in the assessment method. The course composite score for each outcome is based on based on assignments, presentations, laboratory reports, exams, projects, and other assessments. The composite scores for the six targeted courses is compiled, and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

C3.2. Continuous Program Improvement

The procedure of the Continuous Program Improvement is the same as shown in Figure C1.1.

C3.3. Review of Lower Level Prerequisite Courses in Compliance with State-Approved Prerequisites

FAU has formulated policies and developed curricula to comply with the State Board of Education on "College-Level Communication and Computation Skills," also known as the Gordon Rule. This rule requires students entering college or university study for the first time to successfully complete, with grades of "C" or higher, 12 credits of writing and 6 credits of

mathematics as a requirement for admission to the upper division. The 12 writing credits must be distributed as follows: 6 credits of English coursework (ENC 1101 College Writing 1 and ENC 1102 College Writing 2) and 6 credits of additional coursework in which the student is required to demonstrate college-level writing skills through multiple assignments. Students transferring from out-of-state institutions who think they may have completed Gordon Rule equivalent courses with grades of "C" or better must obtain a letter from the previous institution that demonstrates they have fulfilled the writing or computation criteria listed above.

C3.4. Limited Access

Florida Atlantic University Bachelor of Science in Geomatics Engineering is not a limited access program.

C3.5. Admissions Criteria

The minimum University admissions requirements are listed below:

Required High School Units

The following units of study in high school are required to be considered for admission to FAU:

- English (3 with substantial composition): 4 units
- Mathematics (Algebra 1 level and above): 4 units
- Natural Science (2 with lab): 3 units
- Social Science: 3 units
- Foreign Language (of the same language): 2 units
- Academic Electives: 2 units

Total: 18 units

If a student is currently taking or have taken courses that are clearly marked as Honors, Advanced, Gifted, Advanced Placement, Advanced International Certificate of Education or International Baccalaureate, additional weight will be given for these courses. If you would like to read more about the courses that will count towards your degree visit: <http://www.fau.edu/admissions/examcredit.php>.

The University has provisions for admitting students holding a General Equivalency Diploma (GED) and completing nontraditional programs of study. No additional admission requirements are imposed by the College of Engineering and Computer Science or the Department of Civil, Environmental and Geomatics Engineering.

Additional Admission Requirements of the College of Engineering and Computer Science

All entering freshmen interested in engineering and computer science degrees will be directly admitted to the FAU College of Engineering and Computer Science Pre-Professional Engineering Program. To be admitted to one of the engineering or computer science degree programs, students must satisfy the following requirements first:

- Students must meet all University admission requirements.

- In each core course, students must obtain a minimum grade of “C” and have a GPA in the core courses of 2.5 or greater. Calculation of the core GPA will be based on the highest grade received in each of the core courses. Advanced placement credit scores 4 or above will be given credit for the appropriate course(s). A score of 5 is equivalent to an “A” and a score of 4 is equivalent to a “B”.

C3.6. Enrollment Information

The number of majors enrolled in the Bachelor of Science in Geomatics Engineering (annual headcount) in the years 2012-2017 is shown in Table C3.1.

Table C3.1 Student Enrollment, 2007-2015 (IEA)

	Geomatics Engineering (CIP:143801)					College Total	University Total
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2016-2017	2016-2017
Bachelor	16	16	14	24	22	2,712	29,081

The average State-funded FTE production in/out of Department and College is shown in Table C3.2 with combination of the FAU BSCV program.

Table C3.2 Annualized State-Fundable FTE Produced In/Out Of Department or College (IEA)

Course Level	FTE produced by students who are:	2013-2014	2014-2015	2015-2016
Lower Division Undergraduate	Majors within the department	7.7	4.6	7.4
	Majors outside the department, but within the college	8.1	11.3	7.0
	Majors outside the college	2.2	1.8	0.9
	Total	17.9	17.7	15.3
Upper Division Undergraduate	FTE produced by students who are:	78.5	75.7	81.5
	Majors within the department			
	Majors outside the department, but within the college	15.7	16.4	15.2
	Majors outside the college	2.6	3.5	2.3
	Total	96.9	95.6	99.1

C3.7. Average Class Size and Student/Faculty Ratio

The data available for average class size was given IEA as the combination with the BSCV program shown in the Table C3.3.

Table C3.3 Average class size, combined with BSCV (IEA)

Civil Environmental & Geomatics Engineering						
Course Level	Type			2013-2014	2014-2015	2015-2016
Undergraduate	Lecture/ Seminar	Sections Offered	#	64	66	66
			# Enrolled	1,569	1,541	1,361
			Avg Section Enrollment	24.5	23.3	29.6
		Sections Faculty-Taught	#	59	60	44
			%	92.2	90.9	95.7
	Lab	Sections Offered	#	6	5	
			# Enrolled	24	37	
			Avg Section Enrollment	4.0	7.4	
		Sections Faculty-Taught	#	6	3	
			%	100.0	60.0	
	Other Course Types	Sections Offered	#	3	4	8
			# Enrolled	7	19	54
			Avg Section Enrollment	2.3	4.8	6.8
Sections Faculty-Taught		#	3	4	7	
		%	100.0	100.0	87.5	

Similarly, Table C3.4 shows the student/faculty ratio for the academic years 2013-2015 for both BSGE and BSCV programs. The calculation is not based on full-time equivalent students.

Table C3.4 Average student/faculty ratio, combined with BSCV (IEA)

	Civil, Environmental and Geomatics			College Total	University Total
	2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
Undergraduate	17	17.1	18.2	30.5	36.2

C3.8. Curriculum Including Duration of Program and Comparison to Peer Programs

The Bachelor of Science in Geomatics Engineering program consists of 120 credits spread over a four-year period in semesters. Thus, one year of academic work is equivalent to 32 credit hours. The BSGE program curriculum consists of three components:

- General Studies (24 credits)
- Mathematics and Basic Sciences (33 credits)
- Engineering Topics (71 credits)
 - Engineering Fundamentals (6 credits)
 - Professional Core (51 credits)
 - Technical Electives (6 credits)

The BSGE curriculum consists of three components; namely, general studies (24 credits), basic mathematics and science (33 credits), and engineering topics (63 credits) consisting of engineering fundamentals (6 credits), and professional core (57 credits).

Table C3.5 BSGE Curriculum (FAU Catalog)

General Studies		
College Writing 1 (1), (2)	ENC 1101	3
College Writing 2 (1), (2)	ENC 1102	3
Intellectual Foundations Program: Society and Human Behavior Courses (1), (3)		6
Intellectual Foundations Program: Global Citizenship Courses (1), (3)		6
Intellectual Foundations Program: Creative Expressions Courses (1), (3)		6
Total		24

Basic Mathematics and Sciences		
Calculus with Analytic Geometry 1 (1), (4)	MAC 2311	4
Calculus with Analytic Geometry 2 (1), (4)	MAC 2312	4
Engineering Math 1	MAP 3305	3
Probability and Statistics for Engineers	STA 4032	3
General Chemistry 1 (1)	CHM 2045	3
General Chemistry 1 Lab (1)	CHM2045L	1
General Physics for Engineers 1 (1)	PHY 2048	3
General Physics 1 Lab	PHY 2048L	1
Physics for Engineers 2 (1), (5)	PHY 2044	3
General Physics 2 Lab	PHY 2049L	1
Introduction to Physical Geography	GEO 2200C	3
Science or Math Elective (10)		4
Total		33

Engineering Fundamentals		
Fundamentals of Engineering	EGN 1002	3
Introduction to Geomatics Engineering	SUR 2034	3
Total		6

Professional Core (6)		
Fundamentals of Surveying	SUR 2101	2
Fundamentals of Surveying Lab	SUR 2101L	1

Fundamentals of AutoCAD	CGN 2327	3
Computer Applications in Engineering 1	EGN 2213	3
Introduction to Mapping and GIS (7)	GIS 3015C	3
Surveying Data Analysis	SUR 3643	3
Digital Photogrammetry Principles and Applications (8)	SUR 4331	2
Digital Photogrammetry Principles and Applications Lab (8)	SUR 4331L	1
Automated Surveying and Mapping	SUR 3141	2
Automated Surveying and Mapping Lab	SUR 3141L	1
Principles of Geographic Information Systems (7)	GIS 4043C	3
Introduction to Geodesy	SUR 3530	3
Engineering and Construction Surveying	SUR 3205	2
Engineering and Construction Surveying Lab	SUR 3205L	1
Land Subdivision and Platting	SUR 3463	2
Land Subdivision and Platting Lab	SUR 3463L	1
Civil, Environmental and Geomatics Engineering Design 1	CGN 4803C	3
Remote Sensing of the Environment (7)	GIS 4035C	3
Legal Aspects of Surveying	SUR 4403	3
Satellite Positioning	SUR 4531	2
Satellite Positioning Lab	SUR 4531L	1
Civil, Environmental and Geomatics Engineering Design 2	CGN 4804C	3
Introduction to Terrestrial Laser Scanning	SUR 4150C	3
Total		51
Technical Electives (select two courses from the list below) (9)		
Transportation Operations and Logistics Management	TTE 4105	3
Construction Project Management	CCE 4031	3
GIS for Civil Engineering Applications	CGN 4321	3
Programming in GIS	GIS 4102C	3
Field Methods	GLY 4750C	3
Hydrogeology	GLY 4822	3
Transportation and Spatial Organization	GEO 4700	3
Application in GIS	GIS 4048C	3
Introduction to Hydrogeology Modeling and Aquifer Test	GLY 4832C	3
Digital Image Analysis	GIS 4037C	3

Geovisualization and GIS	GIS 4138C	3
Engineering Geology	GLY 4830	3
Entrepreneurship	ENT 4024	3
Business Law 1	BUL 4421	3
Engineering Economics	EGN 4613	3
Hydrographic Surveying (7)	SUR 4302	3
Hydrographic Surveying Lab (7)	SUR 4302L	1
Thermal Infrared Remote Sensing and Applications	SUR 4384	3
Total		6

Curriculum Relative to Comparison Schools

- Michigan Technological University (MTU)
- New Mexico State University (NMSU)
- University of Florida (UF)
- California State University, Fresno (Fresno)

Table C3.6 Core Course Comparison (Institutions' websites)

Courses to Compare	FAU	MTU	NMSU	UF	Fresno
Geodesy	R	R	R	R	R
Photogrammetry	R	R	R	R	R
Land Subdivision Design	R	R	R	R	R
Data Adjustment	R	R	R	R	R
Construction Surveying	R	N	R	R	R
GIS	R	R	N	R	R
Remote Sensing	R	N	N	R	R
Satellite Positioning	R	R	R	R	R
Legal Aspects of Surveying	R	R	R	R	R
Plane Surveying	R	R	R	R	R
Laser Scanning	R	R	N	N	N

C3.9. Internships, Practicum, Study Abroad and Field Experience

Engineering Cooperative Education

The College of Engineering and Computer Science's Cooperative Education program enables qualified students to gain paid, professional work experience in business and industry prior to graduation. Co-op students either alternate periods of full-time work and study or work half time while pursuing their degrees.

The College of Engineering and Computer Science launched its Innovation Leadership Honors Program (ILHP) specifically to address these new requirements. ILHP offers a comprehensive,

coordinated program incorporating leadership, innovation and entrepreneurship within the engineering and computer science curriculum, placing FAU at the forefront of engineering education. The ILHP also provides students with invaluable practical experience and access to industry leaders. Civil Engineering students are strongly encouraged to gain practical experience through participation in internships.

C3.10. Pedagogy/Pedagogical Innovations

The College of Engineering and Computer Science offers a variety of graduate and undergraduate courses to help meet the needs of students who require more flexibility in their coursework. Internet courses can be completed from any location with the appropriate technology and flexibility required live laboratory sections. These courses use a combination of online resources (chat rooms, threaded discussions, interactive web pages, etc.) to support instruction.

Course Access/Content Delivery: FAU currently uses Canvas, a virtual learning environment and course management system. Lecture recordings are posted 2-4 hours upon completion of the live lectures.

Surveying and Mapping Certificate

The Geomatics Engineering program offers undergraduates a certificate in Surveying and Mapping. Students are entitled to the certificate by completing a minimum of 12-credits of coursework with a grade of "C" or better. Selected courses must be checked for the proper prerequisites. The certificate is open to both degree-seeking and non-degree-seeking students.

Table C3.7 Surveying and Mapping Certificate (FAU Catalog)

Required Courses (6 credits)		
Introduction to Geomatics Engineering	SUR 2034	3
Fundamentals of Surveying (1)	SUR 2101	2
Fundamentals of Surveying Lab (1)	SUR 2101L	1
Select additional courses from below for a minimum of 6 credits		
Digital Photogrammetry Principles and Applications (2)	SUR 4331	2
Digital Photogrammetry Principles and Applications Lab (2)	SUR 4331L	1
Automated Surveying and Mapping (2)	SUR 3141	2
Automated Surveying and Mapping Lab (2)	SUR 3141L	1
Land Subdivision and Platting (2)	SUR 3463	2
Land Subdivision and Platting Lab (2)	SUR 3463L	1
Legal Aspects of Surveying (2)	SUR 4403	3
Principles of Geographic Information System	GIS 4043C	3
Introduction to Terrestrial Laser Scanning	SUR 4150C	3

C3.11. Institutional Contributions

The faculty in the department contribute in the following ways:

- Some geomatics engineering courses are taken by students in other engineering programs and non-degree students working in the geomatics engineering, surveying and mapping field.
- Faculty activities include extensive working relationships with other colleges, departments and administrators at FAU as well as Federal, state, counties and cities entities.

C3.12. Student Profiles, Scholarly Activities

Table C3.8 reports the majors in geomatics engineering by gender and ethnicity.

Table C3.8 Student profile (IEA)

			Geomatics Engineering		
			2013-2014	2014-2015	2015-2016
Undergraduate	American Indian/Alaskan Native	Female	0	0	0
		Male	0	0	0
		Total	0	0	0
	Asian or Pacific Islander	Female	0	0	0
		Male	0	0	0
		Total	0	0	0
	Non Resident Alien	Female	0	0	0
		Male	0	1	1
		Total	0	1	1
	Black (Not of Hispanic Origin)	Female	1	0	0
		Male	1	1	1
		Total	2	1	1
	Hispanic	Female	0	0	0
		Male	0	1	3
		Total	0	1	3
	White (Not of Hispanic Origin)	Female	4	3	5
		Male	9	8	13
		Total	13	11	18
	Two or more races	Female	1	0	1
		Male	0	0	0
		Total	1	0	1
	Total	Female	6	3	6
		Male	10	11	18
		Total	16	14	24

C3.13. Advising Procedures

The Advising System. — First year students are typically advised in their first 30 credits by the University Advising Services. Advising materials for the BSGE program are provided to the University Advising Services annually or when changes affect the geomatics engineering curriculum. Freshmen are also welcome to seek advising in the College of Engineering &

Computer Science from engineering academic advisors employed by the Division of Engineering Student Services and Advising (DESSA).

The College of Engineering & Computer Science has centralized advising through the Division of Engineering Student Services and Advising (<http://www.dessa.fau.edu/eng-advising>). DESSA advises students in seven bachelor degree programs including geomatics engineering. There is a corresponding non-degree program for each bachelor degree program. The non-degree programs are Pre-Professional Engineering programs for students who have not met the minimum entrance requirements for one of the bachelor degree programs. Once those requirements are met, the student is admitted into one of the bachelor degree programs. Each engineering academic advisor specializes in at least two degree programs and is capable of advising all degree programs within the College, as needed. All advisors and staff members reside in Engineering East Building, Room 102, which also houses the Division of Engineering Student Services and Advising. There are currently two directors, an associate director, an academic programs coordinator, four professional advisors, and two program assistants.

DESSA advises students who have earned thirty or more college credit hours. All students must see an engineering academic advisor at least once each semester. During the initial visit, the engineering academic advisor interviews the student to get information about the student's academic history. The student is informed about the degree requirements, and an individualized plan of study is created. After the initial visit, an engineering academic advisor evaluates a student's performance and progress in their degree program. The student's plan of study is modified by the engineering academic advisor, as necessary. Students who are identified as at-risk or are having difficulties progressing must meet with an engineering academic advisor multiple times during the term. During these meetings, strategies are developed that help the student reach academic success. A plan of study and an estimate of the expected date of graduation are developed and created for each student. The plan of study is presented in the form of a degree program flowchart, an excel spreadsheet, or a copy of a degree audit. Each student in the College is closely monitored until all degree requirements have been met.

C3.14. Retention Rates

Because majority of students in BSGE were transfer students and they were not included in the metrics of the retention rates

C3.15. Degrees Awarded

Table C3.8 reports the number of degrees awarded in geomatics engineering in the years 2013-2017 and the College of Engineering and Computer Science in the year 2016-17.

Table C3.9 Degree Completions (IEA)

Bachelor Degrees	Geomatics Engineering					College Total
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2016-2017
	4	3	1	6	6	535

The first graduation class was in 2010-2011. The number of degree completions in the Geomatics program for the last five years is 20, 10 short of the threshold of 30 set forth by the Board of Governance. Based on the current student body in the program, it is very difficult to meet the BOG requirement even though the Department has made great effort to improve the student pipeline by adopting the following measures:

- Curriculum Change
- Academic Advisors
- Industry Support
- Articulation Agreement with State Colleges
- Recruiting Visits

Recent evidence has shown that the FAU Geomatics Engineering program will play an important role in improving the nation’s infrastructure/transportation systems and changing the aging workforce of the surveying and mapping industry. In the recent kick-off meeting of the FAU University Transportation Center (UTC), Dr. Caesar Singh, Director of USDOT UTC, articulated the benefit of the investment of Geomatics Engineering to address important issues in nation’s infrastructure/transportation systems. In the state of Florida, among 2,750 licensed surveyors in Florida, only 176 are younger than 40 years old and only 117 are female (information from Florida Surveying and Mapping Society). There is urgency to produce a large number of new surveyors to meet the high demand of the industry in the next 20 years.

After assessing the situation of national needs and student pipeline, the faculty agreed that a drastic action is needed to significantly improve the Geomatics Engineering program. With the support of the Dean’s office, the CEGE Department has proposed to replace the current program with a BS Engineering Technology program (CIP 15.9999). The program curriculum was designed to target students who pass Calculus 1 with grade D but do not meet minimum requirements to enter Civil Engineering, Mechanical Engineering, Ocean Engineering, Electric Engineering, Computer Engineering and Computer Science majors. The program curriculum provides students with great flexibilities to study Geomatics Engineering Technology, Construction Engineering Technology, Engineering Mechanics Technology, Environmental Engineering Technology and Computing engineering technology as shown in the following curriculum:

Table C3.10 Proposed BSET Curriculum (120 Credits)

Intellectual Foundations Program		24
College Writing I	ENC1101	3
College Writing II	ENC1102	3
Foundations of Society and Human Behavior Course 1		3
Foundations of Society and Human Behavior Course 2		3
Foundations of Global Citizenship Course 1		3
Foundations of Global Citizenship Course 2		3

Foundations of Creative Expressions Course 1		3
Foundations of Creative Expressions Course 2		3

Basic Mathematics and Sciences		21
Calculus w/ Analytical Geometry 1	MAC 2311	4
General Physics for Engineers 1	PHY2048	3
General Physics I Lab	PHY2048L	1
Mathematics Restricted Elective 2		3
Statistics Elective		3
Physical and Natural Science Restricted Elective 1		3
Physical and Natural Science Restricted Elective 2		4

Engineering Technology Fundamentals		18
Fundamentals of Engineering	EGN1002	3
Engineering Graphics Elective		3
Computer Programming Elective		3
Geomatics	SUR3103	2
Geomatics Lab	SUR3101L	1
Thermal Infrared Remote Sensing and Applications	SUR 4384	3
Digital Photogrammetry Principles and Applications/Lab	SUR 4331/L	2+1

Choose 3 of the following 5 Core course groupings

Surveying Engineering Technology Core		21
Automated Surveying and Mapping	SUR3141	2
Automated Surveying and Mapping Lab	SUR3141L	1
Geodesy and Geodetic Positioning	SUR4530	2
Geodesy and Geodetic Positioning Lab	SUR4530L	1
Measurement Theory and Data Adjustments	SUR3643	3
Cadastral Principles and Legal Aspects	SUR4403	3

Construction Engineering Technology Core		12
Construction Project Management	CCE4031	3
Engineering and Construction Surveying	SUR 3205	2
Engineering and Construction Surveying Lab	SUR 3205L	1
Introduction to Laser Mapping Technology	CCE4516	3
Intro to Transportation Engineering	TTE3004C	3

Environmental Engineering Technology Core		12
Introduction to Pollution Prevention and Sustainability	ENV4072	3
Remote Sensing of the Environment	GIS4035C	3
Oceanography	OCE 3008	3
Geo-Environmental Elective		3

Engineering Mechanics Technology Core		
Statics	EGN 3311	3

Dynamics	EGN 3321	3
Strength of Materials	EGN 3331	3
Materials Elective		3

Computing Technology Core *

Introduction to Logic Design	CDA 3201C	4
Foundations of Computer Science	COP 3014	3
Introduction to Microprocessor Systems	CDA 3331C	3
Data Structures	COP 3530	3

**Computing Technology core is 13 credits, so only 17 credits tech electives required
One additional upper division computer science course will grant minor in
CS*

Engineering Technology Capstone		3
Engineering Technology Capstone	ETG 4670	3

Technical Electives **18**

Approved College of Engineering and Computer Science course 3000 level or above		
Programming in GIS	GIS 4102C	3
Field Methods	GLY 4750C	3
Transportation and Spatial Organization	GEO 4700	3
Application in GIS	GIS 4048C	3
Introduction to Hydrogeology Modeling and Aquifer Test	GLY 4832C	3
Digital Image Analysis	GIS 4037C	3
Geovisualization and GIS	GIS 4138C	3
Environmental Issues in Atmospheric and Earth Science	EVR 3704	3
Water Resources	GEO 4280C	3
Coastal and Marine Science	GLY 3730	3
Sea-Level Rise: Impacts and Responses	GEO 3342	3
Quantitative Methods	GEO 4022	3
Spatial Data Analysis	GEO 4167C	3
Biogeography	GEO 4300	3
Urban Geography	GEO 4602	3
Geovisualization and GIS	GIS 4138C	3
Planning Methods	URP 4011	3
City Structure and Change	URP 4055	3
Planning Implementation Strategies	URP 4120	3
Introduction to Visual Planning Technology	URP 4254	3
Plan Making and Design	URP 4343	3
Sustainable Cities	URP 4403	3
Environmental Planning Methods	URP 4420	3
Urban Development Planning Methods	URP 4546	3
Capital Facilities Planning	URP 4730	3
Site Planning	URP 4870	3

The above curriculum can be ABET accredited under the category of Engineering Technology. If a student takes the Surveying Engineering Technology core and proper elective classes, he/she is eligible to take the Fundamentals of Surveying exam (FS). However, this curriculum does not qualify students to take the Fundamentals of Engineering exam (FE) in Florida. The proposed BSET program will significantly improve the retention rate and graduation rate not only in the Department of Civil, Environmental and Geomatics Engineering, but also in the entire College of Engineering and Computer Science. It is expected that about 20 students will graduate with the BSET degree in the second year of the implementation of the program.

C3.16. Graduation Rates

Similarly, because majority of students in BSGE were transferred from local state colleges, they were not included in the metrics of the retention rates

C3.17. Licensure Rates

The licensure rates of the students graduating from the FAU BSGE program in the surveyor license examinations compare reasonably with the national pass rates since 2013.

C3.18. Placement Rates

The placement data recorded informally by the Department indicates that 95% of geomatics engineering graduates obtain employment as geomatics engineering, surveyor and/or mapper professionals right after graduation.

C3.19. Student Recruitment

The Geomatics faculty and graduate students have paid many visits to state colleges and recruitment events, such as:

- Palm Beach State College South County campus
- Participation in Palm Beach State College's Math Awareness Week
- Palm Beach State College, Lake Worth campus
- FDOT South Florida Construction Career Days (mostly high school students)
- FAU Expo
- FAU Honors College Dean's Office
- Broward College Open House
- Broward College South campus
- Broward College Central campus

The FAU College of Engineering and Computer Science Middle School and High School programs enable potential students to interface with the different areas of the College to find out their interests, and inspire them to consider majors in engineering and computer science. Also, the college offers the following two summer programs which are designed to motivate the high achieving high school students to consider engineering career path.

Summer Engineering Technology Program. The College offers a middle school Summer Engineering Technology program for high-achieving 7th thru 9th grade students. Students learn how to think critically in a fun and academically stimulating environment. Enrollment opens in the spring and classes are held over the summer.

Engineering Scholars Program. This is a three-credit, dual-enrollment program in engineering and computer science for high achieving high school students in Broward and Palm Beach counties. Enrollment opens in the spring and classes are held over a three-week period in the summer.

4. Bachelor of Science in Environmental Engineering Academic Program Review

A4. Mission and Purpose of the Program

The Bachelor of Science in Environmental Engineering (BSEV), integrates principles of engineering with mathematics, earth science, soil science, life science, and materials science with emphasis on the design and development of solutions to environmental challenges, such as improvement of water and air pollution control, safe disposal of wastes, and the stewardship of our natural resources.

Program Educational Objectives: The Bachelor of Science in Environmental Engineering (BSEV) degree program in the College of Engineering & Computer Science is designed to provide students with the following program educational objectives:

- A. Practice environmental engineering within the general areas of water and wastewater, air quality, solid and hazardous waste, and groundwater and soils in the organizations that employ them.
- B. Advance their knowledge of environmental engineering, both formally and informally, by engaging in lifelong learning experiences including attainment of professional licensure, and/or graduate studies.
- C. Serve as effective professionals, based on strong interpersonal and teamwork skills, an understanding of professional and ethical responsibility, and a willingness to take the initiative and seek progressive responsibilities.
- D. Participate as leaders in activities that support service to, and/or economic development of, the region, the state and the nation.

Environmental engineering relates strongly with geology/geography (geosciences), environmental science, and ecology, and it is closely aligned with civil engineering, ocean engineering, mechanical engineering, geomatics engineering and urban/regional planning. It is not uncommon for individuals to be licensed as a professional engineer in environmental engineering and work for a civil engineering firm.

The BSEV program links closely with existing FAU undergraduate and graduate programs in engineering, science, and urban & regional planning, and political science. The environmental engineering curriculum includes two technical electives selected from a list of offerings from Geosciences, Political Science, Engineering, and Urban & Regional Planning. Capstone projects involve joint multidisciplinary teams of students from these various fields.

B4. Date and Description of Last External Review

To date, no external reviews of the program have been conducted since it is only one year old.

C4. Instruction

C4.1 Outcome Assessment

The BSEV program also integrates with academic programs originating from the Harbor Branch Oceanographic Institute. Many of the HBOI faculty have research interests that overlap environmental engineering topics.

Outcome 1. An ability to apply knowledge of fundamentals, experimental methodologies, and modern engineering tools to identify and formulate engineering solutions.

Assessment Method :

In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score (on a scale of 1-5 with 5 being highest) based on assignments, laboratory reports, exams, projects, and other assessments. A score less than 3.5 will result in an improvement strategy to be implemented in the following semester. The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to identify, formulate, and solve engineering problems
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for
- engineering practice

These forms are appraised by an external evaluator during the ABET accreditation visit and routinely evaluated by the Program Advisory Council, consisting of industry partners.

Implementing Strategy:

Students will have a working knowledge of math, science and engineering fundamentals and the ability to plan and execute an engineering design to meet an identified need in environmental engineering curricular content areas, specifically with respect to the following engineering core courses:

- CWR 3201C Applied Hydraulics
- CWR 4202 Hydrologic Engineering
- ENV 3001C Environmental Science and Engineering
- ENV 4341 Solid and Hazardous Waste and Site Remediation
- ENV 4514 Water and Wastewater Treatment Systems
- ENV 4072 Introduction to Pollution Prevention and Sustainability
- ENV 4112C Air Pollution and Control Systems with Lab
- ENV 4053 Environmental Fate and Transport
- CGN 4803C Civil, Environmental & Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental & Geomatics Engineering Design 2

Criterion for success:

The content knowledge that students obtained will be evaluated by the faculty members who teach the courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provides a composite score for course-specific student learning outcomes a, e, h, j, and k as stated in the assessment method. The course composite score for each outcome is based on assignments, laboratory reports, exams, projects, and other assessments. The composite scores for the 6 targeted courses is compiled and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

Outcome 2. An ability to communicate and function effectively on multi-disciplinary teams.

Assessment Method:

The faculty evaluates the content knowledge by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to function on multi-disciplinary teams
- An ability to communicate effectively

Implementing Strategy:

Graduates will also be able to communicate ideas and results to diverse audiences using their knowledge of written, oral and graphical communication, function effectively on teams using their knowledge of team dynamics, team communication, social norms, and conflict management with respect to the following Writing Across the Curriculum (WAC) courses:

- CGN 4803C Civil, Environmental & Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental & Geomatics Engineering Design 2

Criterion for success:

The communication skills that students obtained will be evaluated by the faculty members who teach the design courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty (and members of an industry evaluator team) provide a composite score for course-specific student learning outcomes d and g as stated in the assessment method. The course composite score for each outcome is based on based on assignments, presentations, reports, exams, projects, and other assessments. The composite scores for the 2 targeted courses is compiled, and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

Outcome 3. An ability to apply their discipline-specific knowledge to successfully execute a design with multiple realistic constraints using applicable design codes and standards, conduct experiments, analyze and interpret data, understand professional and ethical responsibility, and recognize the need for engaging in life-long learning.

Assessment Method:

The faculty evaluates critical thinking by giving scores (1 through 5, with 5 as the highest) for the following course-specific student learning outcomes on the CIW form each semester for the specific courses listed in "Implementing Strategy":

- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
- An understanding of professional and ethical responsibility
- A recognition of the need for and an ability to engage in life-long learning

Analytical skills are assessed through examining the quality of components of design work through oral presentations and/or technical reports. Creative and practical skills are assessed by examining the quality of the technical solution to a practical problem. The critical thinking skills that students obtained will be evaluated by the faculty members who teach the courses listed in "Implementing Strategy" by giving composite scores (1 through 5, with 5 as the highest) based on assignments, laboratory reports, exams, projects, and other assessments.

Implementing Strategy:

Although all environmental engineering courses contain a critical thinking component, the following courses have more in depth critical thinking components:

- CWR 4202 Hydrologic Engineering
- ENV 4514 Water and Wastewater Treatment Systems
- ENV 4612 Introduction to Pollution Prevention and Sustainability
- ENV 4356 Solid and Hazardous Waste and Site Remediation
- ENV 4668 Environmental Fate and Transport
- CGN 4803C Civil, Environmental and Geomatics Engineering Design 1
- CGN 4804C Civil, Environmental and Geomatics Engineering Design 2

Criterion for success:

The critical thinking skills that students obtained will be evaluated by the faculty members who teach the courses. In the Continuous Improvement Worksheet (CIW) at the end of the semester, the faculty provide a composite score for course-specific student learning outcomes b, c, f, and i as stated in the assessment method. The course composite score for each outcome is based on based on assignments, presentations, laboratory reports, exams, projects, and other assessments. The composite scores for the 7 targeted courses is compiled, and the benchmark student success is 3.5 on a scale of 0-5. A score less than 3.5 for any course outcome will result in an improvement strategy to be implemented in the following semester.

C4.2 Curriculum

The Environmental Engineering curriculum is designed to meet all requirements for accreditation by the Accreditation Board for Engineering and Technology (ABET) with a total of 120 credit hours. Graduation from an ABET-accredited program is the universally accepted education credential

required for professional registration as an environmental engineer. The implementation date was August 1, 2016, with the first students accepted for the Fall 2016 semester. The curriculum was developed with the assistance of the Department Advisory Council comprised of industry representatives.

1. Students must meet University admission requirements.
2. In each core course listed below, students must obtain a minimum grade of "C". Advanced placement scores of 4 or above will be given credit for the appropriate course(s). A score of 5 is equivalent to an "A," and a score of "4" is equivalent to a B.
3. A maximum of two attempts for any of the option listed courses will be allowed. Failure to receive a passing grade in the second attempt is grounds for denial of admission to an engineering or computer science program.

The entry-level mathematics requirement for the engineering programs is MAC 2311 Calculus with Analytic Geometry 1. Students who are placed in lower-level mathematics courses based on their ALEKS test scores and who need to maintain full-time status may have problems finding courses that are accepted in an engineering or computer science program in future semesters. This may delay their entry into a particular engineering or computer science program.

After successfully completing the core courses, students may apply to a particular engineering program. Admission will be based on the student's performance in the core courses. The Division of Engineering Student Services and Advising is available to assist students in selection of a major field of study. Students with engineering degrees from ABET-accredited institutions will be directly admitted to engineering or computer science programs of their choice.

Students may appeal denial of admission to a major through the academic petition process. For an appeal to have merit, students must explain new academic or personal information as well as extenuating circumstances. The evidence should show a student's case is stronger than the GPA evidence suggests. The faculty coordinator for the pre-professional program will review the petition according to the established College guidelines and make a recommendation to the academic petition committee.

Table C4.1 BSEV Curriculum (FAU Catalog)

Course (Department, Number, Title)	Math and Basic Sciences	Engineering Topics Check if Contains Significant Design (✓)	General Education
ENC 1101 English Composition 1			3
ENC 1102 English Composition 2			3
Foundations of Society & Human Behaviors (1)			3

Course (Department, Number, Title)	Math and Basic Sciences	Engineering Topics Check if Contains Significant Design (√)	General Education
Foundations of Society & Human Behaviors (2)			3
Foundations of Global Citizenship (1)			3
Foundations of Global Citizenship (2)			3
Foundations of Creative Expressions (1)			3
Foundations of Creative Expressions (2)			3
MAC 2311 Calculus with Analytical Geometry 1	4		
MAC 2312 Calculus with Analytical Geometry 2	4		
MAC 2313 Calculus with Analytical Geometry 3	4		
MAP 3305 Engineering Mathematics 1	3		
STA 4032 Probability & Statistics for Engineers	3		
CHM 2045 General Chemistry 1	3		
CHM 2045L General Chemistry 1 Lab	1		
PHY 2048 General Physics 1 (for Engineers)	3		
PHY 2048L General Physics 1 Lab	1		
PHY 2044 Physics for Engineers 2	3		
PHY 2049L General Physics 2 Lab	1		
CHM 2046 General Chemistry 2	3		
CHM 2046L General Chemistry 2 Lab	1		
Biological Science Elective	4		
Earth Science Elective	3		
CWR 3201C Applied Hydraulics		3	
EGN 3311 Statics		3	
CGN 2327 Fundamentals of AutoCAD		3	
EGN 3331 Strength of Materials		3	
EGN 2213 Computer Applications in Engineering 1		3	
EGN 3343 Engineering Thermodynamics		3	
EGN 1002 Fundamentals of Engineering*		3	
ENV 4341 Solid and Hazardous Waste and Site Remediation*		3√	
ENV 4053 Environmental Fate and Transport		3√	
ENV 4702 Introduction to Pollution Prevention and Sustainability*		3√	
ENV4112C Air Pollution and Control Systems with Lab*		4√	
CGN4803C Civil, Environmental and Geomatics Engineering Design 1*		3√	
CGN4804C Civil, Environmental and Geomatics Engineering Design 2*		3√	
CWR4202 Hydrologic Engineering*		3√	
ENV3001C Environmental Science & Engineering*	1	2	

Course (Department, Number, Title)	Math and Basic Sciences	Engineering Topics Check if Contains Significant Design (✓)	General Education
ENV4514 Water and Wastewater Treatment System*		3✓	
Environmental Engineering Technical Electives*		6	
Total ABET Basic-Level Requirements	42	54	24
Total Credit Hours			120
Percentage of Total	36%	44%	20%
Total must satisfy either credit hours or percentage			
Minimum Semester Credit Hours	32	48	
Minimum Percentage	25%	37.5%	

Curriculum Relative to Comparison Schools

- Florida Gulf Coast University (FGCU)
- University of Central Florida (UCF)
- Clarkson
- Missouri University of Science and Technology (MUST)
- University of California-Merced (UC-Merced)

Table C4.2 Curriculum Comparison (Institutions' websites)

Category	FAU	FGCU	UCF	Clarkson	MUST	UC-Merced
Basic Math and Science	41	38	40	40	43	40
General Education	24	24	24	30	21	17
Engineering Mechanics	6	7	9	3	9	12
Computer Programming	3	2	--	E	--	4
Engineering Fundamentals	6	6	4	8	4	10
Fluid Mechanics	3	6	3	3	3	3
Thermodynamics	3	--	3	3	3	E
Water Resources	3	3	7	3	3	4
Fate and Transport	3	3	6	3	3	4
Pollution Prevention	3	E	E	E	E	E
Sustainability	3	3	E	E	E	4
Water and Wastewater Treatment Design	3	6	7	E	6	E
Air Pollution Control Design	4	3	3	E	3	4
Solid/Haz Waste Design	3	6	3	E	E	E

Category	FAU	FGCU	UCF	Clarkson	MUST	UC-Merced
Technical Electives	6	6	6	12	15	15
Other Upper Division	--	12	10	12	12	3
Capstone	6	3	3	3	3	3
Total Credits	120	128	128	120	128	123
Faculty	2	6	8	10	8	14

D. Faculty

Administrative Structure

As indicated in the following administrative structure chart, the Department leadership team is composed by the Chair, Associate Chair, and five faculty standing committee chairs. The Chair also serves as the secretary of the Department Advisory Council and the Associate Chair serves as the secretary of the Department Alumni Council. Three staff members are supervised by the Chair. The academic advisor works with the Graduate program director on recruiting and admission matters. The chair directly reports to the Dean.

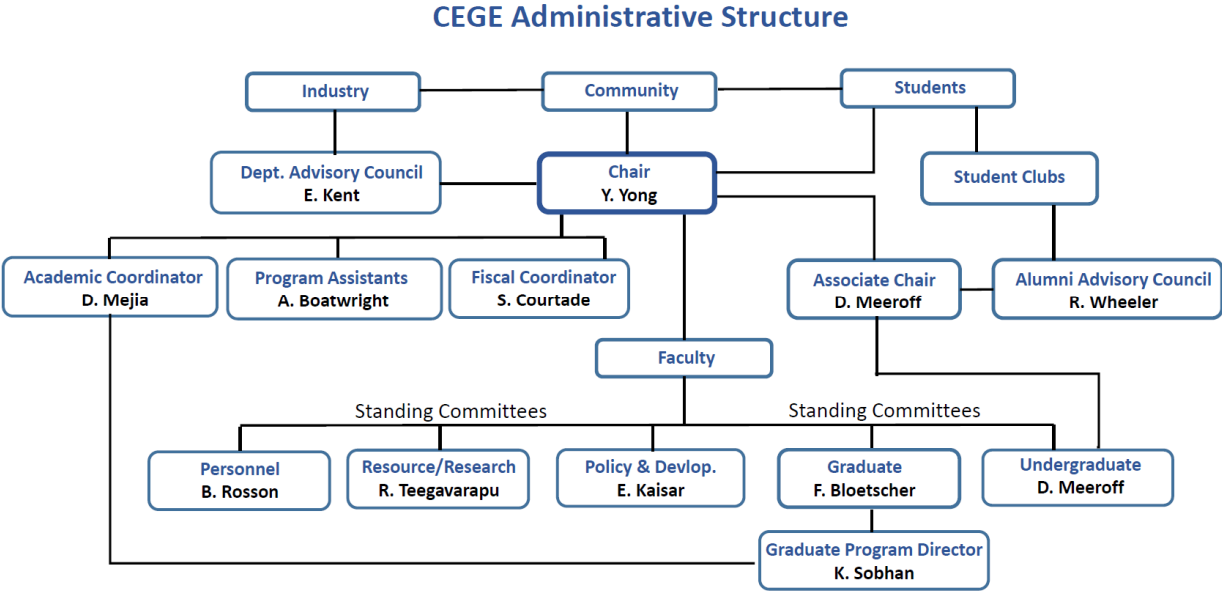


Figure C5.1 Administrative Structure

There are four Department centers, namely Freight Mobility Research Institute (FMRI, <http://eng.fau.edu/research/fmri/>), Center for Intermodal Transportation Safety and Security, (<http://www.fau.edu/citss/>), Center for Infrastructure and Constructed Facilities, (<http://www.cege.fau.edu/research/cicf.php>), and Center for Marine Structures and Geotechnique, (<http://www.cege.fau.edu/research/cmsg.php>).

Faculty Profile

With the recent two hires, the Department now has 17 faculty. However, the faculty FTE is 15.5 since Dr. Bober has 25% employment, and Dr. Stevanovic and Dr. Jang each has 80% and 50% appointments with the Department, and the rest of their appointments are with I-SENSE, an FAU pillar. The faculty's excellent teaching and research have been recognized by many prestigious awards, such as:

- 1 PYI (NSF Presidential Yong Investigator award)
- 3 Educator of the Year (Engineering Council)
- 2 Distinguished Teacher of the Year (FAU)
- 1 Mentor of the Year (FAU)
- 1 Research of the Year (FAU)
- 1 Scholar of the Year (FAU)
- 1st prize award for a capstone design project (NCEES)

The faculty expertise covers a wide spectrum of typical civil, Environmental and Geomatics Engineering as shown in Table C5.1.

Table C5.1 Faculty and their technical areas

Civil, Environmental & Geomatics Engineering Faculty			
Name	Rank-Position	Appointment	Academic Specialty
Dr. Madasamy Arockiasamy	Professor	100% 9 Months	Structure
Dr. Frederick Bloetscher	Professor	100% 9 Months	Water Resource
Dr. William Bober	Associate Professor	25% 9 Months	Water Resource
Dr. Jinwoo Jang	Assistant Professor, I-SENSE Fellow	50% 9 Months	Structure/ Transportation
Dr. Evangelos Kaisar	Associate Professor	100% 9 Months	Transportation
Dr. Daniel Meeroff	Professor, Associate Chair	100% 9 Months	Environmental
Dr. Sudhagar Nagarajan	Assistant Professor	100% 9 Months	Geomatics
Dr. D.V. Reddy	Professor	100% 9 Months	Geotechnical
Dr. Barry Rosson	Professor	100% 9 Months	Structure
Dr. Panagiotis Scarlatos	Professor	100% 9 Months	Water Resource
Dr. Khaled Sobhan	Professor	100% 9 Months	Geotechnical
Dr. Aleksandar Stevanovic	Associate Professor, I-SENSE Fellow	82.2% 9 Months	Transportation
Dr. Hongbo Su	Assistant Professor	100% 9 Months	Geomatics
Dr. Ramesh Teegavarapu	Associate Professor	100% 9 Months	Environmental
Dr. Peng Yi	Assistant Professor	100% 9 Months	Geomatics
Dr. Yan Yong	Professor, Chair	100% 12 Months	Structure
Olfat Sarhang Zadeh	Instructor	100% 9 Months	Structure

The faculty is Currently composed of 9 Asians, 1 Hispanic white, 3 American whites, 3 European whites, 1 Middle Eastern. In terms of gender diversity there are 1 female and 16 males. Table C5.2 shows the faculty profile before fall 2016.

Table C5.2 Faculty Profile (IEA)

Instructional Faculty (Tenured, tenure-earning, & non-tenure-earning)		Civil Environmental & Geomatics Engineering			College Total	University Total
		2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
American Indian/Alaskan Native	Male					1
	Total					1
Asian or Pacific Islander					0	1
	Female				4	40
	Male	6	8	8	33	92
	Total	6	8	8	37	133
Black (Not of Hispanic Origin)						0
	Female					38
	Male				4	22
	Total				4	60
Hispanic					2	2
	Female				1	37
	Male	1	1	1	5	30
	Total	1	1	1	8	69
White (Not of Hispanic Origin)					1	9
	Female	1			5	297
	Male	7	7	6	27	382
	Total	8	7	6	33	688
Total					3	12
	Female	1			10	412
	Male	14	16	15	69	527
	Total	15	16	15	82	951

Faculty Teaching Loads and Methods of Calculation

Faculty teaching loads are assigned based on the Florida 12-hour rule, in which a 3-credit course is defines as 3 contact hours plus 7 hours of course preparation and office hours. Without any other assignments, a faculty member would have taught four 3-credit courses to make up 40 working hours for the week. The Department has applied 2-2 teaching model to assign a faculty member to teach two 3-credit course each fall and spring semesters. The 50% teaching assignment

is accompanied by 25% Department research and 25% of combined teaching, research and service. Exceptions are made for cases of new faculty and those faculty with large research grants.

Research Productivity

Faculty research is one of the important components to measure the Department success. Table C5.3 shows Faculty FTE devoted to research:

Table C5.3 FTE devoted to research (IEA)

				Civil Environmental & Geomatics Engineering			College Total	University Total	
				2013-2014	2014-2015	2015-2016	2015-2016	2015-2016	
Departmental Research	.	--	Person-Years				0.1	0.9	
			FTE				0.1	1.2	
	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years	2.0	2.5	4.0	19.6	141.8	
			FTE	2.7	3.4	5.3	26.1	189.0	
	Non-tenure-earning faculty	Instructors, Lecturers, Visiting Faculty	Person-Years				0.1	5.3	
			FTE				0.1	7.0	
	Other personnel paid on faculty pay plan	--	Person-Years					6.5	
			FTE					8.6	
	Total			Person-Years	2.0	2.5	4.0	19.7	154.4
				FTE	2.7	3.4	5.3	26.3	205.8
Sponsored Research	.	--	Person-Years				0.1	0.6	
			FTE				0.1	0.8	
	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years	0.7	0.9	1.3	5.7	18.8	
			FTE	1.0	1.2	1.7	7.6	25.1	
	Non-tenure-earning faculty	Instructors, Lecturers, Visiting Faculty	Person-Years					2.6	
			FTE					3.4	
	Other personnel paid on faculty pay plan	--	Person-Years				0.0	27.3	
			FTE				0.0	36.4	
	Total			Person-Years	0.7	0.9	1.3	5.8	49.2
				FTE	1.0	1.2	1.7	7.7	65.6

Research Funding Profile

The CEGE faculty has conducted research in areas of structural/geotechnical, transportation/geomatics and water resources/environmental engineering. Figure C5.2 shows the Department research funding for the last five years. The two spikes were due to a large amount of research activities in the transportation area. In particular, the Department received a University Transportation Center (UTC) grant from the US Department of Transportation with \$1.4 million plus \$0.7 million non-federal matching funds per year for the next five years.

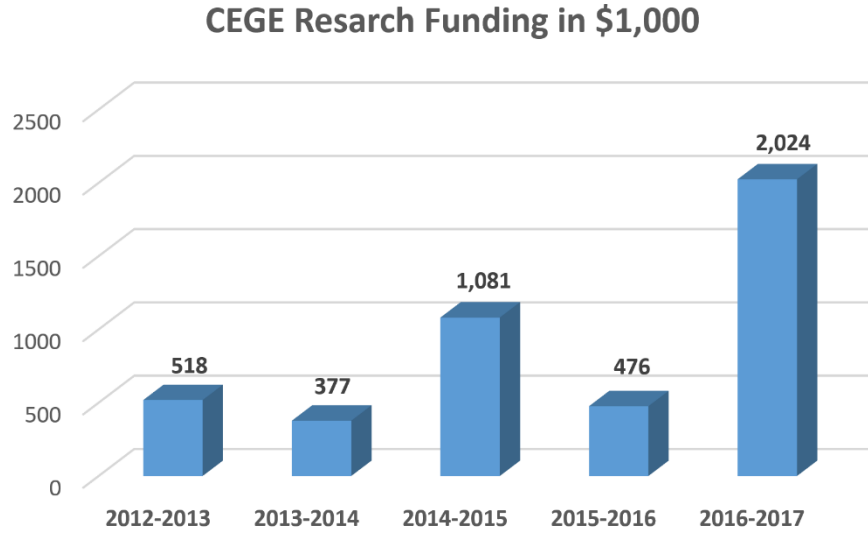


Figure C5.2 Research Funding (FAU Grantsera)

Figure C5.4 shows the funding sources of the \$2 million research grants that CEGE received during 2016-2017 ranges from federal agencies to local industry.

2016-2017 Research Funding Sources (\$2 Million)

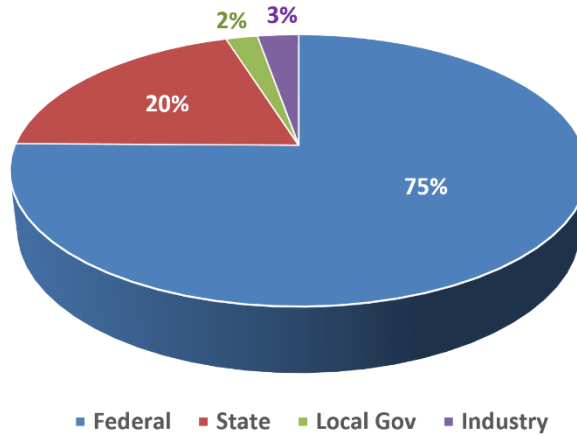


Figure C5.3 Funding Sources (2016-2017)

The following table lists selected active research grants:

Table C5.4 Selected active research grants

Funding Agent	Title
National Science Foundation	E-Beam Technical Conference focused on Science, Applications, and Design Considerations

Florida Department of Transportation	Guidance for Identifying Corridor Conditions that Warrant Deploying Transit Signal Priority and Queue Jump
US Department of Transportation	Freight Mobility Research Institute - FMRI
Bill Hinkley Center. for Solid & Hazzard. Waste Management at UF	Beneficial Reuse Solutions for Landfill Operations and Management
Environmental Research and Education Foundation	Detection of Nuisance Odors Using Odor Binding Protein Sensor
Transportation Research Board	Non-contact Deflection Monitoring System for Timber Railroad Bridges
University of Utah	400 S Corridor Assessment Study
Florida Department of Transportation	Development of a Traffic Map Evaluation Tool for TMC Applications
Florida Department of Transportation	Evaluation of Technologies to Support Multimodal Operations in Southeastern Florida
Florida Department of Transportation	Analysis of Traffic Demand Patterns and Signal Retiming Strategies for ITS-data-rich Arterials
US Army Corps of Engineers	Evaluation and development of Approaches for Quality Assurance of Precipitation Data for Integration to the HEC Hydrologic Simulation Model

To sustain the research growth, the Department will build on UTC and expand its success to other areas of civil, environmental and geomatics engineering.

In recent years, sponsored research in the structural/geotechnical area has experienced steady decline while funding in the water resources/environmental area has been pretty stable around \$250,000-300,000K. To reposition CEGE research strength in the current challenging environment, the Department recently reorganized the research focus groups to

- Urban Mobility and Infrastructure
- Water Resources and Environmental Sustainability

The two research groups have their own specific focuses. However, they are closely related in terms of infrastructure and sustainability.

The current research dollars per person for CEGE faculty is \$145K. Our long-term goal is to increase it to \$200K by year 2022, which is equivalent to \$3.1 million for the Department size of 15.5 faculty.

Faculty Scholarly Productivity

CEGE faculty have been extremely active in scholarly publications. Table C5.4 indicates that CEGE faculty has 3.2 peer-reviewed publications per person in 2015-2016. This is the result of

broad faculty participations in journal and conference publications. Our goal is to increase this number to 5 by 2022.

Table C5.5 Faculty scholarly productivity/person (IEA)

	Civil Environmental & Geomatics Engineering			College Total	University Total
	2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
1. Books (including monographs & compositions) per faculty member	0.6	0.6	0.5	0.3	0.2
2. Other peer-review publications per faculty member	2.8	3.6	3.2	4.4	1.7
3. All other publications per faculty member	2.6	2.7	1.9	1.1	0.9
4. Presentations at professional meetings or conferences per faculty member	3.1	4.9	3.6	2.9	2
5. Productions/Performances/Exhibitions per faculty member	0.7	0.4	0.3	0.1	0.3
6. Grant proposals submitted per faculty member	1.2	1.6	1.9	1.9	0.6
Sponsored Research & Program Expenditures	N/A	N/A	N/A	N/A	N/A
7. Organized research expenditures per faculty member	\$31,380	\$39,966	\$0	\$0	\$0
8. Sponsored instruction expenditures per faculty member	\$1,290	\$6,816	\$0	\$0	\$0
9. Other sponsored activity expenditures per faculty member	\$3,253	\$154	\$0	\$0	\$0

CEGE faculty are also very active in signing book contracts. Here are some recent book publications:

1. **Bloetscher, F.** (2018), *Infrastructure Management*, JRoss – In publication
2. **Bloetscher, F.** and Meeroff, D.M. (2015) *Practical Design Concepts for Capstone Engineering Design*, JRoss, Plantation, FL.

3. **Bober, W.**, *MATLAB Essentials, A First Course for Engineers and Scientists*, CRC Press, 2017.
4. **Bober, W.**, *Numerical and Analytical Methods with MATLAB for Engineers and Scientists*, CRC Press, 2014.
5. Koutitas, C.G. and **Scarlato, P.D.** *Computational Modelling in Hydraulics and Coastal Engineering*, Taylor & Francis Group, CRC Press, 2016.
6. Braja M. Daz and **Khaled Sobhan**, *Principles of Geomatics Engineering*, 8th edition. Cengage Learning, 2018.
7. **Ramesh S. V. Teegavarapu**, *Floods in a Changing Climate: Extreme Precipitation*, Cambridge University Press-UNESCO (United Nations Educational Scientific and Cultural Organization), January, 2013.

E. Service and Community Engagement

The CEGE faculty are very active in terms of service within and outside of the university. As indicated in Table D1, the service productivity per faculty demonstrates that CEGE faculty have devoted large effort to service activities despite of their busy teaching and research schedules.

Table D1 Service productivity (IEA)

	Civil Environmental & Geomatics Engineering			College Total	University Total
	2013-2014	2014-2015	2015-2016	2015-2016	2015-2016
1. Faculty memberships on department, college or university committees per faculty member	4.1	3.3	3.1	2.7	4.1
2. Faculty memberships on community or professional committees per faculty member	3.6	2.9	2.7	2.4	1.5
3. Faculty serving as editors or referees for professional publications per faculty member	5.9	0.9	0.7	0.8	0.8

The Department has also hosted a number of high profile outreach activities. Here are some examples:

- **2017 Southeast ASCE Student Conference.** The conference was held March 16-18, 2017 at the Boca Raton campus. More than 1,100 students from 28 institutions in the southeast US, Puerto Rico and China participated in 20 national/local competitions, a career fair and a formal awards banquet. The success of the well-prepared three-day event not only recognized FAU as an elite member of the conference but also raised the reputation of FAU to the national level. By the time the event took place in March 2017, The Department had secured almost \$100,000 cash donations and \$50,000 registration fees. The conference was completely supported by these funds. The FAU student team also achieved its highest ever finish at this event.

- **15th Anniversary of the CEGE Department.** The anniversary party was held on Saturday, August 27, 2016 at the FAU Stadium to celebrate 15 years of academic excellence of the CEGE Department. It was organized by the Department and Department Alumni Advisory Council. 80 of 650 CEGE alumna attended the event along with College faculty, staff and CEGE students.
- **2015 Infrastructure Day.** The CEGE Department hosted the second Infrastructure Day and invited the FDOT deputy secretary as the keynote speaker. The network event drew a crowd of 400 participants. Some students either were offered internships or permanent jobs at the event. It was so successful that industry partners suggested to make it as an annual event.
- **2016 Concrete Expo.** The CEGE Department also hosted the second Concrete Expo with more than 250 participants. Students learned about the concrete industry as a whole and benefited from interactions with 18 government and industry sponsors. The Concrete Expo has already become an annual event that brings engineering professionals to campus for continuing education and opportunities to interact with students and faculty.
- **2016 FSMS Tri-County Surveyors Week Celebration.** Under the request of the FSMS tri-county chapters, the CEGE Department hosted a Surveyors Week Celebration on Boca campus. The geomatics students had a great opportunity to interact with 80 industry practitioners.

F. Other Program Goals

- One of the research goals CEGE faculty set two years ago was to target large research grants from federal agencies. Winning the University Transportation Center was a result of this initiative. The newly formed research focus groups will add additional strength to build on this achievement.
- Professional licensure is a top priority for our students especially if they want to practice engineering in Florida. CEGE students are required to take the Fundamentals of Engineering (FE for BSCV and BSEV) or Fundamentals of Surveying (FS for BSGE) before taking CGN4804C – CEGE Design 2. The pass rate has so far has been consistently lower than the national average. However, it is still unclear how to evaluate FAU students' performance compared to the national average because not all universities require their civil engineering students to take the exams before graduation. Efforts have been devoted to obtain data of the national average of the institutions requiring FE to be taken before graduation. Nevertheless, the faculty has worked hard to improve FE/FS pass rate.
- As the state funding for improving educational facilities is hard to come by, the faculty started planning a \$450K fundraising to improve the conditions of the CEGE laboratories three years ago. As the fundraising for the 2017 Southeast ASCE Student Conference had overtaken this effort for the last two years, the \$450K fundraising has not been restarted. This fundraising campaign will become the major focus of our outreach effort for the next few years.

G. Strengths and Opportunities that Support Achievement of Program Goals

The major strengths of the FAU Civil, Environmental and Geomatics Engineering are:

- Geographic location in the part of the State where many of the major issues facing today's infrastructure and environment such as sea level rise, clean drinking water, hurricane disasters and congested roads are strongly in play.
- The faculty holds high-level interdisciplinary expertise needed for today's competitive environment. Their teaching and research experience enable them to provide students with a first class education not only in fundamental theories but also in engineering practice.
- Faculty members with non-traditional civil engineering expertise is a huge advantage of the Department. Increasing evidence has shown that many of today's complex civil engineering problems can be affectively solved by geomatics engineering and bioengineering.
- The leading edge expertise in Transportation Engineering and Environmental Engineering have gradually become recognized by federal and state funding agencies recently. The University Transportation Center is the best example.
- The Department has excellent alignment with FAU's Strategic Plan. Two faculty members are fellows of I-SENSE, one of the four pillars of the University.
- The scholarly productivity of the faculty (books, peer reviewed articles, presentations, etc.) surpasses the College and University averages given the small size of the Department.
- The Department is in a university designated as a Hispanic-serving institution (HSI). This gives a significant advantage in terms of research and education funds from federal, state and local governments.

H. Weaknesses and Threats that Impede Program Progress

- Lack of a dedicated Ph.D. program is a huge disadvantage in terms of research and scholarly productivity. Although there is a temporary solution indicated in C2.16, It is impractical to ask students planning to pursue Ph.D. in Transportation and Geospatial engineering to follow the Ph.D. requirements in Mechanical and Ocean Engineering. This was the reason why none of the current seven Ph.D. students is in the Transportation area. Given high-level of research activities for the University Transportation Center, it will negatively impact the possibility for CEGE to win another University Transportation Center when the current one ends in 2022.
- In areas of core strength, such as Transportation, there is a sense that FAU is often outmaneuvered by the University of Florida (UF) when it comes to influence at the State level.
- The heavy teaching load among faculty is affecting their ability to bring in more research funding.
- There are not enough incentives to bring in more research money.

- Inadequate labs that are not fully up to date or suffering from insufficient lab management and technician support. This is having a negative impact on the morale of undergraduate and graduate students.
- Geomatics Engineering has been on life support for the last two years despite continuous effort to increase the student pipeline. Other Geomatics programs in the nation are facing the same issue.

I. **Core Threats**

- The BOG metrics for the Department regarding funding are too skewed to quantity versus quality.
- The Department’s graduate program growth is at a critical junction. The faculty needs to make a choice to focus on the future Ph.D. program or current MSCV program productivity. The choice will significantly affect the Department in years to come.

J. **Resource Analysis**

- **Faculty.** Since 2013, the Department has not experienced gross gain in terms of faculty FTE while other departments in the College had significant gains. Figure I1 shows that the faculty FTE has been around 15 for the last seven years despite 5.5 recent hires, because CEGE has lost 6.5 Faculty FTE (2 due to retirement, 3 due to personal reasons, 1 due to transfer out of the Department, 0.75 due to a health reasons and 0.25 due to new assignment to I-SENSE). Currently, the Department is in desperate need for two new faculty members in Transportation and Environmental Engineering areas. The two positions would fulfil the requirement of critical mass for research and teaching needs of the two areas which each has only two faculty members. The faculty is also very top-heavy, with two more members set to achieve full professor status, meaning only less than one-third of the Department is junior faculty.

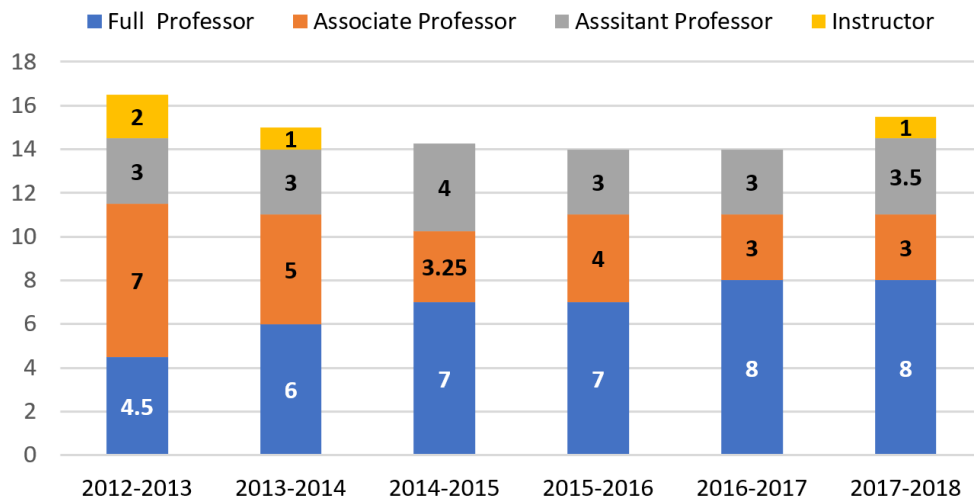


Figure I1 Faculty FTE in Ranks

- **Lab Technicians.** Currently, CEGE has five teaching/research laboratories but not a single lab technician. Therefore, it is difficult to enforce lab rules and regulations and properly

maintain lab facilities. As a result, it poses a serious challenge to improving lab safety conditions, particularly in the Materials Lab EW-152 and Geotechnical Lab EW-262, where many heavy machines are located.

- **TA Funding.** The lack of TA funding has been a constant struggle for the Department. The Dean's office has provided 2-3 10-hour TA supports and the Department has supported the remaining 60-70 hours of TA support from its own operational budget.

K. Future Direction

To be ranked by the US News and World Report as a nationally recognized Department, CEGE faculty plans to reach the following goals by 2022:

- **Dedicated Civil Engineering Ph.D. Program.** The CEGE faculty have worked very hard to supervise three Ph.D. students to complete Ph.D. tracks in Ocean and Mechanical Engineering. The Provost's Office CEGE Department has recently given a green light to propose a new Ph.D. degree in Civil and Environmental Engineering. The University has hired an independent agency to conduct the market research of the proposed program.
- **Increasing research funding from the current \$140K to \$200K per faculty each year.** With the newly created research groups to cover interdisciplinary areas, the faculty are better poised to win large proposals with the strength of unique combinations of their expertise. The two group have already developed their plans to move in this direction.
- **Increasing peer-reviewed publications per faculty each year to five, including two journal papers.** The CEGE faculty fully understand that the scholarly activities build the foundation for future sponsored research. The Department needs to find a way to reward scholarly work in conjunction with the sponsored research.
- **Increasing four-year graduation rate for full time FTIC students to 80%.** This goal can be reached through consideration of early exposure to majors, removal of unnecessary prerequisites and curriculum flexibility. An ad hoc committee has started looking into this practice.
- **Raising the pass rate of the Fundamentals of Engineering/Fundamentals of Surveying to the national average.** The CEGE faculty has already taken measures to improve the FS/FS pass rate. Those measures included, but not limited to, mini FE/FS exams, FE manuals in regular classes and some others.

L. Questions to Program Reviewer Team

- Are the steps we plan to take sufficient to bring our department nationally ranked? What else do we need to do to get there?
- Does the requirement of students taking FE before graduation help the department ranking?
- How significant are faculty's professional licenses? Should the faculty be required to obtain professional licenses?
- What can a department do to help FTIC students improve their math skills?

MADASAMY AROCKIASAMY, PH.D., P.E., P.ENG., FELLOW ASCE

Professor and Director

Center for Infrastructure and Constructed Facilities

Department of Civil, Environmental and Geomatics Engineering

Florida Atlantic University, Boca Raton, FL 33431

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PROFESSIONAL PREPARATION

University of Madras	Civil Engineering	Bachelor of Engineering, 1960
University of Madras	Structural Engineering	Master of Struct. Eng., 1963
University of Wisconsin, Madison	Civil Engineering	Ph.D., 1971

APPOINTMENTS

2000-present	Professor of Civil Engineering, Florida Atlantic University
2017-present	Member, Committee AR050, Transportation Research Board, Nat. Academies
2011- Present	Subject Matter Expert, International Electrotechnical Commission
1986 - 2000	Professor of Ocean Engineering, Florida Atlantic University
1984 - 1986	Associate Professor of Ocean Engineering, Florida Atlantic University
1981 - 1984	Associate Professor, Memorial Univ. of Newfoundland
1976 - 1981	Professor of Structural Engineering, Anna Technical University
1960-1976	Asst. Prof./Lecturer/Assoc. Lecturer, Anna Technical University

CLOSELY RELATED PRODUCTS (5)

1. X.Yang, **M. Arockiasamy**, A. Mirmiran, and W. Potter, "High Creep Stress Test of Carbon Fiber Composite Cable with Generic Field-Made Anchorage", Technical Note, ASCE Journal of Composites for Construction, ASCE, ISSN 1090-0268, March 2017.
2. X.Yang, P. Zohrevand, A. Mirmiran, **M. Arockiasamy**, and W. Potter, "Comparative Study of Un-bonded Carbon Fiber and Steel Strands in Post-tensioned Pier Caps", ASCE Journal of Composites for Construction, 10.1061/(ASCE)CC.1943-5614.0000596,04015042, June 2015.
3. X.Yang, P. Zohrevand, A. Mirmiran, **M. Arockiasamy**, and W. Potter, "Post-tensioning of Segmental Bridges Using Carbon-fiber Composite Cables", PCI Journal, May-June 2015, Vol. 60, No.3, pp. 50-61.
4. X.Yang, P. Zohrevand, A. Mirmiran, **M. Arockiasamy**, and W. Potter, "Effect of Elastic Modulus of Carbon Fiber Reinforced Polymer Strands on the Behavior of Post-tensioned Segmental Bridges", ASCE Journal of Composites for Construction, June 2015
5. S. Ishwarya, **M. Arockiasamy**, and R. Senthil, "Inelastic Nonlinear Pushover Analysis of Fixed Jacket-Type Offshore Platform with Different Bracing Systems Considering Soil-Structure Interaction", Journal of Shipping and Ocean Engineering, Vol.6, No. 4, July-Aug. 2016.

OTHER SIGNIFICANT PRODUCTS (5)

6. O. Chaallal, **M. Arockiasamy**, and A. Godat, "Field Test Performance of Buried Flexible Pipes for under Live Truck Loads" ASCE Journal of Performance of Constructed Facilities, Sept. 2014.

7. O. Chaallal, **M. Arockiasamy** and A. Godat (2014). "Numerical Finite-element Investigation of the Parameters Influencing the Behavior of Flexible Pipes for Culverts and Storm Sewers under Truck Load", *Journal of Pipeline Systems Engineering and Practice*, ASCE, Sept. 2014
8. O. Chaallal, **M. Arockiasamy** and A. Godat (2014). "Laboratory Tests to Evaluate Mechanical Properties of Flexible Pipes", *Journal of Performance of Constructed Facilities*, ASCE, Dec. 2013.
9. Felix Achille, **Madasamy Arockiasamy**, Perambur Neelakantaswamy and Charles E. Carraher, "Stability of Modified Inorganic Polymers Derived from Fly Ash to Extreme Hostile Environmental Conditions", *Polymeric Materials: Science and Engineering*, 104, 3-5, 2011.
10. Felix Achille, **Madasamy Arockiasamy** and Charles E. Carraher, "Inorganic Polymers- Stability of Fly Ash to Extreme Hostile Environmental Conditions", *Polymeric Materials: Science and Engineering*, 102, 97-98, 2010.

SYNERGISTIC ACTIVITIES

1. Co- Principal Investigator, NCHRP Rail Safety and Transit Idea Program, Transportation Research Board, National Academy of Sciences *Non-contact Deflection Monitoring System for Timber Railroad Bridges* 2017-2018
2. Co- Principal Investigator, SEED Grant, I-SENSE, Florida Atlantic University, *Transportation Infrastructure Health Monitoring and Management System using Wireless/Remote Sensors*, 2017
3. Principal Investigator (FAU), *Use of Fiber Reinforced Polymer Composite Cable for Post-Tensioning Applications*, Collaboration with Florida International University, Florida Dept. Transportation, 2012-2014
4. Co- Principal Investigator, Florida Dept. Transportation, *Development of a Methodology for the Assessment and Mitigation of Sea Level Rise Impacts on Florida's Transportation Models and Infrastructure*, 2010-2011
5. Co- Principal Investigator, *Developing a Multi-Hazard Mitigation Plan for FAU Multi-Campuses*. Federal Emergency Management Agency (FEMA)

Ph.D. Advisor: Ph.D. Dissertation Advisor: Dr. C.K.Wang, University of Wisconsin, Madison

WILLIAM BOBER, PH.D.

Associate Professor

Department of Civil, Environmental and Geomatics Engineering

Florida Atlantic University, Boca Raton, Florida 33431

Phone: 561-297-3090; Email: boberw@fau.edu

PROFESSIONAL PREPARATION

B.C.E. in Civil Engineering, C.C.N.Y. M.S. in Engineering Science, Pratt Institute. Ph.D. in Aerospace and Engineering Science, Purdue University.

APPOINTMENT

November 1981- May 2009, Associate Professor, Department of Mechanical Engineering, Florida Atlantic University – Tenured.

May 2009 – Present, Associate Professor, Department of Civil, Environmental and Geomatics Engineering, Florida Atlantic University – Tenured.

September 1969 - November 1981, Associate Professor, Department of Mechanical Engineering, Rochester Institute of Technology, Rochester, New York.

September 1968 - June 1969, Visiting Professor, Applied Mechanics Department, Virginia Polytechnic Institute, Blacksburg, Virginia.

July 1964 - August 1968, Associate Engineering Physicist, Applied Mechanics Department, Cornell Aeronautical Laboratory, Buffalo, New York.

Xerox Corporation, Rochester, New York, 1981-82.

Pratt & Whitney, West Palm Beach, Florida, Summer, 1986.

PRODUCTS

1. **Bober, W.**, "Fluid Mechanics Computer Project for ME Students", *IJMEE*,
2. **Bober, W.**, Tsai, C. T., Masory, O., *Numerical and Analytical Methods With MATLAB*, CRC Press, 2009.
3. **Bober, W.**, Stevens, A., *Numerical and Analytical Methods with MATLAB for Electrical Engineers*, CRC Press, 2013.
4. **Bober, W.**, *Numerical and Analytical Methods with MATLAB for Engineers and Scientists*, CRC Press, 2014.
5. **Bober, W.**, *MATLAB Essentials, A First Course for Engineers and Scientists*, CRC Press, 2017.
6. **Bober, W.** and Chow, W. L. "Non-ideal Isentropic Gas Flow Through Converging-Diverging Nozzles", *Journal of Fluid Engineering*, Vol. 112, No 4, 1990, p.455-461.
7. **Bober, W.**, "A Finite Difference Method for Boundary Layers Utilizing the Falkner and Skan Transformation", *International Journal of Mechanical Engineering Education*, Vol. 18, No. 1, 1990.
8. **Bober, W.** and Rossy, K. L., "A Desalination Problem as a Design Project", *International Journal of Mechanical Engineering Education*, Vol. 15, No. 2, 1987.
9. **Bober, W.** and Duyar, A., "Ground Heat Loss of a Solar Pond: Bottom and Side Losses", ASME, Paper No. 84-WA/Sol-23, Winter Annual Meeting, New Orleans, LA, 1984.

11. **Bober, W.**, Irby, J. B. and Abdallah, G. M., "The Conversion of an Analysis Type Computer Problem to a Design Project", International Journal of Mechanical Engineering Education, Vol. 12, No. 3, 1984
12. **Bober, W.**, "The Use of the swanee-Jain Formula in Pipe Network Problems", Journal of Pipelines, Vol. 4, p. 315, 1984.
13. **Bober, W.** and Robinson, J. A., "The Colebrook Equation Utilized in the Hardy-Cross Method", Journal of Pipelines, Vol. 3, p. 173, 1983.
14. **Bober, W.** and Kenyon, R. A., Fluid Mechanics, New York, Wiley and Sons,
15. **Bober, W.**, "Fluid Mechanics Computer Project for ME Students", IJMEE,

SYNERGISTIC ACTIVITIES

1. Chairman, Academic Affairs Committee (1992-2009).
2. College Graduate Committee (1992-2005).
3. College Undergraduate Committee (2006-Present).
4. Academic Advising for ME students, including updating computer advising program, printing and screening of all undergraduate ME student records, pre graduation check and graduation certification. (1993-2008).

PROFESSIONAL LICENTURE

1. Registered Professional Engineer, State of Florida, Retired.

FREDERICK BLOETSCHER, PH.D., P.E., DWRE, LEED-AP

Professor

Department of Civil, Environmental & Geomatics Engineering

Florida Atlantic University (FAU), Boca Raton, FL 33431

Phone: 239-250-2423; Email: h2o_man@bellsouth.net

PROFESSIONAL PREPARATION

Ph.D., 2001, Civil and Environmental Engineering University of Miami M.P.A.
1984 Public Administration University of N. Carolina at Chapel Hill
B.S. 1982 Civil Engineering University of Cincinnati

APPOINTMENTS

2016 – present Professor, Department of Civil, Environmental & Geomatics Engineering, College of Engineering and Computer Science, FAU
2011 – 2016 Associate Professor, Department of Civil, Environmental & Geomatics Engineering, College of Engineering and Computer Science, FAU
2005 - 2011 Assistant Professor, Department of Civil Engineering, College of Engineering and Computer Science, FAU
2004 – 2005 Adjunct Professor, Department of Civil, Environmental & Geomatics Engineering, College of Engineering and Computer Science, FAU
2001 – 2005 Adjunct Professor, Department of Civil, Architectural, and Environmental Engineering, University of Miami
2000 – Present President, Public Utility Management and Planning Services Inc., Hollywood, FL
1999 – 2000 Director of Engineering, Operations and Planning, Florida Governmental Utility Authority, Dania Beach, FL
1994 – 1999 Deputy Public Utilities Director, City of Hollywood, FL
1989 – 1994 Assistant Utilities Administrator, Collier County, FL
1986 – 1989 Town Administrator/Director of Public Works, Richlands, NC
1985 – 1986 Town Manager, Erwin, NC
1983 – 1985 Utilities Engineer, Public Utilities Department, City of Jacksonville, NC

PRODUCTS

- (i) Up to 5 products closely related to the proposed project
1. Englehardt, J.D.; Uu, T.; **Bloetscher, F.**; Deng, Y.; Pisani, P.; Eilert, S.; Elmir, S.; Guo, T.; Jacangelo, J.; LeChevallier, M.; Leverenz, H.; Mancha, E.; Plater-Zyberk, E.; Sheikh, B.; Steinle-Darling, and Tschobanoglous, G. 2015, Net-Zero Water Management: Achieving Energy-Positive Municipal Water Supply, *Environmental Science - Water Research & Technology*, Published By The Royal Society of Chemistry (accepted 2016).
 2. **Bloetscher, Frederick**; Pleitez, Fernando; Hart, James; Stambaugh, David; Jon Cooper; Kennedy, Karl; and Sher Burack, Lauren. 2014. Comparing Contaminant Removal Costs For Aquifer Recharge With Wastewater With Water Supply Benefits, *JAWRA Volume 50, Issue 2*, pages 324–333, April 2014
 3. AWWA, 2014, Reclaimed Water Program Operation and Management, ANSI/AWWA G481014 Standard, AWWA, Denver, CO.
 4. **Bloetscher, F.**; Stambaugh, D., Hart, J., Cooper, J.; Kennedy, K.; Burack, L.S. Ruffini, A.P.; Cicala, A.; Cimenello, S.; **Bloetscher, F.**; Stambaugh, D., Hart, J., Cooper, J.; Kennedy, K.; Burack, L.S. Ruffini, A.P.; Cicala, A.; Cimenello, S. 2013. Use of Lime, Limestone And Kiln Dust To Resolve Saturation Issues With Reverse Osmosis Treated Wastewater For Injection, *Journal of Water Reuse and Desalination* doi:10.2166/wrd.2013.09

5. Lisk, Bryan; Greenberg, Ely and **Bloetscher, Frederick** 2012. *Implementing Renewable Energy at Water Utilities Web Report #4424*, Water Research Foundation, Denver, CO.
- (ii) Up to 5 other significant products
 1. Carsey Thomas; Jack Stamates; Jia-Zhong Zhang; **Frederick Bloetscher**; Daniel Meeroff; Natchanon Amornthammarong; Joseph Bishop; Cheryl Brown; Charles Featherstone; John Proni, 2015. Point Source Nutrient Fluxes from an Urban Coast: the Boynton (Florida). Environment and Natural Resources Research, v.5 (2). DOI: 10.5539/enrr.v5n2p121
 2. Bloetscher, F.; Meeroff, D.E., Long, S.C. and Bocca, T. 2013 The Use of Multiple Tracers to Evaluate the Impact of Sewered and Non-sewered Development on Coastal Water Quality in a Rural Area of Florida, Water Environment and Research 2014 May;86(5):445-56.
 3. Meeroff, D.M., Reddy, D.V.; **Bloetscher, F.**; Gasnier, F.; Jain, S.; McBarnette, A. and Hamaguchi, H. 2012. Application of Photochemical Technologies for Treatment of Landfill Leachate, Journal of Hazardous Materials. (Impact factor: 4.14). 03/2012; 209-210:299-307. DOI:10.1016/j.jhazmat.2012.01.028.
 4. Carsey, T.; Amornthammarong, N.; Bishop, J.; **Bloetscher, F.**; Brown, C.; J. Craynock, J.; Cummings, S.; Dammann, P.; Davis, J.; Featherstone, C.; Fischer, C.; Goodwin, K.; Meeroff, D.E.; Proni, J.R.; Sinigalliano, C.; Stamates, J.; Swart, P.; Zhang, J-Z. September, 2012, Boynton Inlet 48-Hour Sampling Intensives: June and September 2007. NOAA Technical Report, OAR AOML-40, Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida.

SYNERGISTIC ACTIVITIES

Courses Taught:

Environmental Systems & Processes, Water/Wastewater Technology, Civil Engineering Design 1 & 2, Construction Project Management, Hydrology, Environmental Systems Modeling, Groundwater, Infrastructure Management, Groundwater Contamination, AutoCAD for Engineers, Intro to Environmental. Engineering.

THESIS ADVISEES (CHAIR ONLY)

C. Skinner (2006), A. Toro (2008), J. Pire-Schmidt (2009), J. Gao (2009), E. Kennedy (2009), K. Bernsten (2009), E. Stanley (2012), T. Romah (2012), A. Cicala (2013), T. van Allen (2015), R. Eustice (2015), C. Dickinson (2015), M. Wood (2016).

SERVICE/OTHER ACTIVITIES

Advisory Committee on Water Information (ACWI – advises the United States Geological Survey) 2006 – date

American Water Works Association (1986 to date)

Water Resource Division Trustee (2003 to date -Vice Chair, 2004 to 2007, Chair 2007 – 2010, Chair Sustainable Water Sources Conference, Reno, 2008); Education Committee (2007-2010, 2012-date, Chair, 2010); Climate Change Committee (2010-date); Groundwater Committee (1994 to date, Chairman, 1999 to 2002, 2011- date)

Florida Section American Water Works Association (1989 to date), Technical Program Chair (2004 - date)

American Society of Civil Engineers – Diplomate 2007

LICENSES AND CERTIFICATIONS:

Professional Engineer's License (North Carolina, Florida, Georgia, South Carolina, Utah, Colorado, Tennessee, Michigan and Ohio).

National Groundwater Association Fly-in of Water Scarcity (with federal agencies)

Testified to US Senate subcommittee

JINWOO JANG, PH.D.

Assistant Professor and I-SENSE Fellow

Department of Civil, Environmental and Geomatics Engineering

Florida Atlantic University, Boca Raton, FL 33431

Phone: 561-297-2987; Email: jangj@fau.edu

PROFESSIONAL PREPARATION

Kookmin University	Civil & Environmental Engineering	B.E. 2009
Columbia University	Civil Eng. & Eng. Mechanics	M.S., 2011
Columbia University	Civil Eng. & Eng. Mechanics	M.Phil. 2013
Columbia University	Civil Eng. & Eng. Mechanics	Ph.D., 2016

APPOINTMENTS

2017 - Present	Assistant Professor, Civil, Environmental & Geomatics Engineering, Florida Atlantic University
2017 - Present	Faculty Fellow, Institute for Sensing & Embedded Network Systems Engineering (I-SENSE), Florida Atlantic University
2016 - 2017	Postdoctoral Research Scientist, Columbia University
2014 - 2014	Research Intern, Philips Research North America
2013 - 2016	Staff Associate, Columbia University

CLOSELY RELATED PRODUCTS (5)

1. **Jang, J.** (2017). "Development of data analytics and modeling tools for civil infrastructure condition monitoring applications." Ph.D. thesis, Columbia University Academic Commons, New York
2. **Jang, J.**, and Smyth, A. W. (2017). "Bayesian model updating of a full-scale finite element model with sensitivity-based clustering." *Structural Control and Health Monitoring*.
3. **Jang, J.**, and Smyth, A. W. (2017). "Model updating of a full-scale FE model with nonlinear constraint equations and sensitivity-based cluster analysis for updating parameters." *Mechanical Systems and Signal Processing*. 83(15): 337-355.
4. **Jang, J.**, Yang, Y., Smyth, A. W., Cavalcanti, D., and Kumar, R. (2016). "Framework of data Acquisition and integration for the detection of pavement distress via multiple vehicles." *Journal of Computing in Civil Engineering*. 31(2).
5. **Jang, J.**, Smyth, A. W., Yang, Y., and Cavalcanti, D. A. T. (2015). "Road surface condition monitoring via multiple sensor-equipped vehicles." *IEEE INFOCOM*. 43-44. Hong Kong.

SYNERGISTIC ACTIVITIES

- 1) Journal reviewer: *Mechanical Systems and Signal Processing*, *Structural Control and Health Monitoring*
- 2) Associate member of American Society of Civil Engineers (ASCE): Member of ASCE EMI Dynamics Committee, Member of ASCE EMI Structural Health Monitoring and Control Committee

- 3) Developed a sensitive-based parameter clustering method for vibration-based damage detection approaches
- 4) Developed a framework of a road surface monitoring system which leverages connected vehicles, embedded networking systems and sensor networks.

EVANGELOS I. KAISAR, PH.D.

Associate Professor and Director
Geomatics and Transportation Engineering Program
Freight Mobility Research Institute (FMRI)
Department of Civil, Environmental and Geomatics Engineering
Florida Atlantic University, Boca Raton, FL 33431;
Phone: 561-297-4084; Email: ekaisar@fau.edu

PROFESSIONAL PREPARATION

University of Maryland at College Park	Civil Engineering	Bachelor of Science, 1998
University of Maryland at College Park	Civil Engineering	Master of Science, 2000
University of Maryland at College Park	Civil Engineering	Ph.D., 2005

APPOINTMENTS

2016 - Present	Director, Freight Mobility Research Institute (FMRI), TIER 1 Transportation Research Center, USDOT
2012 – Present	Associate Professor (tenured), Civil Engineering, Florida Atlantic University
2012 - Present	Director, Geomatics and Transportation Engineering Program, Florida Atlantic University
2013 - Present	Member, Committee AT050, Transportation Research Board, Nat. Academies
2014 - Present	Member, Committee ABR30, Transportation Research Board, Nat. Academies
2006 - 2012	Assistant Professor, Civil Engineering, Florida Atlantic University
2005 - 2006	Program Manager, Maryland Transportation Authority (MdTA)

CLOSELY RELATED PRODUCTS (5)

1. Soltani-Sobh A., Heaslip k., Scarlatos P., and **Kaisar E.**, “Reliability Based Pre-Positioning of Recovery Centers for Resilient Transportation Infrastructure”, International Journal of Disaster Risk Reduction, Sept, 2016.
2. **Kaisar E.**, Coolahan J., Koomullil R., and Averkiou P., “Infectious Disease and Hospital Surge Capacity Impacts on Urban Transportation”, International Journal of Transportation, Vol 4, No. 2, pp-15-30, Aug. 2016.
3. Zhao Y. and **Kaisar E.**, “Modeling and Simulation on Yard Trailers in a Maritime Terminal”, Journal of Logistics Engineering and Management, (2014).
4. Stevanovic A., Olarte C., Gallettebeitia a., Gallettebeitia B., and **Kaisar E.**, “ Testing Accuracy and Reliability of MAC Readers to Measure Arterial Travel Times”, Journal of International Intelligent Transportation System Research, (2014).
5. Golias M.M., Portal M.I., Konur D., **Kaisar E.**, and Kolomvos G., “Robust berth scheduling at marine container terminals via hierarchical optimization.” Journal of Computers and Operations Research, art. Number: 3378, (2013).

OTHER SIGNIFICANT PRODUCTS (5)

1. E. Bou-Harb, **Kaisar E.**, and Austin M., “On the Inference and Characterization of Novel Empirical Attack Models Targeting Container Terminals” conference proceedings at the 5th

IEEE International Conference on Models and Technologies for Intelligent Transportation Systems, Naples, Italy June 26-28 2017.

2. MD Sultan A., **Kaisar E.**, and M. Hadi “Guidance for Identifying Corridor Conditions that Warrant Deploying Transit Signal Priority and Queue Jump” conference proceedings at the 5th IEEE International Conference on Models and Technologies for Intelligent Transportation Systems, Naples, Italy June 26-28 2017.
3. **Kaisar E.**, and Al-Ghandour M., “Comparative Analysis of Diverging Diamond Interchange and Partial Cloverleaf Interchange Using Micro-Simulation Modeling” conference proceedings at the 5th Urban Street Symposium, Raleigh, North Carolina, May 21-24 2017.
4. **Kaisar E.**, Al-Ghandour M., and Averkiou P., “The Impact of Junctions on the Frequency and Severity of Road Crashes in Florida” conference proceedings at the 5th Urban Street Symposium, Raleigh, North Carolina, May 21-24 2017.
5. **Kaisar E.**, and Al-Ghandour M., “Traffic Impact Assessment of Partial Cloverleaf Using Microscopic Traffic Simulation” conference proceedings at the 96th Transportation Research Board Annual Meeting, Washington DC, January 2017.
6. Zhao Y., and **Kaisar E.**, “Modeling and Simulation on the Yard Trailers Deployment in the Maritime Container Terminal”, submitted to 14th World Conference of Transportation Research, Shanghai, China, July 2016.

SYNERGISTIC ACTIVITIES

1. Principal Investigator, “**Freight Mobility Research Institute (FMRI)**” A USDOT TIER 1 University Transportation Center sponsored by the U.S. Department of Transportation, period: 2016-2022, Amount: \$ 10,516,500.
2. Principal Investigator for the Research Project: “**Guidance for Identifying Corridor Conditions that Warrant Deploying Transit Signal Priority and Queue Jump**” sponsored by Florida Department of Transportation, period: 2016-2017, Amount: \$ 135,723.
3. Co-Principal Investigator for the Research Project (50%): “**A Smart Port Resiliency Assessment and Planning Tool**” sponsored by the Department of Homeland Security, period: 2014-2017, Amount: \$525,000.
4. Co-Principal Investigator for the Research Project (30%): “**Developing a Multi-Hazard Mitigation Plan for South East Florida (FAU Multi campuses)**” sponsored by Federal Emergency Management Agency (FEMA), period: 2010-2014, Amount: \$400,000.
5. Co-Principal Investigator for the Research Project (25%): “**Development of a Methodology for the Assessment and Mitigation of Sea Level Rise Impacts on Florida’s Transportation Models and Infrastructure**” sponsored by Florida Department of Transportation (FDOT), period: 2010-2011, Amount: \$149,071.

DANIEL EDUARDO MEEROFF, PH.D., E.I.

Professor and Associate Chair
Department of Civil, Environmental & Geomatics Engineering,
Florida Atlantic University, Boca Raton, FL 33431
Phone: 561-297-3099; Email: dmeeroff@fau.edu,
<http://labees.civil.fau.edu>

Professional Preparation

Florida Tech	Melbourne, FL	Environmental Science	B.S. 1995
University of Miami	Coral Gables, FL	Civil/Env. Engineering	M.S. 1997
University of Miami	Coral Gables, FL	Civil/Env. Engineering	Ph.D. 2001
University of Miami	Coral Gables, FL	Civil/Env. Engineering	Post-Doc 2001-3

Appointments

2013 – Present	Associate Chair and Professor, Department of Civil, Environmental & Geomatics Engineering, College of Engineering and Computer Science, FAU
2008 – 2013	Associate Professor, Department of Civil, Environmental & Geomatics Engineering, College of Engineering and Computer Science, FAU
2003 – Present	Director, Laboratories for Engineered Environmental Solutions
2003-2008	Assistant Professor, Department of Civil Engineering, College of Engineering and Computer Science, FAU
2001 – 2003	Adjunct Professor/Instructor/Post-Doctoral Research Fellow, Department of Civil, Architectural, and Environmental Engineering, University of Miami

Products

- (ii) Up to 5 products (out of 154 including conference proceedings and refereed reports)
1. Carsey, T., Stamates, J., Zhang, J. Z., **Bloetscher, F., Meeroff, D.,** & Featherstone, C. (2015). Point Source Nutrient Fluxes from an Urban Coast: The Boynton (Florida) Inlet. *Environment and Natural Resources Research*, 5(2), 121-134.
 2. D. Chamley-Wiik, K. Dunn, P. Heydet-Kirsch, M. Holman, **D.E. Meeroff,** and J. Peluso. (2014). "Scaffolding the development of student research skills for capstone experiences: A multi-disciplinary approach." *CUR Quarterly*, Volume 34, Number 4, 18-25
 3. **D.E. Meeroff,** F. Bloetscher, S.C. Long, and T. Bocca (2014). "The Use of Multiple Tracers to Evaluate the Impact of Sewered and Non-Sewered Development on Coastal Water Quality in a Rural Area of Florida." *Water Environment Research*, Volume 86, Number 5, 445-456.
 4. **D.E. Meeroff, Bloetscher, F.,** Reddy, D. V., Gasnier, F., Jain, S., McBarnette, A., & Hamaguchi, H. (2012). Application of photochemical technologies for treatment of landfill leachate. *Journal of hazardous materials*, 209, 299-307.
 5. **D.E. Meeroff,** F. Bloetscher, T. Bocca, and F. Morin (2008). "Evaluation of Water Quality Impacts of On-Site Treatment and Disposal Systems on Urban Coastal Waters." *Water, Air, and Soil Pollution*. Volume 192, Number 1-4. pp. 11-24.
- (iii) Up to 5 other significant products
1. F. Bloetscher and **D.E. Meeroff** (2015). "Practical Concepts for Capstone Design Engineering," J. Ross Publishing.

2. Tota-Maharaj, K., and D.E. Meeroff (2013). "Evaluation of Solar Photosensitised River Water Treatment in the Caribbean." *International Journal of Photoenergy*.
3. D.E. Meeroff and Fred Bloetscher (2012). "Opportunities for Innovation in Making Membrane Filtration a Bigger Part of Our Future" 25th Anniversary of the American Filtration Society Annual Conference, Embassy Suites, Boca Raton, FL, June 7, 2012.
4. D.E. Meeroff, F. Bloetscher, and A. Muniz (2008). "Green Building Concepts in the Engineering Curriculum," American Society of Engineering Education, SE Section Conference Proceedings, University of Memphis, TN.
5. D.E. Meeroff, T.D. Waite, J. Kazumi, and C.N. Kurucz (2004). "Radiation-assisted process enhancement in wastewater treatment." *Journal of Environmental Engineering*. Volume 130, Number 2. pp. 155–166. (2012: Impact Factor: 1.312)

Synergistic Activities

Courses Taught

ENV3001C – Env Science/Engineering w Lab	ENV4501 – Water / Wastewater Technology
ENV4341 – Solid/Haz Waste Mgmt/ Remediation	Pollution Control Technologies
EGN2095 – Engineering Chemistry	EGN2095L – Engineering Chemistry Lab
CGN4803C – CEGE Design 1 (WAC)	CGN4804C – CEGE Design 2 (WAC)
CGN3910 – Undergraduate Research in Civ Eng	IDS3911 – Intro to Research Design (NSF)
ENV6668 – Env Systems and Processes	ENV6507 – Wastewater Engineering
ENV6418 – Water Supply and Treatment	ENV6356 – Solid Waste Management
CAE540 – Environmental Chemistry (UM)	CGN240 – Environmental Pollution (UM)

Thesis/Dissertation Advisees

Supervised 47 graduate students, 10 visiting researchers, chaired 17 thesis/project/dissertation committees, and graduated 26 (11 as chair). Note: Department does not have a Ph.D. program.

Patents

J.D. Englehardt and D.E. Meeroff (2003). "Mediated Aeration Process for Purification of Water and Wastewater," International Provisional Patent Application, University of Miami (UM 04-02), October 29, 2003.

Service/Other Activities

Department ABET accreditation leader for two programs; created new B.S. Environmental Engineering degree program; developed a new STEM curriculum for Broward County middle school students that was adopted by the entire system; FAU Distinguished Research Mentor of the Year, 2015; John J. Guarrera Engineering Educator of the Year, The Engineer's Council, 2014; FAU Distinguished Teacher of the Year, 2014; Quality Matters Seal of Recognition for eLearning, EGN2095-Engineering Chemistry, 2013; NCEES Engineering Award \$25,000 Winner, Dania Beach Nanofiltration Plant Expansion, 2012; FAU Excellence and Innovation in Undergraduate Teaching Award, 2011; Co-chair, National Pollution Prevention Roundtable Sustainable Hospitality Research Workgroup; EWRI Joint Committee on Environmental Processes and Technologies, Committee Member

Professional Licensure

Engineer Intern. State of Florida Board of Professional Engineers.

License #: 1100003721 (September 1998)

SUDHAGAR NAGARAJAN, PH.D.

Assistant Professor

Department of Civil, Environmental and Geomatics Engineering,
Florida Atlantic University, Boca Raton, FL 33431
Phone: (561) 297 3104; Email: snagarajan@fau.edu

PROFESSIONAL PREPARATION

Anna University, India	Geoinformatics Engineering	B.E., 2000
Stuttgart University of App. Sci.	Photogrammetry and Geoinformatics	M.Sc., 2006
The Ohio State University	Geodetic Science	M.S., 2008
The Ohio State University	Geodetic Science	Ph.D., 2010

APPOINTMENTS

2013-present: Assistant Professor, Geomatics Engineering, Florida Atlantic University
2012-2013: Assistant Professor, Geomatics, Nicholls State University
2009-2012: Programmer/Postdoctoral Associate/Research Scientist, University at Buffalo
2002-2004: Digital Photogrammetry Engineer, Geofiny Tech. Pvt. Ltd., Chennai, India
2001-2002: Spatial Data Executive, DSM Soft Pvt. Ltd, Trichi, India
2000-2001: Photogrammetry Operator, BlomUAE, Abu Dhabi, United Arab Emirates

PRODUCTS: RELATED PUBLICATIONS

1. **Nagarajan, S.**, M. Arockiasamy, and M. Banyhany, Bridge Pier Scour Hole Simulation and 3D Reconstruction Using Green Laser, Transportation Research Record (Under Review)
2. **Nagarajan, S.**, and S. Moafipoor, Bore-sight Calibration of Low Point Density LIDAR sensors, Photogrammetric Engineering and Remote Sensing Journal. (Under Review)
3. Barsai, G., A. Yilmaz, P. Srestasathiern, and S. Nagarajan, Registration of LIDAR and Image without Establishing Explicit Correspondences. (Accepted), Photogrammetric Engineering and Remote Sensing Journal
4. **Nagarajan, S.**, N. Sairam, C. Antoniou, Integration of Images and Laser Scanning Data for Automated 3D Road Feature Extraction, Surveying and Land Information Science Journal, 2016 issue Vol 75 (No. 2).
5. Sairam, N., S. **Nagarajan, S.** Ornitz, Development of Mobile Mapping System for 3D Road Asset Inventory, Sensors 2016, 16(3), 367;
6. **Nagarajan, S.**, T. Schenk, Feature-based registration of historical aerial images by Area Minimization, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 116, June 2016, Pages 15-23
7. **Nagarajan, S.**, C. Antoniou, Framework for Automatic Extraction of Road Features from Multi-Sensor Data, Compendium of 94th Annual Meeting of Transportation Research Board, January 11-15, 2015, Washington, D.C.
8. **Nagarajan, S.**, A Linear Feature Based Recovery of Registration Parameters Using Area Minimization, Surveying and Land Information Science Journal. 2014, Volume 73, Number 2, November 2014, pp. 61-69(9)

SYNERGISTIC ACTIVITIES

1. Principal Investigator, National Academy of Sciences, Engineering and Medicine,

Transportation Research Board, Rail Safety IDEA Program: Non-contact Deflection Monitoring System for Timber Railroad Bridges, 2017-2019

2. Principal Investigator, Bureau of Land Management/Palm Beach County: 3D Mobile Laser Scanning of Indian River Lagoon around JILONA, 2017 (renewable up to 3 years)
3. Principal Investigator, I-SENSE of Florida Atlantic University Seed Grant: Transportation Infrastructure Health Monitoring and Management System using Wireless/Remote Sensors, 2017
4. Change detection of Dynamic Environments: I am also working on integrating terrestrial or close range photogrammetric, laser scanning and bathymetric techniques for ecological monitoring of habitat of different species of vegetation and animals. The changing season, climate and topography plays an important role in the life cycle of living organisms. My role in this research involves collaborating with environmental scientists, biogeographers, ecologists and related government authorities to develop a mobile mapping system that provides micro-topography and evaluate the impact of climatic changes on the environment. I also have research interest in monitoring the structural health of weakening infrastructures by using feature based photogrammetric methods. This research involves developing high precise and accurate mapping technology that can detect sub-millimeter level surface deflections by collaborating with structural engineering professors
5. Development of Mobile Mapping Systems: I have been collaborating with State transportation authorities and local counties to develop a ground and UAV (Unmanned Aerial Vehicle) based mobile mapping systems consisting of cameras, laser scanner, GPS/IMU (Inertial Measurement Unit) sensors for mapping grade accuracy mapping. This research involves sensor integration, Georeferencing, automated feature extraction and information retrieval in the form of a GIS database.
6. Educational research: The research involves creating pathways to veterans through Geomatics Engineering degree programs. According to U.S Department of Labor, Geospatial Technology is one of three fields to generate high number of jobs in the next 10 years. On the other hand, veterans are a potential source of highly motivated skilled talent and as part of their intensive military training, they learn various engineering techniques. This core idea of this research is to identify the activities related to geospatial engineering and create pathways to geospatial engineering through that training. My other educational research involves incorporating undergraduate research components in Geomatics Engineering courses of Florida Atlantic University.
7. Advisory Editor, Journal of Applied Engineering Sciences, De Gruyter Open; Guest Editor, Special Issue on Physics and Economics of Ecosystem Services Flows, Physics and Chemistry of the Earth, Elsevier; Member, ISPRS, WG I/7: Mobile Mapping Technology; Member, Standing Committee on Geospatial Data Acquisition Technologies, AFB80, Transportation Research Board

D. V. REDDY, Ph.D., P.E.

Professor and Director,
Center for Marine Structures and Geotechnique Director
Department of Civil, Environmental and Geomatics Engineering
Florida Atlantic University, Boca Raton, FL 33431
Phone: 561-297-3443; Email: dreddy@fau.edu

PROFESSIONAL PREPARATION

University of Madras	Civil Engineering	B.E.
Imperial College	Structural Engineering	D.I.C.
Northwestern University	Civil Engineering	M.S.
University of Liverpool	Structural Engineering	Ph.D.

APPOINTMENTS

2001 - Present	Professor of Civil Engineering, Florida Atlantic University
1982 - 2001	Professor of Ocean Engineering, Florida Atlantic University
1989 -present	Director, Center for Marine Structures and Geotechnique, Florida Atlantic University
1980 - 1982	Professor, Coastal and Oceanographic Engineering, University of Florida
1971 - 1985	Professor of Engineering, Faculty of Engineering and Applied Science, Memorial University of Newfoundland
1966 - 1969/ 1969 - 1971	Professor and Head of the Applied Mechanics and Aeronautics/Applied Mechanics, Indian Institute of Technology
1968 - 1969	Associate Professor, Department of Mechanical Engineering, The University of Calgary
1961 - 1966	Assistant Professor of Applied Mechanics, Indian Institute of Technology
1963 - 1965	Visiting Assistant Professor of Civil Engineering, University of Illinois
	Visiting Professorships, University of Hannover (1977&1978), South Dakota School of Mines & Technology (1975) Rapid City, SD , Chulalongkorn University (2002), Bangkok, Thailand

CLOSELY RELATED PRODUCTS (5)

Books:

1. **D.V. Reddy** and A.S.J. Swamidas, "Essentials of Offshore Structures", Taylor and Francis, Boca Raton, FL, 2013. ISBN-13: 978-1420068825.
2. **V. Reddy** and M. Arockiasamy, (Editors), Offshore Structures, Krieger Publishing Co. Inc., Melbourne, FL, Vols. 1 and 2, April 1991.
3. **V. Reddy** and B. V. Rangan (Editors), High Performance Concrete, Proceedings of the USA-Australia Workshop, Sydney, Australia 1997.
4. **V. Reddy** and V. Ramakrishnan (Editors), Durability of Concrete Structures, Proc. NSF Sponsored U.S.A.-India Workshop, Bangalore, August 1993.
5. **V. Reddy** and V. Ramakrishnan (Editors), Durability of Concrete, Proc. NSF Sponsored U.S.A.-Singapore Workshop, Singapore, July 1993.

OTHER SIGNIFICANT PRODUCTS (5)

Journal Papers:

1. **V. Reddy**, F. Martinez, and K. Sobhan (2017). "Fire Resistance of Corroded High-Strength Structural Concrete," submitted to ACI Materials Journal, American Concrete Institute.
2. Sobhan, L. Gonzalez, and **D. V. Reddy** (2016). "Durability of a Pavement Foundation made from Recycled Aggregate Concrete Subjected to Cyclic Wet-dry Exposure and Fatigue Loading," *Materials and Structures*, RILEM, Volume 49, Issue 6, pp. 2271-2284, June 2016.
3. **D. V. Reddy**, K. Sobhan, L. Liu, J. D. Young (2015). "Size Effect on Fire Resistance of Structural Concrete," *Engineering Structures*, 99 (2015), 468-478.
4. **D. V. Reddy**, K. Sobhan, and Young J.D. (2015). "Fire Resistance of Structural Concrete Retrofitted with Carbon Fiber-Reinforced Polymer Composites," *Journal. Transportation Research Board*, No. 2522, Structures, Washington D.C., pp. 151-160.
5. **Reddy, D. V.**, Edouard, J-B., and Sobhan, K. (2013). "Durability of Fly-ash-based Geopolymer Structural Concrete in the Marine Environment," *ASCE Journal of Materials in Civil Engineering*, Volume 25, Issue 6, pp. 781-787.

SYNERGISTIC ACTIVITIES (8)

1. Fulbright Visiting Scholar, Thailand, 2002
2. Distinguished Teacher of the Year, Florida Atlantic University, 1988-89
3. Member, ACI Committees, a) 214, Evaluation of Results of Tests Used to Determine the Strength of Concrete, b) 341, Earthquake-Resistant Concrete Bridges, c) 544, Fiber Reinforced Concrete, d) 222, Corrosion of Metals in Concrete.
4. P.Eng (Newfoundland and Alberta, Canada)
5. P.E. (Florida) and P. Eng. (Newfoundland and Labrador, and Alberta, Canada).
6. FACI (Fellow of the American Concrete Institute).
7. 7) M. ASCE (Member, American Society of Civil Engineers).
8. 8) M.I. Struct. E. and C. Eng. (Member, Institution of Structural Engineers and Chartered Engineer), Great Britain.
9. Principal Investigator of many research projects (NSF, TRB, FDOT, FL Center for Solid and Hazardous Waste Management, Florida Sea Grant) paper awards.

Ph.D. Dissertation Advisor: Dr. A.W. Hendry, University of Liverpool, U.K.

BARRY T. ROSSON, Ph.D., P.E., F.ASCE,

Professor

Department of Civil, Environmental & Geomatics Engineering,
Florida Atlantic University, Boca Raton, FL 33431
Phone: 561-297-4554; Email: rosson@fau.edu

PROFESSIONAL PREPARATION

Texas A&M University	Civil Engineering	B.S. 1983
Texas A&M University	Civil Engineering	M.S. 1985
Auburn University	Civil Engineering	Ph.D. 1991

APPOINTMENTS

2007 - Present	Professor of Civil Engineering, Florida Atlantic University
2010 - 2014	Vice President for Research, Florida Atlantic University
2007 - 2014	Dean of the Graduate College, Florida Atlantic University
2004 - 2007	Associate Dean of Graduate Studies, University of Nebraska
2003 - 2004	Director of Graduate Studies, College of Engineering, University of Nebraska
2003 - 2007	Professor of Civil Engineering and Associate Chair, University of Nebraska
1997 - 2003	Associate Professor of Civil Engineering, University of Nebraska
1997 - 2003	Assistant Professor of Civil Engineering, University of Nebraska

JOURNAL PUBLICATIONS (5)

1. Keierleber, C.W., **Rosson, B.T.**, "Higher-Order Implicit Dynamic Time Integration Method," *ASCE Journal of Structural Engineering*, Vol. 131, No. 8, pp. 1267-1276, 2005.
2. **Rosson, B.T.**, Suelter, J.L., "Closed-Form Equations for Hardening of Sand-Lime Mortar Joints," *ASCE Journal of Engineering Mechanics*, Vol. 27, No. 6, pp. 574-581, 2001.
3. Faller, R.K., Ritter, M.A., **Rosson, B.T.**, Fowler, M.D., Duwadi, S.R., "Two Test Level 4 Bridge Railing and Transition Systems for Transverse Timber Deck Bridges," *Transportation Research Record 1696*, Journal of the Transportation Research Board, National Research Council, Washington, D.C., pp. 334-351, 2000.
4. Boothby, T.E., **Rosson, B.T.**, "Elasto-Plastic Hardening and Shakedown of Masonry Arch Joints," *Meccanica*, Vol. 34, pp. 71-84, 1999.
5. **Rosson, B.T.**, Soyland, K., Boothby, T.E., "Inelastic Behavior of Sand-Lime Mortar Joint Masonry Arches," *Engineering Structures*, Vol. 20, Nos. 1-2, pp. 14-24, 1998.

REFEERED CONFERENCE PUBLICATIONS (5)

1. **Rosson, B.T.**, "Modeling the Influence of Residual Stress on the Ultimate Load Conditions of Steel Frames," *NASCC (AISC) Conference, Structural Stability Research Council*, Baltimore, MD, April 10 – 13, 2018.
2. **Rosson, B.T.**, "A Versatile and Straightforward Approach to Modeling the Stiffness Reduction of Steel W-Shapes," *ASCE (SEI) Structures Congress*, Ft. Worth, TX, April 19 – 21, 2018.
3. **Rosson, B.T.**, "Modeling the Stiffness Reduction Conditions of Steel Beam-Columns," *EuroSteel 2017*, Copenhagen, Denmark, September 13 – 15, 2017.

4. **Rosson, B.T.**, "Major and Minor Axis Stiffness Reduction of Steel Beam-Columns under Axial Compression and Tension Conditions," *NASCC (AISC) Conference, Structural Stability Research Council*, San Antonio, TX, March 21 – 24, 2017.
5. **Rosson, B.T.**, Keierleber, C.W., "Higher-Order MDOF Time Integration Methods," *Second M.I.T. Conference on Computational Fluid and Solid Mechanics*, Cambridge, MA, June 17 – 20, 2003.

CONTRACTS AND GRANTS

18 Research Projects: \$3,064,733 Total Funding

Funding Sources: National Science Foundation; USDA Forest Products Laboratory; Council of Graduate Schools; Nebraska Department of Roads; 3M Corporation; Nebraska Public Power District; Omaha Public Power District; U.S. Army Waterways Experiment Station; and Kansas, Missouri and South Dakota Departments of Transportation

GRADUATE STUDENTS

Supervised 15 graduate students; chaired 2 dissertation committees and 9 thesis committees, and 4 MS design projects.

NATIONAL LEADERSHIP AND SERVICE

Chair of the Committee on Professional Practice, ASCE Presidential and Board Appointment

Chair of the Council of Institute Presidents, ASCE

President of the Architectural Engineering Institute, ASCE/AEI

Associate Editor of the *Journal of Structural Engineering*, ASCE/SEI

Member of the Dynamic Effects Committee, Technical Administration, ASCE/SEI

Control Group Member of the Shock and Vibratory Effects Committee, ASCE/SEI

HONORS AND AWARDS

Fellow, American Society of Civil Engineers

Chapter Honor Member, Chi Epsilon, University of Nebraska

Fellow, Architectural Engineering Institute

Holling Family Master Teacher Award, College of Engineering, University of Nebraska

Distinguished Teaching Award, University of Nebraska Honors Convocation

Recognition for Contributions to Students, University of Nebraska

Faculty Service Award, College of Engineering, University of Nebraska

Outstanding Advisor Recognition, College of Engineering, university of Nebraska

Best Paper Award, TRB Committee on Roadside Safety Features

HONOR SOCIETY AND PROFESSIONAL MEMBERSHIPS

Member, Phi Kappa Phi, Tau Beta Pi, Chi Epsilon and Phi Eta Sigma

Member, Structural Stability Research Council and American Society for Engineering Education

Registered Professional Engineer (P.E.), State of Nebraska, E-7866

PANAGIOTIS (PETE) D. SCARLATOS, DR.-ENG.

Professor

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PROFESSIONAL PREPARATION

Aristotle University of Thessaloniki	Civil Engineering	Dipl. in Civil Engr. (5-yr), 1972
Aristotle University of Thessaloniki	Civil Engineering	Doctorate in Civil Engr., 1981

APPOINTMENTS

2013 - Present	Graduate Professor of Civil Engineering, Florida Atlantic University
2009 - 2013	Chair & Professor, Department of Civil, Environmental & Geomatics Engineering, Florida Atlantic University
2006 – 2010	Executive Director, Universities Consortium for Intermodal Transportation Safety and Security
2006 – 2016	Director, Center for Intermodal Transportation Safety and Security, Florida Atlantic University
2006 – 2016	University Representative for the Transportation Research Board
2005 - 2009	Chair & Professor, Department of Civil Engr., Florida Atlantic University
2004 – 2005	Interim Chair & Professor, Dept. of Civil Engr., Florida Atlantic University
2001 – 2004	Professor of Civil & Ocean Engineering, Department of Civil Engineering, Florida Atlantic University
1996 – 2001	Professor & Coordinator, Civil Engineering Graduate Program, Department of Ocean Engineering, Florida Atlantic University
1989 - 1996	Associate Professor & Coordinator (tenured in 1994) of the Water Resources/ Environmental Engineering, Department of Ocean Engineering, Florida Atlantic University
1986 - 1989	Adjunct Assistant Professor, Department of Ocean Engineering, Florida Atlantic University
1985 - 1989	Water Resources Engr., Dept. of Resource Planning, South Florida Water Management District
1984 - 1985	Post-Doctoral Research Associate, Louisiana Water Resources Research Institute, Louisiana State University
1981 -1983	Post-Doctoral Research Associate, Coastal Ecology Laboratory, Center for Wetland Resources, Louisiana State University

CLOSELY RELATED PRODUCTS (5)

1. *Computational Modelling in Hydraulics and Coastal Engineering* by Koutitas, C.G. and **Scarlatos, P.D.**, Taylor & Francis Group, CRC Press, 2016; 301 pages. ISBN: 878-1-4987-0891-3
2. Soltani-Sobh, A., Heaslip, K., **Scarlatos, P.** and Kaiser, E. (2016). "Reliability based
3. Positioning of recovery centers for resilient transportation infrastructure", *Int'l Journal of*

4. Hoffman, D.C. and **Scarlatos, P.D.** (2012). "Application of artificial neural network for prediction of stable river geometry" 11th International Conference on Protection and Restoration of the Environment, Thessaloniki, Greece
5. *Estuarine Hydraulics*, Book Chapter 9 in Environmental Hydraulics, Vijay P. Singh and Willi H. Hager, Editors, ISBN: 0-7923-3983-5, Kluwer Academic Publishers, 1996, pp. 289-346
6. *Ecohydrodynamics*, Book Chapter 10 in Environmental Hydraulics, Vijay P. Singh and Willi H. Hager, Editors, ISBN: 0-7923-3983-5, Kluwer Academic Publishers, 1996, pp. 347-398

OTHER SIGNIFICANT PRODUCTS (5)

1. Kaisar, E., Parr, S. and **Scarlatos, P.D.** (2010). "Traffic Simulation Modeling for Urban Chemical Disaster: Emergency Evacuation Development and Case Study", 8th LACCEI Annual Conference, Arequipa, Peru.
2. **Scarlatos, P.D.** and Kaisar, E. (2009). "Simulation and visualization applications for security analysis of infrastructure facilities", 2009 EURO SIW, European Simulation Interoperability Workshop, Istanbul, Turkey
3. **Scarlatos, P.D.** (2007). "Flow measurements in submerged tidal spillways", 13th Int'l Conference on Computational Methods and Experimental Measurements, Prague, Czech Republic.
4. **Scarlatos, P.D.** and Kim, H.-S. (2002). "On the Geometry of Cohesive Settling Particles", Fine Sediment Dynamics in the Marine Environment, Winterwerp & Kranenburg, Editors. Proceedings in Marine Science, Elsevier, (5): 265-276

SYNERGISTIC ACTIVITIES

1. Principal Investigator, *Expanding the Student-Centered Undergraduate Research Culture across the Curriculum*, Center for Teaching and Learning, Florida Atlantic University, 2013-2014
2. Principal Investigator, *Developing a Multi-Hazard Mitigation Plan for FAU Multi-Campuses*, Federal Emergency Management Agency, 2010-2014
3. Project Manager, Florida State University System Center for Intermodal Transportation Safety, *ITS Research Projects*" Federal Highway Administration, US-DOT, 2006-2010
4. Co-Leader, Professional Learning Community#2: *Assessing the Impact of Community Engagement on Student Success*, Florida Atlantic University, 2016
5. Expert Witness, Power Plant (Oglethorpe, GA and Seminole, FL) Estimated Life and Importance to Civil Infrastructure, Case: *Altria vs. United States*, U.S. Attorney's Office, Southern New York District, U.S. Department of Justice, 2007-2009

KHALED SOBHAN, PH.D.

Professor and Graduate Director

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PROFESSIONAL PREPARATION

Bangladesh University of Engr. & Tech.	Civil Engineering	Bachelor of Science, 1988
The Johns Hopkins University	Civil Engineering	Master of Science, 1991
Northwestern University	Civil Engineering	Ph.D., 1997

APPOINTMENTS

2013 - Present	Professor of Civil Engineering, Florida Atlantic University
2012 - 2013	Consultant, the World Bank, Washington, D.C.
2007 - 2012	Associate Professor (tenured), Civil Engineering, Florida Atlantic University
2005 - 2011	Chair, Committee AFS90, Transportation Research Board, National Academies
2012 - Present	Member, Committee AFS70, Transportation Research Board, Nat. Academies
2005 - 2012	Chair, College of Engineering Graduate Committee, Florida Atlantic University
2009 - Present	Director of Graduate Programs, Civil Engineering, Florida Atlantic University
2003 - 2007	Assistant Professor, Civil Engineering, Florida Atlantic University
1999 - 2002	Assistant Professor, Civil Engineering, New Mexico State University
1995 - 1999	Visiting Assistant Professor, Civil Engineering, Bucknell University

CLOSELY RELATED PRODUCTS (5)

1. *Principles of Geotechnical Engineering* – Ninth Edition by Braja M. Das and **Khaled Sobhan**, Cengage Learning, 2018; 819 pages. ISBN: 978-1-305-97093-9
2. Brown, N., Sobhan, K., An, P-C., Sherman, R., and Romance, N. (2015). "Investigating the Relationship between Faculty Knowledge of Self Determination Theory, the Classroom Learning Environment, and Engineering Student Outcomes," *American Society of Engineering Education*, 122nd Annual Meeting and Exposition, June 14-17, Seattle, WA.
3. Sobhan, K., An, P-C., Sherman, R., Romance, N., and Brown, N. (2014). "Exploring the Disconnect between Self Determination Theory and the Engineering Classroom Environment," 121st ASEE Conference and Exposition, American Society of Engineering Education, Indianapolis, June 15-18.
4. Petry, T. M. and **Sobhan, K.** (2005). "Evaluation of Chemical Stabilizers: State-of-the-Practice Report," Transportation Research Circular E-C086, ISSN 0097-8515, Transportation Research Board (TRB), The National Academies, Washington, D. C.
5. *Slope Stability*, Book Chapter in *Geotechnical Engineering Handbook*, Braja M. Das, Editor in Chief, ISBN: 978-1-932159-83-7, J. Ross Publishing, August 2010, 75 p.

OTHER SIGNIFICANT PRODUCTS (5)

1. **Sobhan, K.** (2017). "Challenges due to Problematic Soils: A Case Study at the Crossroads of Geotechnology and Sustainable Pavement Solutions." *Innovative Infrastructure Solutions*, 2:40, Springer International Publishing, DOI 10.1007/s41062-017-0070-y.
2. **Sobhan, K.**, Gonzalez, L., and Reddy, D. V. (2016). "Durability of a Pavement Foundation made from Recycled Aggregate Concrete Subjected to Cyclic Wet-dry Exposure and Fatigue Loading," *Materials and Structures*, RILEM, Volume 49, Issue 6, pp. 2271-2284, June 2016.
3. Reddy, D. V., **Sobhan, K.**, Liu, L., and Young, J. D. (2015). "Size Effect on Fire Resistance of Structural Concrete," *Engineering Structures*, Volume 99, pp. 468-478.
4. Reddy, D. V., **Sobhan, K.**, and Young, J. D. (2015). "Fire Resistance of Structural Concrete Retrofitted with Carbon Fiber Reinforced Polymer Composite," *Transportation Research Record*, Journal of the Transportation Research Board, Washington, D.C., Volume 2522, pp. 151-160.
5. **Sobhan, K.**, Ramirez, J. C., and Reddy, D. V. (2012). "Cement Stabilization of Highly Organic Subgrade Soils for Controlling Secondary Compression Settlement," *Transportation Research Record*, Journal of the Transportation Research Board, Volume 2310, pp. 103-112.

SYNERGISTIC ACTIVITIES

1. Principal Investigator, NSF Research Initiation Grant in Engineering Education (RIGEE): *Exploring the Disconnect between Self Determination Theory and the Engineering Classroom Environment*, 2013-2016, National Science Foundation.
2. Principal Investigator, FAU Seed Grant: *Barriers to STEM Reform: Exploring the Disconnect between Self-Determination Theory (SDT) and the Engineering Classroom Environment*, 2013-2015.
3. Principal Investigator, Faculty Learning Community: *Inquiry Based Learning in Classroom Teaching*, FAU Center for Teaching and Learning, 2009-2010.
4. Co-PI, FAU Faculty Assessment Grants, *Investigative Learning-Centered Assessment in Undergraduate Engineering Coursework*, 1/2010 – 9/2010
5. Associate Editor, ASCE Journal of Materials in Civil Engineering, January 2010 – present; Editorial Board Member, Journal of Geotechnical and Geological Engineering, Kluwer Academic Publishers, The Netherlands, (January 2003 – present); Editorial Board Member, International Journal of Geotechnical Engineering, J. Ross Publishers; Editorial Board, ASTM Geotechnical Testing Journal (2010-present).

Ph.D. Advisor: Ph.D. Dissertation Advisor: Dr. Raymond J. Krizek, Northwestern University

ALEKSANDAR STEVANOVIC, PH.D., PE

Associate Professor

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PROFESSIONAL PREPARATION

University of Belgrade, Serbia	Traffic & Transport Engineering	Bachelor of Science, 1998
University of Utah	Civil Engineering	Master of Science, 2003
University of Utah	Civil Engineering	Ph.D., 2006
State of Utah	Professional Engineer	Lic #: 7124750-2202

APPOINTMENTS

2015 - Present	Program Leader – Infrastructure Systems, Institute for Sensing and Embedded Network Systems Engineering, Florida Atlantic University
2015 - Present	Associate Professor (tenured), Civil Engineering, and Florida Atlantic University
2009 - Present	Director, Laboratory for Adaptive Traffic Operations & Management, Florida Atlantic University
2009 - 2015	Assistant Professor, Civil Engineering, Florida Atlantic University
2007 - 2009	Research Assistant Professor, University of Utah
2006 - 2007	Post-doctoral Research Associate, University of Utah
2003 - 2009	Traffic Lab Manager, University of Utah
2001 - 2006	Graduate Research Assistant, University of Utah
2000 - 2001	Graduate Research Assistant, University of Delaware
1998 - 2000	Flight Operations Engineer, Yugoslav Airlines

CLOSELY RELATED PRODUCTS (5)

1. Dakic, I. and **Stevanovic, A.Z.** (2017) "On development of arterial fundamental diagrams based on surrogate density measures from adaptive traffic control systems utilizing stop-line detection." Accepted for publication in Transportation Research Part C, <https://doi.org/10.1016/j.trc.2017.08.013>
2. **Stevanovic, A.Z.**, Stevanovic, J., and Kergaye, C. (2013). "Green Light Optimized Speed Advisory Systems - Impact of Signal Phasing Information Accuracy." Transportation Research. Rec., Journal of the Transportation Research Board, No. 2390 (2013) 53-59.
3. **Stevanovic, A.Z.**, Stevanovic, J., and Kergaye, C. "Optimizing Signal Timings to Improve Safety of Signalized Arterials." Transportation Research C - Vol. 32 (2013) 159-178.
4. **Stevanovic, A.Z.**, Kergaye, C., and Stevanovic, J. "Long-Term Benefits of Adaptive Traffic Control under Varying Peak-hour Weekday Traffic Flows." Transportation Research Rec., Journal of the Transportation Research Board, No. 2311 (2012) 99-107.
5. **Stevanovic, A.Z.**, Stevanovic, J., Zhang, K., and Batterman, S. "Optimizing Traffic Control to Reduce Fuel Consumption and Vehicular Emissions: An Integrated Approach of VISSIM, CMEM, and VISGAOST." Transportation Research Rec., Journal of the Transportation

Research Board, No. 2128 (2009) 105-113.

OTHER SIGNIFICANT PRODUCTS (5)

1. Kergaye, C., **Stevanovic, A.Z.**, and Martin, P.T., 2009: Comparison of Before/After versus On/Off Adaptive Traffic Control Evaluations: Park City Case Study. *Transportation Research Rec.*, 2128, 192-201.
2. Stevanovic, J., **Stevanovic, A.Z.**, Martin, P.T., Bauer, T., 2008: Stochastic Optimization of Traffic Control and Transit Priority Settings in VISSIM. *Transportation Research C*, 16-3, 332-349.
3. **Stevanovic, A.Z.**, Abdel-Rahim, A., Zlatkovic, M. and Amin, E., 2009: Microscopic Modeling of Traffic Signal Operations: Comparative Evaluation of Hardware-in-the-Loop and Software-in-the-Loop Simulations. *Transportation Research Rec.*, 2128, 143-151.
4. **Stevanovic, A.Z.**, Martin, P.T., and Stevanovic, J., 2007: VISGAOST: VISSIM-based Genetic Algorithm Optimization of Signal Timings. *Transportation Research Rec.*, 2035, 59-68.
5. **Stevanovic, A.Z.**, Stevanovic, J., Zhang, K., and Batterman, S., 2009: Optimizing Traffic Control to Reduce Fuel Consumption and Vehicular Emissions: An Integrated Approach of VISSIM, CMEM, and VISGAOST. *Transportation Research Rec.*, 2128, 105-113.

SYNERGISTIC ACTIVITIES

1. Speaker on several ITE, ASCE, and ITS conferences and scientific national and international panels on the topic of Adaptive Traffic Control.
2. Member, Editorial Board of the Road and Traffic - Serbian journal for road transportation (2011 – present).
3. Member, Committee of Traffic Signal Systems and Chair of its Research Subcommittee - AHB25, Transportation Research Board, National Academy of Sciences (2011 – present).
4. Web Administrator and Member, Joint Simulation Sub-Committee - AHB45 (1), Transportation Research Board, National Academy of Sciences (2010 – present).
5. During the past 5 years, Dr. Stevanovic has served as PI, Co-PI, or Sole Subcontractor on: 1 NSF project | 2 NCHRP projects | 1 FHWA project | 7 FDOT projects and several other DOT and municipal projects for a total budget of over \$2.7M (PI for \$1.75M).

Ph.D. Advisor: P. T. Martin (University of Utah)

HONGBO SU, PH.D.

Assistant Professor

Department of Civil, Environmental and Geomatics Engineering

Florida Atlantic University

Phone: (561) 297-3936; E-mail: suh@fau.edu

Professional Preparation

Wuhan University	Photogrammetry and Remote Sensing	B.E, 1997
Institute of Geography, Chinese Academy of Sciences	Cartography and GIS	
Ph.D., 2002		
Princeton University	Environmental Engineering	Ph.D., 2008
Institute of Global Environment & Society	Hydrology and Remote Sensing	Post-Doc, 2006-2009

Appointments

2014 – Present	Assistant Professor Department of Civil, Environmental and Geomatics Engineering Florida Atlantic University, Florida
2010 –2014	Assistant Professor, Environmental Engineering, Texas A&M University-Kingsville, Kingsville, Texas
2009– 2010	Research Scientist, Center for Research on Environment and Water (CREW), Institute of Global Environment & Society (IGES), Calverton, Maryland
2006 – 2009	Research Associate, Center for Research on Environment and Water (CREW), Institute of Global Environment & Society (IGES), Calverton, Maryland

Products (Five closely related)

1. Biswas, D., Su, H., Wang, C., Blankenship, J., & Stevanovic, A. (2017). An automatic car counting system using OverFeat Framework. *Sensors*, 17(7), 1535.
2. Su, H., Yang, Y., Xu, L., Chávez, J. L., Evett, S. R., Howell, T. A., ... & Zhan, J. (2016). A method to correct eddy covariance flux underestimates under an advective environment for arid or semi-arid regions. *Physics and Chemistry of the Earth, Parts A/B/C*, 96, 2-15.
3. Yang, Y., Su, H., Zhang, R., Tian, J., Li, L. (2015) An enhanced two-source evapotranspiration model for land (EEMML): Algorithm and evaluation. *Remote Sensing of Environment* 168, 54-
4. Su, H. B., E. F. Wood, H. Wang, and R. T. Pinker (2008), Spatial and temporal scaling behavior of surface shortwave downward radiation based on MODIS and in situ measurements, *IEEE Geoscience and Remote Sensing Letters*, 5(3), 542-546.
5. Su, H. B., M. F. McCabe, E. F. Wood, Z. Su, and J. H. Prueger (2005), Modeling evapotranspiration during SMACEX: Comparing two approaches for local- and regional-scale prediction, *Journal of Hydrometeorology*, 6(6), 910-922.

(Five other significant combined)

1. Hongbo Su, Jing Tian, Renhua Zhang, et al., (2013) "A Physically Based Spatial Expansion Algorithm for Surface Air Temperature and Humidity," *Advances in Meteorology*, vol. 2013, Article ID 727546, 8 pages, 2013. doi:10.1155/2013/727546
2. Li, B., Su, H., Chen, F., Li, S., Tian, J., Qin, Y. & Rong, Y. (2013). The changing pattern of droughts in the Lancang River Basin during 1960–2005. *Theoretical and Applied Climatology*, 111(3-4), 401-415.

3. Tian, J., **Su, H.**, Sun, X., Chen, S., He, H., & Zhao, L. (2013). Impact of the Spatial Domain Size on the Performance of the Ts-VI Triangle Method in Terrestrial Evapotranspiration Estimation. *Remote Sensing*, 5(4), 1998-2013.
4. **Su, H. B.**, R. H. Zhang, X. Z. Tang, X. M. Sun, Z. L. Zhu, and Z. L. Li (2003), An alternative method to compute the component fractions in the geometrical optical model: Visual computing method, *Ieee Transactions on Geoscience and Remote Sensing*, 41(3), 719-724.
5. Chen, S. H., **H. B. Su**, J. Tian, R. H. Zhang, and J. Xia (2011), Estimating soil erosion using MODIS and TM images based on support vector machine and a trous wavelet, *International Journal of Applied Earth Observation and Geoinformation*, 13(4), 626-635.

Synergistic Activities

1. Curricular Developments: Created a new course SUR4384 (“*Thermal infrared remote sensing and applications*”) at Florida Atlantic University in 2015. Modified SUR3530 (“*Introduction to Geodesy*”) at Florida Atlantic University in 2014 and 2015. Integration of the existing curricula with multidisciplinary research activities through EVEN 6356 *Remote Sensing of the Environment*, EVEN6332 *Environmental Data Analysis*, at Texas A&M University-Kingsville.
2. Student Mentoring: Supervision of two undergraduate minority students (two Hispanics) and two middle school teachers for participating in research activities at Texas A&M University-Kingsville since summer 2011. Supervision of three graduate students in research activities at Texas A&M University-Kingsville since 2011. Supervision of two international graduate students and five summer research students at Florida Atlantic University since 2014.
3. Scientific Research: Diverse research areas cover Land surface-atmospheric interactions with emphasis on energy balance and water cycling, Surface hydrology, quantitative remote sensing and Geographic Information Systems. Hongbo Su’s scientific findings have been recognized by peer research scholars and his publications have received 2010 citations according to the data released from Google Scholar (profile at: <http://scholar.google.com/citations?user=12afRdYAAAAJ&hl=en>). The current *H* index of the journal publications is 16 since 2011.
4. Professional Service: Actively involved in the services to the international scientific community. Served on the organizing committee of the Fourth international Workshop on Catchment Hydrologic Modeling and Data Assimilation (CAHMDA IV) and the scientific program committee for IEEE International Geoscience and Remote Sensing Symposium (IGARSS). Services to the scientific and engineering community outside of the individual’s immediate organization include Sigma Xi (since 2007), Senior Member of IEEE Geoscience and Remote Sensing Society (since 2003), Member of American Geophysical Union (AGU, since 2003) and Member of Association of American Geographers (AAG, since 2007).
5. Hongbo Su has been serving on the Earth Science Informatics Technical Committee (ESI TC) of the IEEE Geoscience and Remote Sensing Society and the Environmental Sensing, Networking and Decision-Making (ESND) Technical Committee of IEEE since 2015. Hongbo Su also served as the guest editor of special issues on *Advances in Meteorology and Physics and Chemistry of the Earth*.

RAMESH S. V. TEEGAVARAPU, Ph.D., P.E.

Associate Professor

Department of Civil Environmental and Geomatics Engineering,

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Phone (561) 297 3444; Email: rteegava@fau.edu,

Web Sites: Personal <http://faculty.eng.fau.edu/ramesh>,

Lab <http://hrl.fau.edu>

PROFESSIONAL PREPARATION

- Fulbright Scholar, December 2016- March 2018.
- Post-Doctoral Scholar/Research Engineer, University of California, Davis, October 2000 – Sept 2001. Department of Land Air and Water Resources. Advisor: Dr. Miguel Marino
- Ph. D. (Water Resources Systems), Civil Engineering, September, 2000
University of Manitoba, Winnipeg, Canada, <http://www.umanitoba.ca>
- M. Sc. (Water Resources Systems), Civil Engineering, 1995
Indian Institute of Science, Bangalore, India, <http://www.iisc.ernet.in>
- B. E. (Civil Engineering), July, 1992.
Osmania University, Hyderabad, India, <http://www.osmania.ac.in>

APPOINTMENTS

- **Visiting Research Professor**, June-August, 2016. Politecnico Di Torino, University of Brescia, Italy.
- **Visiting Research Professor**, [Nov 25, 2015 – Jan 22, 2016], Research Center for Urban Safety and Security Kobe University Kobe, Japan.
- **Associate Professor** – [August 2012- till date], Department of Civil Engineering, Florida Atlantic University, Boca Raton
- **Assistant Professor** – [August 2006 – August 2012]
Department of Civil Engineering, Florida Atlantic University, Boca Raton
- **Assistant Director** – [May 2004 – August 2006]
Kentucky Water Resources Research Institute (KWRI), University of Kentucky, Lexington, USA, 40506.
- **Adjunct Faculty** – [June 2004 – August 2006]
Department of Civil Engineering, University of Kentucky, Lexington, USA, 40506-0281
- **Assistant Professor (Visiting)** – [September 2001 – May 2004]
Department of Civil Engineering, University of Kentucky, Lexington, USA, 40506-0281
- **Post-Doctoral Scholar/Research Engineer** - [October, 2000 – August 2001]
Department of Land, Air and Water Resources, University of California, Davis

FUNDING

- **Support from NSF, USGS, NOAA, USACE and several state agencies. Total support Over**
- **3 Million as a PI and CO-PI**

PUBLICATIONS

Research Publications Summary

- 43 refereed journal papers, 6 under review

- 60 refereed conference papers
- 26 refereed extended abstracts
- 3 book chapters, several book articles
- 1 book (sole author)
- 2 books edited, 2 books under contract to be delivered December 2017.
- 45 Research Posters
- Over 1010 citations, H-index:16 and i10: 27

Student supervision and Guidance

Thesis Advisor and Postdoctoral supervisor

Supervised 17 M.Sc. theses and 1 Ph.D. dissertation to completion. Currently supervising 2 Ph.D. students and 4 M.Sc. students. Supervised two postdoctoral scholars. Committee member for 15 M.Sc. students.

Relevant Publications

1. **Ramesh S. V. Teegavarapu**, Spatial and Temporal Estimation and Analysis of Precipitation, 2016, Handbook of Applied Hydrology, McGraw Hill, Published
2. **Ramesh S. V. Teegavarapu**, Aneesh Goly and Qinglong Wu, Comprehensive Framework for Assessment of Radar-based Precipitation Data Estimates, Journal of Hydrologic Engineering, ASCE, 2015. [10.1061/\(ASCE\)HE.1943-5584.0001277](https://doi.org/10.1061/(ASCE)HE.1943-5584.0001277) , E4015002
3. **Ramesh S. V. Teegavarapu**, Missing Precipitation Data Estimation using Optimal Proximity Metric-based Imputation, Nearest Neighbor Classification and Cluster-based Interpolation Methods, *Hydrological Sciences Journal*, 2013. DOI:10.1080/02626667.2013.862334. Published.
4. **Ramesh S. V. Teegavarapu**, Climate Change-Sensitive Hydrologic Design under Uncertain Future Precipitation Extremes, *Water Resources Research*, 49(11), 7804-7814, 2013. Published.
5. **Ramesh S. V. Teegavarapu**, Statistical Corrections of Spatially Interpolated Precipitation Estimates, *Hydrological processes*, 28(11), 3789–3808, 2014. DOI: 10.1002/hyp.9906. Published.

SYNERGISTIC ACTIVITIES

1. Associate Editor, Journal of Hydrologic Engineering, ASCE, Guest Editor, JHE, ASCE, Editorial board member, Journal of Hydro-informatics, European Water Journal.
2. Reviewer for over 75 international technical journals and 34 international conferences.
3. Chaired, convened and moderated over 55 technical sessions at national and international conferences and served on advisory committees of conferences and as general and technical co-chair of two international conferences

4. COLLABORATORS AND OTHER AFFILIATIONS

- **Collaborators and Co-editors**

Chandra Pathak, USACE, Elpida Kolokytha, Satoru Oishi (Kobe University), Chandramouli Viswanathan, Purdue University-Calumet

- **Graduate Advisors and Postdoctoral Supervisors**

Dr. Slobodan Simonovic, University of Western Ontario, Canada, Dr. Lindell Ormsbee, University of Kentucky, Dr. Miguel Marino, University of California, Davis

PENG YI, PH.D.

Assistant Professor

Department of Civil, Environmental and Geomatics Engineering

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Professional Preparation

Harbin Institute of Technology, China Water Supply and Drainage Engineering
B.Eng. 2006

Harbin Institute of Technology, China, Municipal Engineering, M. Eng., 2008

Johns Hopkins University, MD, Environmental Process Engineering, Ph.D., 2013

Appointments

2014 – present Assistant Professor Florida Atlantic University

2013 – 2014 Postdoctoral Research Scientist Connecticut Agricultural Experiment Station

Publications

1. Huang, R., **Yi, P.**, and Tang, Y., Probing the interactions of organic molecules, nanomaterials, and microbes with solid surfaces using quartz crystal microbalances: methodology, advantages, and limitations, *Environmental Science: Processes & Impacts*, 2017, 19 (6), 793–811.
2. Xiao, Q., Wang, T., Yu, S., **Yi, P.**, and Li, L., Influence of UV lamp, sulfur (IV) concentration, and pH on bromate degradation in UV/sulfite systems: Mechanisms and applications, *Water Research*, 2017, 111, 288–296.
3. **Yi, P.**, Pignatello, J. J., Uchimiya, M., and White, J. C., Heteroaggregation of Cerium Oxide Nanoparticles and Nanoparticles of Pyrolyzed Biomass, *Environmental Science and Technology*, 2015, 49, 13294–13303.
4. Speed, D., Westerhoff, P., Sierra-Alvarez, R., Draper, R., Pantano, P., Aravamudhan, S., Chen, K. L., Hristovski, K., Herckes, P., Bi, X., Yang, Y., Zeng, C., Otero-Gonzalez, L., Mikoryak, C., Wilson, B. A., Kosaraju, K., Tarannum, M., Crawford, S., **Yi, P.**, Liu, X., Babu, S. V., Moinpour, M., Ranville, J., Montano, M., Corredor, C., Posner, J., and Shadman, F., Physical, Chemical, and *In Vitro* Toxicological Characterization of Nanoparticles in Chemical Mechanical Planarization Suspensions Used in the Semiconductor Industry: Towards Environmental Health and Safety Assessments, *Environmental Science: Nano*, 2015, 2, 227–244.
5. **Yi, P.** and Chen, K. L., Release Kinetics of Multiwalled Carbon Nanotubes Deposited on Silica Surfaces: Quartz Crystal Microbalance with Dissipation (QCM-D) Measurements and Modeling, *Environmental Science and Technology*, 2014, 48, 4406–4413.
6. **Yi, P.** and Chen, K. L., Influence of Solution Chemistry on the Release of Multiwalled Carbon

Nanotubes from Silica Surfaces, *Environmental Science and Technology*, 2013, 47, 12211–12218.

7. Tang, L., Gu, W., **Yi, P.**, Bitter, J. L., Hong, J. Y., Fairbrother, D. H., and Chen, K. L., Bacterial Anti-Adhesive Properties of Polysulfone Membranes Modified with Polyelectrolyte Multilayers, *Journal of Membrane Science*, 2013, 446, 201–211.
8. **Yi, P.** and Chen, K. L., Interaction of Multiwalled Carbon Nanotubes with Supported Lipid Bilayers and Vesicles as Model Biological Membranes, *Environmental Science and Technology*, 2013, 47, 5711–5719.
9. **Yi, P.** and Chen, K. L., Influence of Surface Oxidation on the Aggregation and Deposition Kinetics of Multiwalled Carbon Nanotubes in Monovalent and Divalent Electrolytes, *Langmuir*, 2011, 27, 3588–3599.
10. Xiao, F., **Yi, P.**, Pan, X., Zhang, B., and Lee, C., Comparative Study of the Effects of Experimental Variables on Growth Rates of Aluminum and Iron Hydroxide Flocs during Coagulation and Their Structural Characteristics, *Desalination*, 2010, 250, 902–907.
11. Xiao, F., Zhang, B., Ma, J., **Yi, P.**, and Cui, C., Effects of Low Temperature on Floc Fractal Dimensions and Shape Factors during Alum Coagulation, *Journal of Water Supply: Research and Technology-AQUA*, 2009, 58.1, 21–27.
12. Xiao, F., Ma, J., **Yi, P.**, and Huang, J. H., Effects of Low Temperature on Coagulation of Kaolinite Suspensions, *Water Research*, 2008, 42, 2983–2992.

Synergistic Activities

Member of American Chemical Society (ACS)

Member of Association of Environmental Engineering and Science Professors (AEESP)

Member of Sustainable Nanotechnology Organization (SNO)

2010-2013, Outreach activities in Silver Spring International Middle School, Baltimore: Teaching assistant in the science lectures given to the students

YAN YONG, PH.D.

Chair and Professor

Department of Civil, Environmental and Geomatics Engineering

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PROFESSIONAL PREPARATION

Wuhan University of Technology, Applied Mechanics, BS 1982

University of Illinois at Urbana-Champaign, Aerospace Engineering, MS 1983

University of Illinois at Urbana-Champaign, Aerospace Engineering, Ph.D. 1987

APPOINTMENT

2001- Present	Florida Atlantic University, Boca Raton, Florida Professor; Department of Civil, Environmental and Geomatics Engineering
1988-2001	Professor (since 2000); Associate Professor (1992-2000); Assistant Professor (1988-1992); Visiting Professor (1987-1988) Department of Ocean Engineering
1990	Wright-Paterson Air Force Base, Visiting Scientist
1987 - 1988	Center for Applied Stochastics Research Florida Atlantic University Postdoctoral Fellow
1984 - 1986	Center for Applied Stochastics Research Florida Atlantic University Research Associate
2/82 - 8/84	Department of Aeronautical and Astronautical Engineering University of Illinois at Urbana-Champaign Research Assistant

PRODUCTS

(i) Related Products

1. W. Chow and Y. Yong, A Treatise in Fluid Dynamics, 2012, BUAA Publisher, ISBN 978-7-81124-291-1.
2. G. Gao, and Y. Yong, 2008, "A review of research on partial average based study of turbulent flows," Chinese Mechanics Abstract, Vol. 22, (2), pp. 1-20.
3. G. Gao, and Y. Yong, 2005, "Incompressible turbulent flow: partial average based theory and applications," Journal of Hydraulic Research, Vol.43, No.4, pp.399-407.

4. B. Liu, G. Gao, and Y. Yong, Y., 2004, "Simulation of coherent structures in turbulent boundary Layer using GAO- YONG equations of turbulence," *Journal of Heat Transfer - Asian Research*, Vol. 33 (5) pp.287-298.
5. G. Gao, and Y. Yong, "Partial average based equations of incompressible turbulent flow," *International Journal of Nonlinear Mechanics*, Vol. 39, No.9, pp.1407-1419, 2004.

(ii) Other Products

1. J. Cuschieri, S. Glegg, and Y. Yong (eds), *Proceedings of Internoise 99*, 3 volumes, Ft. Lauderdale, FL, December 6-8, 1999.
2. Y. Yong, 1997, "Response of Pipeline Structure Subjected to Earthquake Ground Motion," *Engineering Structures*, Vol.19, No.8, pp.679-684.
3. Y. Yong, R.C. Zhang, R.C and J. Yu, 1997, "Motion of Foundation on a Layered Medium, Part I: Impedance Characteristics," *Soil Dynamics and Earthquake Engineering*. Vol.16,pp.295-306.
4. Y. Yong, R.C. Zhang, R.C and J. Yu, 1997, "Motion of Foundation on a Layered Medium, Part II: Response Analysis," *Soil Dynamics and Earthquake Engineering*,
5. Vol.16, pp.307-316.
6. Yong, Y., 1995, "Vibration of One-Dimensional Structure with Arbitrary Constraints," *Journal of Engineering Mechanics*, Vol.121, No.6, pp.730-736.

SYNERGISTIC ACTIVITIES

PI: Presidential Young Investigator (PYI) Award, NSF, 1990-1997

PI: An Industry-Academia Partnership Model for Improvement Retention, Accelerated Degree Completion, and Successful Placement of women/Minority/ Other Financially Disadvantaged Students, NSF, 2004-2008

PI: on Motorola sponsored grant "Integrated MFG System Service", 2002-2003

GRADUATE AND POST GRADUATE ADVISORS:

Lin Y.K., Florida Atlantic University (MS and Ph.D. advisor)

OLFAT SARHANG ZADEH, M.S.

Instructor

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Phone: 561-297-3090; Email: ozadeh@fau.edu

PROFESSIONAL PREPARATION

Azerbaijan University of Shahid Madani	Civil Engineering	B. S.,	2004
Sharif University of Technology	Civil Engineering	M.E. SC.,	2009
Western University	Civil Engineering	M.E. SC.,	2012

APPOINTMENTS

2017 - Present	Instructor, Florida Atlantic University
2014 – 2016	Civil Engineering Adjunct Lecturer, Rochester Institute of Technology, NY
2013-2014	Civil and Structural Engineer, Concentric Associates Inc., London, ON, Canada
2010-2012	Civil Engineer, Western University Engineering Laboratory
2008-2009	Civil Engineer, FARA ZAB Consulting Engineers Inc., Tabriz, Iran.
2004-2006	Civil Structural Engineer, KARADENIZ Engineering Company, Tabriz, Iran.
2003-2004	Civil Engineer Intern, Tabriz Road and Transportation Organization, Tabriz, Iran

Civil Engineering Instructor, Florida Atlantic University, Boca Raton, Florida. Teaching of engineering courses; Structural Steel Design, Fundamental of Drawing.

Civil Engineering Adjunct Lecturer, Rochester Institute of Technology, Rochester, New York
Ensured the preparation, delivery and evaluation of engineering courses to over 100 students.

Civil and Structural Engineer, Concentric Associates Inc., London, ON, Canada
Recognized for promptly and accurately providing design and modeling of structures including composite foundations.

Civil Engineer, Western University Engineering Laboratory, Ontario, Canada
Accurately performed analysis and reports of cable stayed bridges using structural optimization, finite element modeling, optimization algorithm, SAP and CAD drawing tools.

- Provided a structural evaluation of a highway bridge located in London, Ontario.
- Provided Seismic Analysis of the 30-story building located in Hamilton using ETABS.
- Structurally compared three main types of cable stayed bridges, analyzed cost and control.

Civil Engineer, FARA ZAB Consulting Engineers Inc., Tabriz, Iran.

Designed and provided construction costs of sewerage systems, pumping stations and treatment plants as well as the construction of different structural buildings.

Civil Structural Engineer, KARADENIZ Engineering Company, Tabriz, Iran.

Designed and provided construction cost and conceptual estimation and life-cycle costing for sprinkler and drip irrigation structures, buildings and channels.

Civil Engineer Intern, Tabriz Road and Transportation Organization, Tabriz, Iran.

Accurately and promptly inspected construction sites and designed roads using AutoCAD.



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