

Florida Atlantic University
Department of Civil, Environmental and Geomatics Engineering
Program Review: March 19-20, 2018
Review Submitted: March 30, 2018

Review Team:
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OVERVIEW

The team consisting of Dr. Pezeshk, Dr. Schnabel, and Dr. Xie visited and reviewed the Department of Civil, Environmental, and Geomatics Engineering (CEGE), situated with FAU's College of Engineering and Computer Science, on March 19 and 20, 2018. Prior to the site visit, the team reviewed the self-study report produced by CEGE dated Spring 2018. During the site visit, the review team met with:

- Dr. Stella Batalama (Dean)
- Dr. Yan Yong (CEGE Dept. Chair)
- Dr. Daniel Meeroff (CEGE Associate Chair)
- Dr. Russell Ivy (Associate Provost for Programs and Assessment)
- Debra Szabo (Assistant Director of Programs and Assessment)
- Dr. Edward Pratt (Dean of Undergraduate Studies)
- Dr. Karin Scarpinato (Associate Vice President for Research)
- Liana Smith (Assistant Dean of the Graduate College)
- Dr. Ali Zilouchian (Associate Dean for Academic Affairs)
- George Beck (CEGE Alumnus)
- Aneesh Goly, Shirish Rajpathak, Gordon McSweeney, Fred Kaub (CEGE DAC)
- Tamsyn Carey (Advising and Support Services)
- Mahesh Neelakanta (Engineering Technical Support)
- Tenured faculty in CEGE
- Untenured faculty in CEGE
- CEGE graduate and undergraduate students

In addition to the formal meetings, the review team met informally with departmental personnel during mealtimes. Mealtime guests included Dr. Batalama (Dean), Dr. Yong (Dept. Chair), and CEGE faculty members including Dr. Bloetscher, Dr. Kaiser, Dr. Meeroff, Dr. Sobhan, and Dr. Stevanovic. Finally, the review team toured the CEGE facilities in the Engineering West and Instructional Service buildings. Specific laboratories toured include the Materials Lab,

Environmental Research Labs, Student Maker Space (Concrete Canoe), Applied Hydraulics Lab, Environmental Chemistry/Engineering Lab, AutoCAD Lab, Transportation Lab, and the Capstone Design Lab (currently under construction).

In general, the review team was charged with providing input on the observed strengths and challenges faced by the CEGE programs, and delivering recommendations intended to help CEGE meet its stated goals. Those goals are encapsulated in the departmental vision and mission statements below:

Vision: Be nationally recognized for high-quality education and research

Mission: To provide our engineering students with a high-quality education on fundamental theories and engineering design, and to conduct cutting-edge research in urban mobility/infrastructure and water resources/ environmental sustainability to benefit communities in Florida and beyond.

This report is structured according to the broad categories of topics evaluated and discussed in the self-study and site visit. The topics include undergraduate programs, graduate programs, faculty workloads and research productivity, and equipment/facilities. We conclude by providing a list of recommendations to be considered by CEGE faculty and university administrators.

UNDERGRADUATE PROGRAMS

CEGE offers three undergraduate degrees, including a BS in Civil Engineering (BSCV), a BS in Geomatics Engineering (BSGE), and a BS in Environmental Engineering (BSEV). The BSCV and BSGE programs are both accredited by ABET, whereas the BSEV was just recently initiated (August 2016), and has not yet gone through the accreditation process.

The course offerings and credits required for the BSCV, BSGE, and BSEV programs are similar to the programs offered by the peer institutions listed in the self-study, as well as other programs nationwide. The ABET accreditation process itself helps to ensure relative consistency and quality of programs across universities, so CEGE's programmatic similarities to its peers unsurprising. While the BSEV program has not yet gone through accreditation, we did note through evaluation of the self-study that the program was clearly developed with the intention of seeking accreditation.

There are currently 233 students enrolled in the CEGE undergrad programs, with an additional ~110 students considered to be pre-majors who have not yet met the requirements (often mathematics-based prerequisites) to be admitted into the program. There were concerns from the provost office regarding the large number of pre-professional students and the number years it takes for them to meet the requirements to be admitted into the program. We recommend that the department make additional efforts in the introductory engineering course (ENG 1002) to ensure that the pre-majors feel connected to the college and the engineering professions. The

department should consider methods for motivating students to complete pre-major requirements and move on to the full program.

Approximately 56% of CEGE's undergrad students are full-time. The relative high fraction of part-time students may be attributed to FAU's status as a metropolitan campus, whereby many students from the region seek degrees while simultaneously working in industry. Even indirectly, this high fraction of part time students may contribute to the low 4-year graduation rate described by several faculty members and administrators. Part-time students, many of them presumably working in industry, can bring news and discussion of existing employment opportunities to CEGE's classrooms and hallways. While this has the benefit of more closely linking the programs to the outside world, it may also draw some of the full-time students towards part-time status. Since CE-related engineering programs tend to have prescriptive prerequisite flow-paths, taking less than a full-load of courses tends to delay graduation. We did note that the BSCV program, the largest undergrad program in CEGE, has proposed curricular changes that would add more flexibility to the program through a higher number of technical electives (proposed changes included in Dr. Yong's Power Point overview presentation) and relaxation of some of the unnecessary prerequisites. Successful implementation of the proposed changes could potentially decrease the average time to graduation.

The Fundamentals of Engineering (FE) exam is a national standardized test conducted by an external entity (NCEES) and represents an important step towards licensure as a Professional Engineer (PE). PE licensure is more highly valued in the Civil Engineering industry compared to some of the other branches of engineering, thus it is especially useful for students graduating from civil programs to take and pass the test. We consider it a mark of quality that the BSCV program requires its students to take the FE exam as a prerequisite for graduation. In so doing, the program pushes its graduates to works towards professional excellence. That said, requiring all students just to take the exam, without requiring them pass the exam, can also lead to relative low pass rates, as not all students are available or motivated to adequately prepared for the exam. This appears to be the case with the BSCV program, as their pass rates are consistently lower than the national average. Nonetheless, the review team considers the FE requirement to be a programmatic strength. We recommend that the department retain the requirement, but work on improving the pass rate by conducting multiple study sessions and providing practice exams for the students prior to the test date. We note that some programs purchase study guides or practice exams for their graduating seniors using foundation funds or other flexible spending accounts. Furthermore, we recommend that the department consider other incentives for students to take the FE exam seriously.

The BSGE program, in its current form, does not appear to be sustainable given the consistently low enrollment numbers. This was the consensus of faculty, students, and the chair. The program has fallen short of the Board of Governor's threshold of 30 graduates/5 year period for each of the past three years, and will likely fall short again this year. This trend does not appear to be improving. In light of this, CEGE has proposed a new Bachelor of Science in Engineering Technology that will allow graduates to become licensed surveyors, but will not require them to take the rigorous mathematics courses necessary for an engineering degree. Thus, the program will meet the industry's stated demand for surveyors, while at the same time provide an outlet for students desiring to focus on geomatics without the additional burden of engineering design-

related coursework. Given the stated availability of survey-related jobs, we anticipate that this program will attract strong enrollments following a startup period. If authorized and initiated, we recommend that FAU and CECE heavily market the new BSET program throughout the region. Also, it is important to make it clear to potential enrollees that students graduating from Engineering Technology will not be able to take the FE exam and consequently will not be able to become professional engineers.

The BSEV is a new program, and enrollment numbers were not readily available. Moreover, the enrollment numbers are likely to change as more potential students learn about the program's existence. As described above, however, the program has well-defined outcomes, assessment methods, criteria for success, and implementation strategies, consistent with a program seeking ABET accreditation. Indeed, the program's stated goal is to seek accreditation in 2020. One challenge the program may have is the relative low number of faculty members designated to the program. While FAU's BSCV program has a similar number of environmental-related courses to teach compared to their peer institutions, the FAU program has only 2 faculty listed compared to the 6-14 faculty members listed for the peer institutions. This could potentially pose a problem during the accreditation process. Similar to civil engineering, environmental engineering encompasses a wide variety of classes most often taught by a diverse array of subject matter experts. Thus, the two faculty members dedicated to the new BSEV program may not represent sufficient subject matter diversity expected by accrediting agencies.

Finally, we noted in our conversations with advisory board members (DAC) that improvements could likely be made with respect to communication between board members and the department itself. For example, two board members noted that they very frequently have internship opportunities, but do not often hire CECE students because they do not receive CECE resumes. As advisory boards are frequently seeking beneficial ways to help their departments, this could likely be remedied by developing a board sub-committee specifically devoted to linking CECE students to industry opportunities.

GRADUATE PROGRAMS

CECE has a single graduate program, the MS of Civil Engineering (MSCV) that provides a pathway for graduates of all CECE undergraduate programs to pursue a graduate degree. The MSCV program is broken down into three concentration areas including structural/geotechnical engineering, transportation/geomatics engineering, and water resources/environmental engineering. The thesis option of program requires 30 credits and the non-thesis option requires 33 credits, similar to the credits required for programs in the peer institutions. CECE employs an innovative incentive to attract graduates from their undergraduate program into the graduate program, whereby a student may apply up to three upper-level courses towards both the BS and MS degree. The program has enjoyed steady enrollments (averaging 29 students), with a slight upward trend over the past several years. Class sizes for the MSCV graduate courses are most often in the 5-10 student range. Overall, the program appears to be in good health and serves an important role not only in producing MS graduates, but also in fostering research productivity.

A stated goal of the Dean and numerous faculty members is for CEGE to become nationally recognized for high quality education and research. Indeed, this comprises CEGE's vision statement. However, nationally-recognized high quality research is most often associated with programs that produce PhD graduates. While MS students and undergraduates are certainly capable of producing high quality results, they tend to require significantly more oversight from faculty members in order to produce those results. PhD students, due to their more advanced level of training, tend to be more capable of working on their own. As a consequence, a single faculty member can pursue numerous promising avenues of research working with PhD students, whereas they are more constrained working with MS students or undergraduates.

CEGE currently has no PhD program. In response, CEGE faculty have developed a workaround, whereby they co-advise PhD students working through the Ocean Engineering PhD program. However, this is a flawed mechanism. The OE PhD students, even though they may be focused on issues related to civil engineering, are required to take the majority of their coursework through the Ocean and Mechanical Engineering department. As a result, their coursework is frequently not well aligned with their intended area of expertise. A more effective solution would be to initiate a PhD program in civil engineering. This would have the advantage of allowing students to focus not only their research, but also their coursework, upon their intended area of expertise. Variations upon this theme might be to develop a PhD program that is even more specific than civil engineering, such as a PhD in transportation engineering or PhD in water resource engineering. These would have advantages that include capitalizing upon CEGE's current research strengths, and would also avoid duplicating other civil engineering PhD programs in the region. However, they would have the potential disadvantage of being too specific. They would not necessarily capitalize upon new emerging areas of research strength. An alternative consideration would be to convert the college's existing PhD programs into a single Engineering PhD program with multiple concentrations. In our experience, few potential employers of PhD graduates will draw a distinction between a named discipline-specific engineering PhD, and a general engineering PhD containing a disciplinary concentration. Combining the programs would help to ensure that all of the college's existing PhD programs meet their Board of Governor's mandated enrollment goals because all students would be merged into a single program. This will help with the Board of Governor's threshold of 10 PhD/5 year period.

We believe CEGE requires a PhD program if it seeks to become a nationally-recognized research leader. Students in that program must be able to focus their research as well as their coursework upon their specific area of expertise. Faculty members and administrators should closely consider the various options for getting there.

Finally, we note that FAU does not provide health insurance for graduate students, and the university has recently ceased to provide tuition waivers for research assistants. Both of these factors can be expected to decrease research productivity, especially for those researchers who primarily seek funds from state or industry sources. While costs such as health insurance and tuition are generally written in and covered by grants from large federal agencies such as NSF, they can decrease the cost-competitiveness of grant applications to smaller agencies or commercial entities. Confusion regarding changes in how to pay graduate students' tuition has caused anxiety among faculty members. A quick resolution will be helpful.

RESEARCH PRODUCTIVITY / FACULTY WORKLOADS

As stated previously, CEGE seeks to become a nationally-recognized research leader. Current research strengths include transportation and mobility, as demonstrated by the recent award of a US Dept. of Transportation University Transportation Center (UTC) grant supporting the Freight Mobility Research Institute. Other stated research strengths include water resources and environmental engineering topics.

In order to achieve national prominence, sufficient faculty resources must be dedicated to the conduct of research. Since some faculty members demonstrate interest and capacity for high-level research while others seek to focus on teaching, efforts should be made to distribute heavier teaching loads towards teaching-oriented faculty members – freeing up time for research oriented faculty members to write proposals and conduct the research.

According to the Dean and to the self-study report, the standard departmental teaching load for tripartite faculty members is two 3-credit courses per semester. In order to shift the teaching load more heavily to the faculty members focused on teaching, a consistent algorithm should be developed and applied to differentiate levels of research productivity and teaching focus. Inevitably, the algorithm will need to be based upon the financial resources afforded by externally-sponsored research. The 25% of time allocated to “Departmental Research” in the historic faculty workload serves as a good example. Presumably, “departmental research” refers to research conducted during the 9-month contract period without external support. While this research tends to promote work with graduate students completing unfunded projects, it does not necessarily lead to nationally-recognized research products. Nationally-recognized research tends to be associated with large funding agencies that not only sponsor the research from a financial perspective, but also work with researchers to promote the products of that research. Thus, CEGE should work to replace departmental research time with sponsored research time whenever possible. Allocating fewer courses to faculty members with sponsored research, and allocating higher course loads to faculty members without sponsored research (thus displacing their departmental research time) would accomplish this. We note that many agencies require substantial match commitments in order to fund research (e.g., UTC’s). Thus, another effective use of departmental research time is to serve as match for sponsored research, and this should be considered in the algorithm. We do note that converting departmental research time to sponsored research time during the 9-month contract period may have the impact of decreasing the production of faculty-authored textbooks. CEGE faculty members have produced numerous academic textbooks in recent years, presumably on departmental research time, thus raising the national profile of the department. In light of this, the algorithm should take into account those activities that attract positive national attention to the department without requiring external funds. Finally, we note that any modification of the research/teaching loads must take into consideration the promotion and tenure process. If a faculty member’s workload is more heavily weighted towards teaching, for example, then the expectation for research products such as peer-reviewed journal articles should be lower than the expectation for research-focused faculty members. This point should be explicitly made in faculty assignments and evaluations.

CEGE research expenditures have increased dramatically in recent years, owing largely to the new UTC grant. Center grants of this type tend to increase productivity for a relative large

number of department faculty for the life of the grant. CEGE's challenge is to make full use of this opportunity and leverage it to build research programs that will outlive the UTC grant. In our view, CEGE is well-equipped to accomplish this. Transportation research is notably diverse, providing opportunities for virtually all of the specialty areas contained within CEGE. While the scope of the existing UTC grant may or may not incorporate the research interests of all research-focused departmental faculty, its prominence can likely be used to attract other funds. Since CEGE is a relatively small department seeking to gain national prominence as a research entity, we recommend focusing efforts upon a small number of areas – preferably areas that will allow most faculty members to pursue their interests. Transportation research is one such area, and we recommend pursuing continued research funding from a diverse array of sources through the lens of transportation research.

EQUIPMENT/FACILITIES

As described in the introduction, the review team visited the laboratory facilities in the Engineering West building and the Instructional Services building. We noted that the Engineering West building is currently under renovation, and as such, is in a state of disarray. Moreover, the faculty members were not certain when the renovations are scheduled to be completed. Consequently, we recommend that the renovation schedule be developed and clearly communicated to faculty so that they can adequately plan their research and teaching activities.

Throughout many of the labs, we observed a notable amount of clutter and equipment in various states of disrepair. From our experience, this is a common circumstance for facilities that do not have dedicated technicians to manage the laboratories. Indeed, CEGE does not currently employ dedicated technicians to manage the labs. This can lead to numerous negative outcomes, the most important of which is laboratory **safety**. Civil and environmental laboratories tend to contain multiple safety hazards including mechanical and chemical hazards. We did not see any posted safety instructions in any of the labs. Labs need to be renovated to include eyewash and safety showers, which are essential safety features in any setting where dangerous chemicals are used. It is rare to walk through a laboratory without coming across at least one. Employing individuals with the skill set to safely operate equipment, maintain chemicals, train students to work safely in the labs, and enforce lab safety standards is essential. CEGE should seek to identify an individual or individuals responsible for these activities immediately. Moreover, we noted that the labs are utilized for both teaching and research activities. Employing technicians capable of efficiently operating the equipment (or supervising operation by students) is an important step towards developing a research program of national prominence. We recommend that such individual to report directly and be evaluated by the Chair of Civil Engineering.

RECOMMENDATIONS

- Implement the proposed BSET program to replace the BSGE program. Solicit industry support to help communicate the need for the new program to the Board of Governors.

- Implement the proposed curricular changes to the BSCV program to allow more flexibility in course selection.
- Provide incentives or tools to encourage more CEGE students to pass the FE exam on the first attempt.
- Pursue ABET accreditation for the BSEV program in 2020. This will likely require hiring or dedicating additional BSEV faculty members, as the FAU program currently lists only 2 faculty members compared to the 6-14 faculty members dedicated to peer programs.
- Develop or re-invigorate an advisory board (DAC) sub-committee specifically intended to link CEGE students to industry opportunities such as internships.
- Initiate a PhD program capable of meeting CEGE student needs. This could either take the form on a civil-specific PhD program, or a merging of current college programs into a single Engineering PhD program with multiple areas of concentration.
- Develop a consistent algorithm that modifies the standard four courses per year faculty workload model. The algorithm should allocate more research time to those faculty members focused on research, and a higher course load to those faculty members focused on teaching.
- Leverage the recent successes in transportation research to attract transportation-related funding from a more diverse array of funding sources.
- Complete renovations of the Engineering West facility and re-integrate the departmental activities into a shared space.
- Hire a dedicated laboratory technician for CEGE to promote lab safety and more effective laboratory research activities.

CONCLUSION

On the balance, we found CEGE to be a well-run department with a promising future of sustained growth. The department boasts an enviable level of collegiality among faculty members, and they appear to appreciate the opportunities and benefits associated with employment at FAU. The recommendations provided in this report were developed to advise the department regarding steps they could take to help meet their goal of achieving national prominence in teaching and research. This is an opportune moment for the department to institute such changes, as they are currently relatively top-heavy with a large number of senior faculty members. Instituting such changes now can ensure that when the next generation of faculty members arrive, they will join a department with an ever-brightening future.