

**Master of Science in Civil Engineering  
AY 2017-18 Program Assessment Report**

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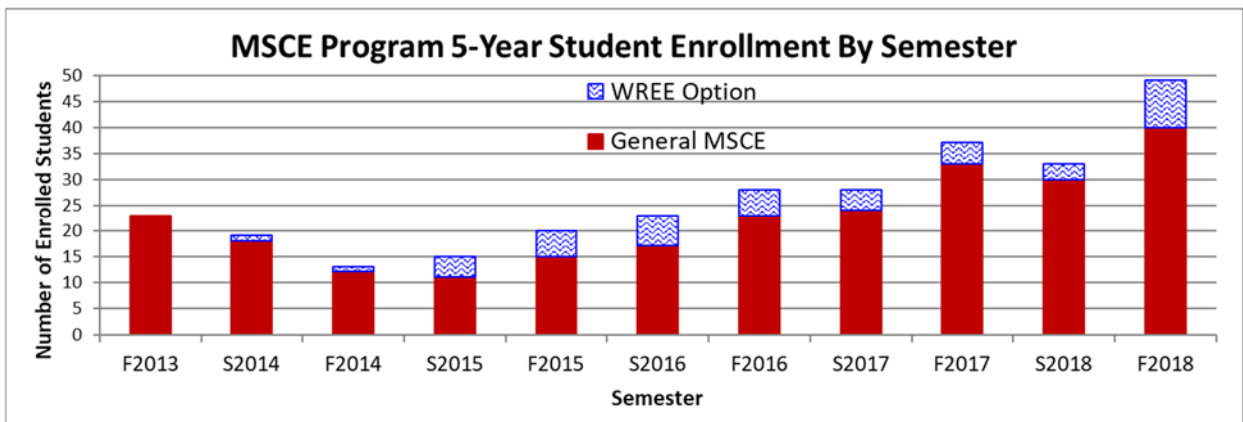
**Report Narrative**

**0. Program Description and Student Enrollment:**

The Civil Engineering Program offers a 30-unit Master of Science (MSCE) degree with an option in Water Resources & Environmental Engineering (WREE). Program requirements include completion of introductory course CE 210 Research Methods (min. grade B); completion of a graduate writing exercise (min. score 87.5%); completion culminating experience CE 298 project or CE 299 Thesis (min. grade C), or comprehensive exam (min. score 75%); and minimum cumulative GPA of 3.0.

Program curriculum consists of technical courses in five subject areas: Geomatics, geotechnical, structural, transportation and water resources/ environmental engineering. Students can take up to 6 units of coursework outside of the program curriculum. Students in the WREE option are required to take 12 units of core courses and 3 units of coursework outside of civil engineering.

MSCE Program student enrollment by semester during the past 5 years is presented in Figure 1. Enrollment was at a low in the Fall of 2014 (13) and is currently at a high in Fall 2018 (49). Enrollment in the WREE Option, which began accepting students in Spring 2014, has fluctuated over time and is currently at the historic high in Fall 2018 (9). Factors driving the downward trend from 2012 to 2014 are not known with certainty, but lack of recruitment activity during that time period is likely a factor. Recruitment efforts have increased since then.



**Figure 1.** Enrollment in the MSCE program by semester (past 5 years).

## 1. Learning Outcomes Scheduled for Assessment

4. Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.
5. Use modern computer software for the analysis, design, operation, and/or measuring and mapping of the built infrastructure.
6. Exhibit excellence in written and graphical communication, including technical documents, research reports, research papers, proposals, and presentations.
7. Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.

## 2. Instruments Used in the Assessment.

### A. Direct Measures:

- |  |                                |
|--|--------------------------------|
| 1) <i>Students communication skills in CE 210:</i>                   | <i>Not assessed this cycle</i> |
| 2) <b>Students' score on specific questions in specific courses:</b> | <b>Outcomes 4 &amp; 5</b>      |
| 3) <b>Students' performance in culminating experience:</b>           | <b>Outcomes 6 &amp; 7</b>      |

### B. Indirect Measures:

- |  |                                |
|--|--------------------------------|
| 1) <i>Program Student Exit Surveys (MSCE Program):</i> | <i>Not assessed this cycle</i> |
| 3) <i>Alumni Survey:</i>                               | <i>Not assessed this cycle</i> |
| 4) <i>Employer Survey:</i>                             | <i>Not assessed this cycle</i> |

## 3. Assessment Methods and Results.

### A. Direct Measures:

- 1) Methods:
  - a) Average student score on specific questions in specific courses: Student Learning Outcomes are assessed by statistical analysis of student scores on one or more questions or problems on course exams or assignments. Questions are selected by the instructor and results are forwarded to the Assessment Coordinator. Course used, learning outcomes assessed, and the implementation schedule are shown in Table 5 of the SOAP. Courses and the associated outcomes assessed in a given academic year vary over time.

|   |        |
|---|--------|
| <b>Learning outcomes scheduled for assessment in courses:</b> | 4 & 5  |
| <b>Learning outcomes assessed this cycle in courses:</b>      | 4      |
| <b>Course(s) assessed this cycle:</b>                         | CE 233 |

- b) Students' performance in culminating experience: Student performance in culminating experiences are assessed based on a rubric that can be found in the program SOAP, Appendix B. Writing skills (Outcome 6) are based on the written report or culminating experience exam and oral presentation skills (Outcome 7) are assessed based on the oral presentation (project and thesis plans only).

- 2) Results: Numeric results of student learning outcomes from direct measures are summarized in Table 1. Discussions are provided below the table.

**Table 1:** Numeric results – learning outcomes in courses & culminating experiences:

| Course           | No. of Students Surveyed | Learning Outcome | Score, %         |                 |
|------------------|--------------------------|------------------|------------------|-----------------|
|                  |                          |                  | Program Standard | Student Average |
| CE 233 (course)  | 5                        | 4                | 75               | 80              |
| CE 298 (Project) | 2                        | 6                | 75               | 87              |
|                  | 2                        | 7                | 75               | 86              |
| Comp. Exam       | 1                        | 6                | 75               | 90              |

\* Program standard.

**Outcome 4:** Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.

Results O4: The results indicate that the department standard for Outcome 4 was exceeded in the sole course that was assessed. The second course scheduled for assessment, CE 205, was not assessed due to an oversight by the assessment coordinator who neglected to request the data from the instructor.

**Outcome 5:** Use modern computer software for the analysis, design, operation, and/or measuring and mapping of the built infrastructure.

Results O5: The second course scheduled for assessment, CE 205, was not assessed due to an oversight by the assessment coordinator who neglected to request the data from the instructor during the semester. Instructor is now on sabbatical.

**Outcome 6:** Exhibit excellence in written and graphical communication, including technical documents, research reports, proposals, and presentations.

Results O6: Learning Outcome 6 was assessed in CE 298 and comp Exam. The results indicate that student achievement in written communication skill was well above the program standard of 75%.

**Outcome 7:** Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.

Results O7: Learning Outcome 7 was assessed in CE 298. The result indicates that student achievement in oral communication was above the program standard of 75%.

#### **B. Indirect Measures:**

Indirect measures were not scheduled for assessment in this cycle.

#### **4. Changes Implemented Since Last Assessment Period.**

- A. Fewer outcomes are being assessed in a given year. This change was made following receipt of a recommendation by the campus Director of Assessment following review of the AY 2016-17 assessment report. This is expected to reduce the burden on the department.
- B. The Dept. Standard for Learning Outcomes 2 and 3 were not met in CE 242 during the prior year. When this course is taught next the instructor will consider whether (1) attainment of Learning Outcomes 2 and 3 is realistic for CE 242, (2) the problems used for assessment of these outcomes were suitable, and (3) there is a need to restructure the course to provide greater instruction in these areas. This action is expected to result in more accurate assessment of learning outcomes in CE 242 and/or greater attainment of Learning Outcomes 2 and/or 3.

## 5. Changes Under Consideration and On-Going Tasks.

- A. SOAP: Changes to the program SOAP are anticipated based on curriculum-related recommendations received following the review of the MSCE Program by campus.
- B. Employer Surveys: Thought has been given to conducting an employer survey. Building and maintain an employer database would be required and the practical and legal aspects of doing so should be explored. Doing so would facilitate implementation of an employer survey, which would be expected to provide insight on the preparedness of our graduates and on how they perform after several years on the job.
- C. Culminating Experience:
  - 1) **CE 298 Project**: Communication skills (Learning Outcomes 6 and 7) are currently being assessed in CE 298 based on the total score from Rubric I (written report) and Rubric II (oral presentation). Assessment of additional learning outcomes (i.e., 1-5) based on the existing evaluation rubrics or an expansion of it is being discussed within the department. Although beneficial to assessment, adding this component may make the grading rubrics overly burdensome and less likely that the rubrics would be used at all.
  - 2) **CE 299 Thesis**: At present a rubric for CE 299 Thesis has not been developed. Instead, the one developed for CE 298 Project is used, but it is not a good fit in all areas of evaluation. The merits of developing a set of rubrics for CE 299 for use in future years are being discussed within the department.
  - 3) **Comprehensive Exam**:
    - a) Only Learning Outcome 6 has been assessed in comprehensive exam. Although several technical learning outcomes can generally be assumed to have been met when the student passes the exam with a minimum score of 75%, assessment of specific could be assessed, resulting in greater resolution.
    - b) Students who select Plan C (Comprehensive Exam) are not required to do undergo an oral defense of their knowledge, which is required for all students who choose Plans A (Thesis) and B (Project). If oral defense of comp. exam were to be implemented a more complete/ accurate measurement of student attainment of oral communication skill in culminating experiences could be obtained.
- D. Oral presentation evaluation rubric. A proposal to adopt the WASC oral presentation evaluation rubric for CE 210 and culminating experiences is being explored.
- E. Timely notification to faculty of data collection needs: More consistent and timely notification to faculty of assessment data needs would result in collection of more assessment data.
- F. Professional License and Doctorate Degrees: The ability to obtain PE and PLS license attainment data from the State board or NCEES, and the practicality of researching the number graduates from our program that went on to earn a doctorate degree, should be investigated because it would provide a new instrument for assessing the technical ability of program graduates.

## 6. Assessment Activities Planned for the 2018-19 Academic Year.

| <u>Activity</u>                                   | <u>Learning Outcomes to be Assessed</u> |
|---|---|
| Instrument 2 -- Questions in specific courses     | 1 & 2                                   |
| Instrument 4 – Program Exit Survey                | All (1 – 7)                             |
| <i>Instrument 6 – Employer survey (tentative)</i> | <i>All (1 – 7)</i>                      |

## 7. Progress Made on Items from Last Program Review Action Plan.

The most recent program review took place in AY 2017-18. This is a periodic review that provides an opportunity for the University to evaluate the effectiveness, progress, and status of the academic program on a cyclical basis. In general, the Review Panel deemed the Program to be viable and appropriate, reflecting the practice and needs of the civil engineering industry. The Review Panel also identified “Strengths” of the Program as indicated below.

**Program Strengths:** Faculty, Curriculum, Assessment, Laboratories and Institutional Support

Department faculty reviewed the review team’s report and generally agree with the findings. Ideas on specific changes that could be implemented to improve the program varied among faculty members and their ideas represent a starting point for further discussions on the issues this fall. Specific responses to the review team’s assessment of areas that could be improved and to review team recommendations are provided below.

### Areas of Improvement (AOI)

**Item 1: Goals of MSCE Program/WREE Option:** “The MSCE Program/WREE Option currently has four educational goals. These goals are centered mainly on technical aspects of the civil engineering, principles of professional ethics, personal responsibility, and communication skills. The review team suggests that leadership, project management skills, and innovation be included in the list of educational goals since the MSCE Program/WREE Option should help prepare students for the future. The review team also suggests that the Student Outcomes Assessment Plan (SOAP) be revised to reflect the changes of the MSCE Program/WREE Option goals.”

**Response to AOI Item 1:** Department faculty strongly support the idea of adding leadership, project management skills, and innovation to the list of educational goals to better prepare students for the future. In AY 2018-19 faculty will seek to determine where and to what extent this content exists in the current curriculum and in courses that students take from outside of the Program\*, and then explore the merits of providing additional content to further those learning outcomes. The Faculty will also discuss the readiness of the program to formally adopt these outcomes as program goals in the SOAP.

\* MSCE students routinely take courses that have leadership, management and/ or innovation content from is the AACSB’s accredited Master of Business Administration (MBA) program in the Craig School of Business. It should also be noted that the Construction Management Department, LCOE, is in the process of setting up a master’s degree program and, when the program becomes operational, management courses could be taken by MSCE students.

**Item 2: Student Enrollment:** “The low enrollment of the MSCE Program/WREE Option is a source of concern for the future of the graduate program. Although the number of students has been growing, low enrollment has significant impacts on student recruitment, retention, and graduation. It also prevents faculty from offering a diverse set of courses in order to meet the broad needs of students enrolled in the program.

The review team determined through the interview with graduate students that students interested in structural engineering, water resources, and environmental engineering are satisfied with the program since many courses have been offered to meet their needs. However, students interested in transportation engineering, geotechnical engineering, and geomatics expressed concerns due to limited course offerings in these areas. This unbalanced course offering pattern is partly the result of the low enrollment in the MSCE Program/WREE Option.”

**Response AOI Item 2:** Department faculty believe offering a diverse set of consistently offered courses is essential to the quality of the program. They recognize the need for increasing enrollment and have expressed various ideas related to recruitment, which will be further developed into a recruitment plan. Recruiting quality students will be the priority of the Department the next few years. The Department will also take a closer look at the appropriateness of the target enrollment, which currently is set at 50 full-time equivalent students, based on the physical, human, and financial resources available.

**Item 3: Curriculum:** “The goals and objectives of the MSCE/WREE curriculum are to provide students with education and training in the area of Civil Engineering, with special reference to the areas of structural engineering, geomatics, water resources, and environmental engineering.

The review team noted that faculty members review the curriculum regularly. This is commendable since the curriculum needs to be revisited, analyzed, and aligned with the current national and international educational trends. It is also commendable that the Department has a strategy to increase class enrollment by dual listing graduate and undergraduate courses.”

**Response to AOI Item 3:** Enrolment in CE graduate courses (2013-2017) averaged about 9 students, which is a desirable size for a faculty teaching the class considering that the same faculty is likely to have three times the number of students or more in his/her undergraduate classes. The Department will explore ideas for increasing enrollment in graduate courses that historically have had low enrollment. Approaches that have been discussed include listing some courses at both the graduate and undergraduate levels and use dual modes of instruction and assessment in the classroom. Another approach is co-listing a course in different programs. One example is CE205 (co-listed as ENGR205) – Computing in Engineering Analysis; this course routinely gets more than 20 students in enrollment, from students within and outside of the Department.

**Item 4: Student Advising and Project Supervision:** “It was evident from discussions with seven (7) graduate students that the faculty members are largely accessible and responsive to the students’ needs. The faculty members make a concerted effort to advise students and offer them opportunities for graduate work in projects or TA positions. It is recommended that the process for students to find an advisor and together with the advisor to select a project or a thesis be improved. It is recommended that the College find a way to assign WTU credit to faculty supporting graduate student research.”

**Response to AOI Item 3:** The Department intends to take a closer examination of the student-advisor selection process. Currently, all incoming graduate students by-default are assigned to the MSCE graduate coordinator, Dr. William Wright. These students are then encouraged to visit with all 16 faculty of the Department to learn about their research interests and receive advice on research endeavors, academic and career planning, etc. The Department agrees with the Review Panel that a more formal student-advisor selection process should be implemented. This issue will be addressed in the upcoming revisions to the strategic and action plans.

The Lyles College of Engineering plans to implement a strategy to account for WTUs of faculty supervising and/ or advising student work in Senior Project (CE 180B), independent study at both undergraduate and graduate level (CE190 or CE290), and MS project (CE298) or thesis (CE299), to prevent overloading its faculty and encourage more of that activity. In general, the mechanism would operate to ensure the combined WTUs of direct teaching assignment and supervision of student work will be kept at most at 24 WTUs per AY per CFA. This typically takes an adjustment to direct teaching WTUs in the spring semester when an exact count of WTUs can be made in the preceding Fall semester to ensure total WTUs is kept at no more than 24 for the AY. Should the combined WTUs exceed 24 WTUs due to circumstance beyond departmental control, the faculty involved would then receive 3 WTUs of released time the Fall semester in the subsequent AY.

## **Recommendations**

The Review Panel provided recommendations in two areas, as listed below. Program responses are provided below each item.

### **Area 1: Student Recruitment and Retention**

**Item 1 of Area 1: Recruitment Plan:** “It is commendable that the Department has conducted significant recruitment activities (including advertising, active responses to inquires of the graduate program, formation of a recruitment committee, accelerated BS/MS program, funding to support graduate students’ financial needs, and creation of a program ambassador) to achieve the target. However, the effectiveness of these activities is not yet clear. It is recommended that a comprehensive recruitment plan be developed, implemented, and assessed to achieve the enrollment target.”

**Response to Rec. Area 1, Item 1:** The Department agrees with the Review Panel's assessment on recruitment plan. The Department intends to develop and implement a comprehensive recruitment plan, and concurrently, develop an assessment plan to gauge the effectiveness of such plan. This recruitment plan will be a priority item as the Department updates and develops its strategic plan of MSCE Program.

While increasing the enrollment of the MSCE program is a high priority, faculty are equally concerned about preserving or improving the quality of students admitted and the capacity of the faculty to advise multiple students in the same time period. Monitoring the success of students admitted to the program and the ability of faculty to provide quality supervision will therefore be integral parts of assessing the effectiveness of the recruitment plan.

**Item 2 of Area 1: BS/MS Blended Program:** "The plan may consider the success of California Polytechnic State University, San Luis Obispo (Cal Poly SLO) and California State University, Los Angeles (Cal State LA) in implementing their BS/MS blended programs to attract more undergraduate students in their universities to graduate programs. Consultation with Cal Poly SLO and Cal State LA is recommended so that their success could be replicated for the MSCE Program/WREE Option."

**Response to Rec. Area 1, Item 2:** The Department will take a closer examination of the blended model adopted by Cal Poly SLO and other institutions offering similar type programs, with the aim of improving the existing *Accelerated BS/MS Program*. It should be noted that the Accelerated BS/MS Program is an option for BSCE juniors with a GPA of at least 3.0. This option allows a BSCE junior interested in pursuing a master degree to take graduate level courses as an undergraduate, while he/she works to fulfill all admission requirements for MSCE. This option offers an opportunity to a student to earn combined BS/MS in 5 years. (<http://www.csufresno.edu/engineering/prospective-students/graduate.html>)

**Area 2: Curriculum:** "Develop a set of common courses for students in all functional areas (Probabilities and Statistics, Project Management, Sustainability of Infrastructure, etc.)

The current curriculum of the MSCE Program/WREE Option has listed a great variety of technical courses in each functional areas (Geomatics, Geotechnical Engineering, Structural Engineering, Transportation Engineering, and Water Resources and Environmental Engineering).

The review team suggests the Department to review the curriculum and develop a plan of actions to address the goal of leadership, project management, and innovation within the curriculum, as well as changes to be made in response to the student outcome assessment. It is commendable that the Department has created a series of CE291T courses. These CE291T courses has incorporated innovative theories and practice of civil engineering into the classroom. However, with the introduction of several topics, many courses listed in the self-study documents have been offered infrequently. Therefore, it is suggested that a couple of new core courses (such as Probabilities and Statistics, Project Management, and Sustainability of Infrastructure) be required of all graduate students. In doing so, the challenges of course offerings due to low enrollments could be reduced."

**Response to Rec. Area 2:** The Department will continue to take a proactive approach to the MSCE curriculum to ensure that the Program remains relevant and current to the practice and needs of the civil engineering industry. The Department will carefully evaluate the viability of offering more course content or new courses in suggested areas and also assess the availability of that content in courses offered by other programs (e.g., Math, MBA, Construction Management, etc.).

***End of M.S.C.E. Assessment Report AY 2017-18***