Master of Science in Civil Engineering
AY 2016-17 Program Assessment Report
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Table of Contents:

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 plotted in Figure 1. During the past 5 years enrollment was at a minimum in the Fall of 2014 (13 students) and at a maximum in the Fall of 2012 (32 students). Enrollment in the WREE Option, which was created in Fall 2013, increased over time to a maximum of 5 students in 2016. Factors driving the downward trend from 2012 to 2014 are not known with certainty, but lack of recruitment activity during that time period is a likely cause. Recruitment efforts have increased since that time period.

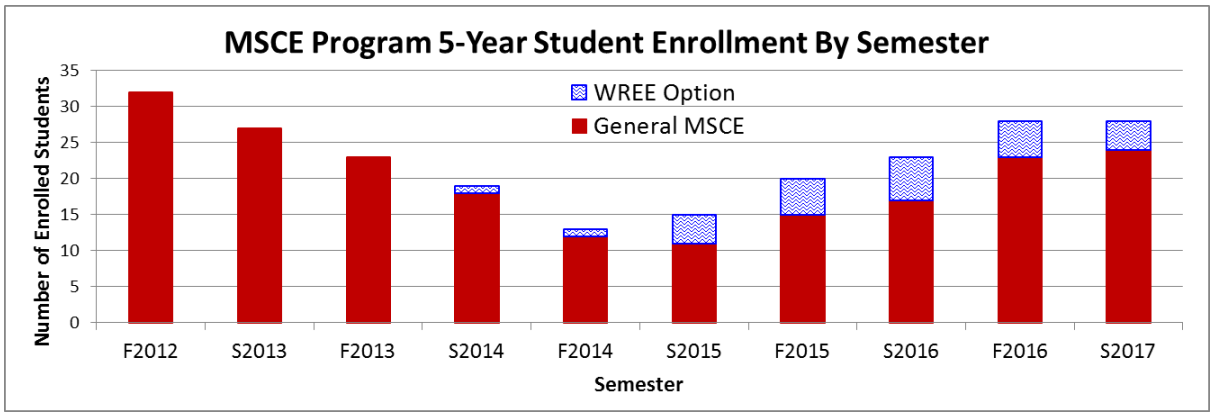


Figure 1. Enrollment in the MSCE program by semester (past 5 years).

1. Learning Outcomes Assessed

1. Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.
2. Describe, explain, and employ beyond the undergraduate level scientific principles and modern professional techniques used in the planning, analysis, management and/or design of:
   a. buildings, bridges, and other structures, and/ or
   b. transportation systems, transportation planning, and traffic operations, and/ or
   c. water supply, flood management, water treatment, and environmental protection/ remediation facilities, and/ or
   d. soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures, and/or
   e. measuring and mapping the earth and the built infrastructure.
3. Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.
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) **Students communication skills in CE 210:** **Outcomes 6 & 7**
2) **Students' score on specific questions in specific courses:** **Outcomes 2 & 3**
3) *Students' performance in CE 298 Project (culminating experience):* *Not assessed this cycle*

B. Indirect Measures:

1) Program Student Exit Surveys (MSCE Program): *Not assessed this cycle*
3) Alumni Survey: **Outcomes 1 through 7**
4) Employer Survey: *Not assessed this cycle*

3. Assessment Methods and Results.

A. Direct Measures:

Methods used in the assessment of direct measures and the results are presented below.

1) Methods:

a) Student communication skills in CE 210: Students are graded for their skill in writing (Outcome 6) and oral presentation (Outcome 7) in CE 210, which is typically completed during the first two semesters of the program. Five areas of written communication are assessed, with equal weighting, as follows: Content, organization, sentence structure, grammar, and references. Ten areas of oral communication are assessed, with equal weighting, consisting of eight parameters related to delivery and five parameters related to content. The results are presented in Subsection 2 below.

b) 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 from 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.

Learning outcomes scheduled for assessment in courses: 2, 3, 6, & 7
Learning outcomes assessed this cycle in courses: 2, 3, 6, & 7
Courses assessed this cycle: CE 205, 210, 233, 240, 242

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

Table 1: Numeric results –faculty assessment of learning outcomes in courses & projects:

Course	No. of Students Surveyed	Learning Outcome	Score, % Program Standard	Score, % Student Average
CE 205		2	**75**	78
CE 210		2	**75**	88
		3	**75**	88
		6	**75**	87
		7	**75**	90
CE 233		2	**75**	82
		3	**75**	80
CE 240		2	**75**	76
CE 242		2	**75**	56
		3	**75**	55

Outcome 2: Describe, explain, and employ beyond the undergraduate level scientific principles and modern professional techniques used in the planning, analysis, management and/or design of: (a) buildings, bridges, and other structures, and/ or (b) transportation systems, transportation planning, and traffic operations, and/ or (c) water supply, flood management, water treatment, and environmental protection/ remediation facilities, and/ or (d) soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures, and/or € measuring and mapping the earth and the built infrastructure.

Results O2: The results indicate that the department standard was exceeded in four out of five courses. Results from the fifth course, CE 242, were significantly below the department standard and may possibly reflect unreasonable expectations by the instructor or the need to restructure the course to provide greater emphasis on the type of problem that was selected for assessment. The instructor is aware of this issue.

Outcome 3: Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.

Results O3: Learning Outcome 3 was assessed in CE 210, 233 and CE 242. Results indicate that the learning outcome was achieved in CE 210 and CE 233, but not in CE 242. For the latter, codes and standards are intermittently introduced to students without discussion of where to find them, and the question used for assessment could be better. These deficiencies can be corrected by adding lecture material and assignments. The instructor is aware of this issue.

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 210. The result (87%) indicates 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 210. The result (90%) indicates that student achievement in written communication skill was well above the program standard of 75%.

Assessment/ Evaluation and Recommendations:

- **Weakness:** The level of achievement in scientific principles and modern professional techniques used in the planning, analysis, management and/or design of civil engineering infrastructure (Outcome 2) was, on average, just above the department standard and lower than other learning outcomes, which can be considered a relative weakness, particularly in one course (CE 242).
- **Strengths:** The level of achievement in communication (Objectives 6 and 7) was well above the department standard, however, this conclusion is based on limited data.
- **Recommended Actions -- Direct Measures:** Address weakness in CE 242 course structure, expectations for attaining learning outcomes, and/ or assessment approach.

B. Indirect Measures:

The Alumni survey was the only indirect measure instrument used during this assessment period, and it was the first time that this measure was used.

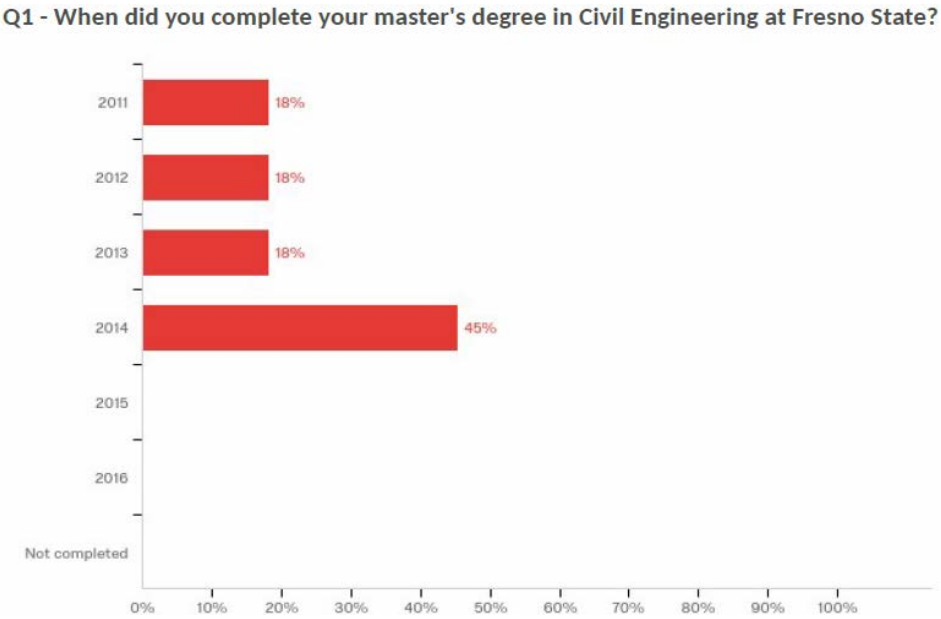
1) Methods:

Alumni Survey: An alumni survey was implemented in 2017 and current plans are to repeat the survey every 3 years (Ref: Figure 2 of the MSCE SOAP). Respondents are graduates of the MSCE Program who have been working at least one year but not more than five years.

2) Results:

Alumni Survey: There were 11 respondents. For this group of alumni,

A. Most (5, or 45%) of respondents graduated in the year 2014, and two respondents from each of the prior years..



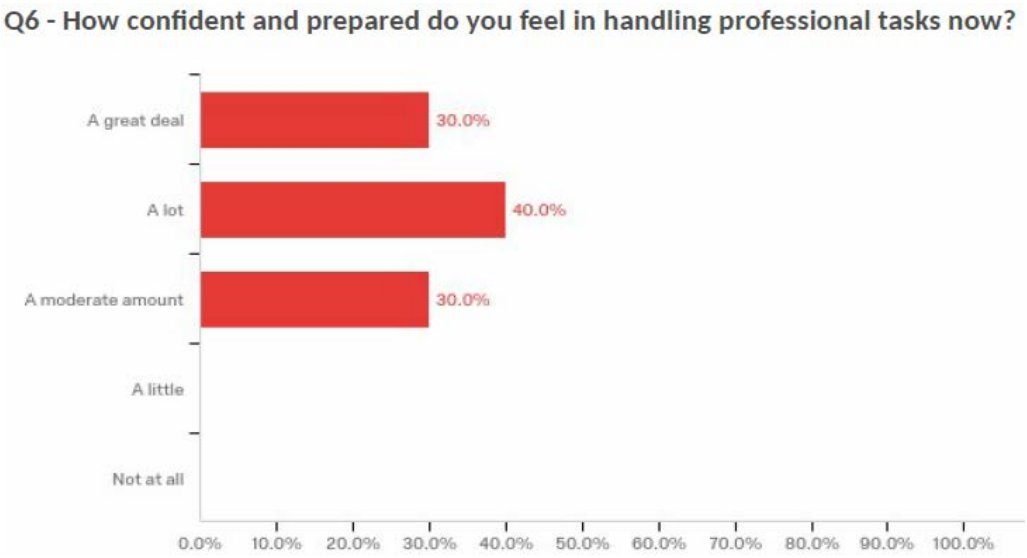
B. All respondents appear to be working in civil engineering; about two-thirds currently work in government; all work in the USA.

Name of employer	Current job title
San Mateo Co. Dep. of Public Works	*(left blank)*
Kern County	Plan Check Engineer II-c
Moore twining associates, inc	Staff engineer
Blair, Church & Flynn	Project Engineer
County of Kern	Engineer
Brooks Ransom Associates	Associate
USDA FOREST SERVICE	Forest Engineer
PCL Construction	Project Engineer
US bureau of Reclamation	Lead civil engineer
State of California	Engineering Geologist
RWQCB	WRCE

C. Average annual salary was between $51,000 and $80,000 for 5 respondents, and exceeded $81,000 for 6 respondents.

D. Most graduates perceive that the quality of their education and preparation for professional practice was above average and that faculty were supportive when they were in the program.

E. Most graduates were confident and perceived themselves as prepared in handling professional tasks at the time they completed the survey.



F. The alumni were asked "On a scale of 1 to 5 (1 is lowest and 5 is highest), please rate the degree of attainment of each of the MS program's learning outcomes (LOs) upon graduation and the importance of each as you relate them to your career success after graduation at Fresno State. If you are not able to answer, please mark N/A (Not Applicable)." The responses are shown on the next page.

- **Strengths:** Learning Outcome 1 (ethics)
  Learning Outcome 2 (analysis and design skills)
  Learning Outcome 6 (writing skills)
- **Weaknesses:** Learning Outcome 5 (Use modern computer software for analysis, design or measuring and mapping)
  Learning Outcome 3 (familiarity with regulations)
  Learning Outcome 4 (use of math in solving problems)

G. Written responses included areas in the master program of study that contributed least to their professional development. Specific responses are disseminated internally to the department and a general summary is provided here as follows:

1) More than one alumnus expressed displeasure with specific courses, and courses in general in one of the technical areas.
2) One alumnus did not like the policy on comprehensive exams that could disqualify them if they failed the exam twice.
3) Additional comments included displeasure with all of the due dates that students need to keep track of to get through the program in conjunction with insufficient reminders from the department.

Written responses also included changes that they foresee in their field of work in the next ten years and how Fresno State's MSCE program might address these changes. The respondents suggested that the curriculum include:

1) Training on advanced software that is used in the current market,
2) Construction-related topics (BIM, scheduling, quality control, safety).

Learning Outcome	**Attainment** (1 is lowest and 5 highest)						
	1	**2**	**3**	**4**	**5**	**N/A**	**Total**
1) Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship				71%	29%		7
2) Describe, explain, and employ the scientific principles and modern professional techniques used in the analysis and/or design of (as applicable): a. buildings, bridges, and other structures; b. transportation systems, transportation planning, and traffic operations; c. water supply, flood management, water treatment, and environmental protection/ remediation facilities; d. soil engineering, retaining walls, foundations, tunnels, and other geotechnical structures; or e. measuring and mapping the earth and the built infrastructure.			14%	57%	29%		7
3) Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.		16%	33%	50%			6
4) Solve problems in engineering analysis and design through the use of mathematical analysis, differential equations, finite elements, finite differences, least square errors, or other numerical methods.		14%	14%	29%	43%		7
5) Use modern computer software for the analysis and design or measuring and mapping of the built infrastructure.	14%	14%	43%	29%			7
6) Exhibit excellence in written and graphical communication, including technical documents, research reports, proposals, and presentations			29%	57%	14%		7
7) Exhibit excellence in oral communication, including public presentations to technical and non- technical audiences.			29%	71%			7

4. Changes Implemented Since Last Assessment Period.

Changes made to the MSCE Program and assessment methods since the last assessment period are summarized below.

A. **Program changes implemented**:

1) Recruitment Plan updated. The MSCE program recruitment plan was improved.

2) Program website. The MSCE website was completely overhauled (most of the credit for this goes to Imelda Santacruz and Sonya Peña of the Graduate Net Initiative).

3) Graduate Writing Requirement (GWR) and CE 210 Research Methods. The way the GWR is assessed in CE 210 was changed and a related new course requirement was added to CE 210: "A passing grade in the Graduate Writing Requirement component of CE 210 is required to receive a passing grade in CE 210." In the event that a passing grade on the writing component is not achieved, students who have a passing grade on the sum total of other course requirements will receive an "Incomplete" and must pursue the completion of the writing requirements independently from the course and in collaboration with his/ her graduate advisor. Students have two semesters to resolve incomplete work to avoid a failing grade in the course (and a high likelihood of disqualification from the graduate program based on low GPA)

4) WREE course content, titles and numbering. WREE-oriented faculty continued discussion on overhauling WREE curriculum (titles, content, numbering). Faculty met with several members of the CE Program Advisory Council in Spring 2016 to review a draft of the proposed changes and solicit their input. Development of the changes continued in AY 2016-17 and will continue until completed.

B. **Assessment changes implemented**:

1) Program Review Self-Study: The MSCE program is undergoing a review this year. A program self-study report was prepared and submitted to campus in March. A copy can be made available to the OIE upon request.

2) Alumni Survey Implemented. An Alumni survey was implemented this year for the first time. Results were summarized above.

3) SOAP Revisions. The MSCE SOAP was updated in conjunction with preparing the program self-study report. Updates included the following changes:

a) **Learning Outcomes.** The wording of Learning Outcomes 2, 4, 5 and 6 was changed and various tables were updated to reflect those changes.

b) **Student Exit Survey.** Improvements were made to several questions on the Student Exit Survey to clear up ambiguities and to obtain additional details on some items.

5. Changes Under Consideration and On-Going Tasks.

A. **Program changes under consideration:**

1) Strategic Plan. A MSCE Strategic Plan is needed. A recruitment plan, first developed in AY 2014-15, and improved since then, is one component of the strategic plan.

2) Recruitment. The current recruitment plan can be found in the 2017 MSCE program review self-study report. That plan needs to be developed further and implemented.

3) Curriculum. Program curriculum is a frequent topic of discussion among faculty, students and their employers. A few issues and potential solutions were presented in the 2017 MSCE program review self-study report.

3) WREE course content, titles and numbering. As noted previously, WREE-oriented faculty are continuing discussions to overhaul WREE curriculum (titles, content, numbering).

4) Admission criteria. A policy is needed for evaluating applicants who have earned (a) a 3-year BSCE degree and (b) BS in geomatics engineering.

5) Prerequisite courses: The number and type of prerequisite courses required for applicants who do not have a BS degree in civil engineering has been debated. Current policy requires these applicants to complete approximately 9 courses that are designed to give the student breadth in civil engineering. The issues are whether breadth is needed and how requiring it impacts the competitiveness of the MSCE program relative to programs at other universities.

6) Graduate Faculty Group. The Graduate Faculty list is outdated and needs updating. Also, need confirmation that non CGE faculty can be chair of a CE thesis committee.

B. Assessment changes under consideration:

1) Program Review: The MSCE program is undergoing a review this year and the review team visit is expected this fall. The review team report will serve as a valuable assessment tool.

2) Comprehensive exam oral presentation/ defense. All students following plans A (Thesis) and B (Project) are required to make a final oral presentation/ defense of their work and submit a final report. Students who select Plan C (Comprehensive Exam) are not required to do this, and their culminating experience is not part of the program assessment. Program faculty have adopted in concept the requirement of an oral presentation/ defense for all culminating experiences. Implementation is pending.

3) Rubrics for evaluation of thesis written reports. At present a rubric for CE 299 Thesis has not been developed. The merits of developing a set of rubrics for CE 299 for use in future years are being discussed within the department.

4) Oral presentation evaluation rubric. A proposal to adopt the WASC oral presentation evaluation rubric for CE 210 and oral defense of culminating experience is being explored.

5) Student Retention and time to completion of degree: Consideration is being given to tracking student retention statistics and the average time to complete their degree.

6) Employer surveys: An employer survey has not yet been implemented even though plans for doing so have been in place for several years. The O.I.E. has expressed a desire to compile alumni contact data from databases of the O.I.E, the Development Office, and alumni associations. Doing so would facilitate the employer and/ or alumni survey effort.

7) Culminating Experience Assessment:

   a) **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.

   b) **CE 299 Thesis:** At present learning outcomes are not assessed in CE 299 Thesis, which has a negative impact on outcomes assessment program-wide since students who select this plan tend to be the best students. The merit of developing a procedure for assessing learning outcomes in CE 299 is being discussed within the department.

   c) **Comprehensive Exam:** Currently specific learning outcomes are not 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 learning outcomes can be discussed.

8) Timely notification to faculty of data collection needs: More consistent notification to faculty of data collection needs for designated courses and in CE 298 Project (or culminating experience in general) is needed, particularly in the case of courses taught in the fall semester. This is currently the responsibility of the Assessment Coordinator.

9) Comparison of first-year and graduating students: It may be possible to determine whether student writing is improving during their time in the program by comparing assessment results from CE 210, which is taken in the first two semesters, and CE 298, which is taken in the last semester. However, this approach has challenges as follows: (a) The rubrics used to assess writing proficiency in CE 210 and CE 298 are not the same; (b) the faculty conducting the assessment is not one person; and (c) the average score in writing shown for CE 298 Project is most likely not representative of the proficiency of all students in their last semester because the evaluation does not include students who choose CE 299 Thesis, who likely have above-average writing skills. The evaluation also does not include students who select comprehensive exam. The first and third limitations could be mitigated and this topic should be discussed among program faculty soon.

10) 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. This information may be useful for assessment.

6. Assessment Activities Planned for the 2017-18 Academic Year.

Activity	Learning Outcomes to be Assessed
Instrument 2 -- Questions in specific courses	4 & 5
Instrument 3 – Culminating Experience	6 & 7
Instrument 4 – Program Exit Survey	All (1 – 7)
Instrument 6 – Employer survey (tentative)	*All (1 – 7)*

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

The most recent program review completed took place about nine years ago Spring of 2008 (report published on August 8, 2008). Several action items were identified in the MSCE Program response to the program review report (dated November, 2008). **These items are discussed in detail in the 2017 MSCE Program Self-Study Report that was completed in March. Copies are available upon request.**

End of M.S.C.E. Assessment Report AY 2016-17