

**Master of Science in Civil Engineering
AY 2015-16 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 an introductory course (CE 210 Research Methods) with a min. grade of B; completion of a graduate writing requirement with a min. score of 87.5%; completion of a culminating experience (CE 298 project, CE 299 Thesis, or comprehensive exam) with a min. grade of “C” for CE 298 and CE 299, and 75% for the comprehensive exam; and maintaining a cumulative GPA of at least 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 6 core courses and 6 units of approved 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 Spring of 2010 (9 students) and at a maximum in the Fall of 2012 (32 students). A recent minimum occurred in Fall 2014 (15 students). Current enrollment (Fall 2016) is 24 students. Enrollment in the WREE Option, which was created in Fall 2013, increased over time to a maximum of 5 students in 2016. Factors that contributed to the upward and downward trends have not been identified. The campus reported a 30% decrease in new graduate students from fall 2010 to fall 2014 (Table 1), and reasons for this trend are also not clear.

Note: Some student enrollment numbers presented in prior year MSCE program assessment reports inadvertently utilized total students in program rather than enrolled students.

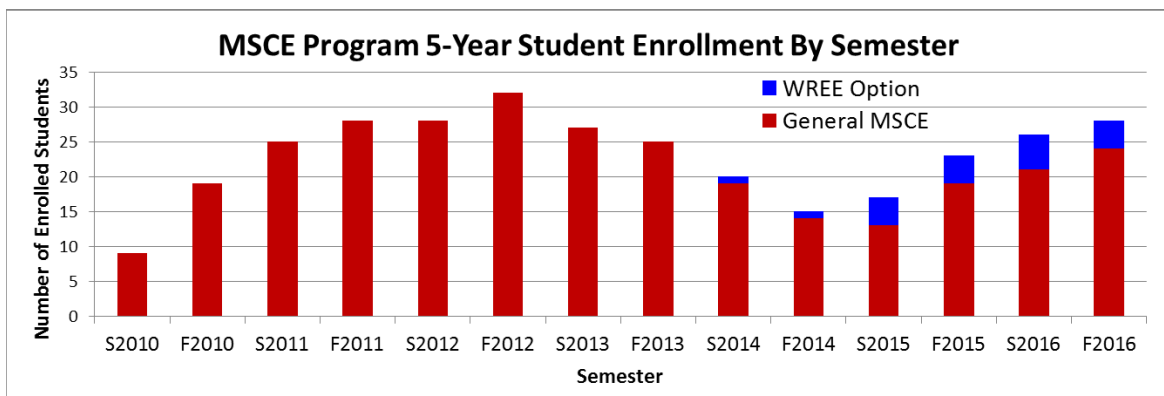


Figure 1. Enrollment in the MSCE program by semester (past 5 years).

Table 1. Number of new master’s students at Fresno State during the past 5 years¹.

	Fall 2010		Fall 2011		Fall 2012		Fall 2013		Fall 2014	
	N	% of Column	N	% of Column	N	% of Column	N	% of Column	N	% of Column
Continuing / Other	15,135	72.3%	16,403	74.6%	17,023	75.4%	16,672	72.3%	16,994	73.3%
First-Time Freshman	2,700	12.9%	2,925	13.3%	3,139	13.9%	3,265	14.2%	3,533	15.2%
New Doctorate	20	0.1%	16	0.1%	85	0.4%	71	0.3%	73	0.3%
→ New Master	939	4.5%	695	3.2%	652	2.9%	747	3.2%	654	2.8%
New UGRD Transfer	2,138	10.2%	1,942	8.8%	1,666	7.4%	2,305	10.0%	1,925	8.3%
Grand Total	20,932	100.0%	21,981	100.0%	22,565	100.0%	23,060	100.0%	23,179	100.0%

¹ Source: <https://tableau.fresnostate.edu/views/Enrollment/Headcount?:embed=y>

1. Learning Outcomes Assessed

- Outcome #1 – Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship.
- Outcome #2 – Describe, explain, and employ the scientific principles and modern professional techniques used in the analysis and/or design of:
 - a. buildings, bridges, and other structures, and/ or
 - b. transportation systems, transportation planning, & 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.
- 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.
- Outcome #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.
- Outcome #5 – Use modern computer software for the analysis and design or measuring and mapping of the built infrastructure.
- Outcome #6 – Exhibit excellence in written and graphical communication, including technical documents, research reports, proposals, and presentations.
- Outcome #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' performance in CE 210 (taken in first 2 semesters): *Not assessed this cycle*
- 2) Students' score on specific questions in specific courses: Outcomes 1 & 5
- 3) Students' performance in CE 298 Project (culminating experience): Outcomes 6 & 7

B. Indirect Measures:

- 1) Program Student Exit Surveys (MSCE Program): Outcomes 1 through 7
- 2) OIE Student Exit Surveys:[For Future Use] *Not assessed this cycle*
- 3) Alumni Survey: [For Future Use*] *Not assessed this cycle*
- 4) Employer Survey: [For Future Use*] *Not assessed this cycle*

* Pending the development of an alumni and employer database.

3. Assessment Methods and Results.

A. Direct Measures:

Methods used in the assessment of direct measures, including details specific to the current assessment period, are presented in Subsection 1. Results are presented in Subsection 2.

- 1) Methods: Methods used for direct assessment are described below.
 - a) Average student score on specific questions in specific courses: Student Learning Outcomes 1 through 5 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 4 of the SOAP. Courses and the associated outcomes assessed in a given academic year vary over time.

Course learning outcomes scheduled for assessment: 1 & 5
Course learning outcomes assessed this period: 5
Courses assessed this period: CE 205
 - b) Students' performance in CE 298 Project (culminating experience): A set of rubrics were adopted program-wide to evaluate student performance in CE 298 Project, and these are used for assessment purposes. Writing skills (Outcome 6) are based on the written report submitted by each student completing CE 298. Oral presentation skills (Outcome 7) are assessed based on the oral presentation (defense) that each student is required to make. Areas of written and oral communication assessed are shown in Appendix A of the SOAP.
- 2) Results: Numeric results are summarized in Table 1. Discussions of outcome-specific results, assessments, 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, %	
			Std*	Student Average
CE 205	12	5	75	85.8
CE 298	3	6	75	81.1
	2	7	75	86.5

* Program standard.

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

Results: Learning Outcome 5 was assessed in CE 205. The result (85.8%) indicates that student achievement as a group in computer literacy was well above the department standard of 75%.

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

Results: Learning Outcome 6 was assessed in CE 298. The result (81.1%) indicates that student achievement in written communication skill was somewhat above the program standard of 75%.

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

Results: Learning Outcome 7 was assessed in CE 298. The result (86.5%) indicates that student achievement in written communication skill was well above the program standard of 75%.

Assessment/ Evaluation and Recommendations:

- **Weaknesses:** The level of achievement in written communication (Outcome 6) was slightly lower than for oral communication (Objective 7) at the end of this groups' time in the MSCE program (CE 298 Project). It also scored slightly lower than the technical objective in computer competence (Objective 5).
- **Strengths:** The level of achievement in use of modern computer software for the analysis and design or measuring and mapping of the built infrastructure (Objective 5) is well above the department standard. The level of achievement in oral communication (Objective 7) was also well above the department standard.
- **Recommendations:** None in this cycle.

B. Indirect Measures:

Methods used in the assessment of indirect measures along with their results are presented below.

1) **Graduating Student Exit Surveys:** Students graduating from the MSCE program are asked to complete an exit survey and the results are used to assess all outcomes (1-7). A summary of the results of statistical analyses conducted on the raw data is provided below.

a) **Learning outcome numeric results.**

No. of students who graduated in current assessment period (i.e., last AY):	4
No. of student exit surveys obtained from this group:	3 (75%)
Individual responses --average of all outcomes:	
• Lowest	83%
• Highest	94%
All responders as a group, by outcome (average):	
Objective 1 –Ethics:	96%
Objective 2 –Principles & techniques of analysis design of infrastructure:	92%
Objective 3 –Regulations, codes, specifications:	77%
Objective 4 –Problem solving using math in engr. analysis and/or design:	90%
Objective 5 –Use modern computer software for analysis, design, or mapping:	83%
Objective 6 & 7 Combined: –Excellence in communication (written & oral):	92%
<u>Outcome with lowest score:</u> Outcome 3 Avg. Score:	77%

“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?”

Outcome with highest score: Outcome 1 Avg. score: 96%

Outcome 4: “Describe and embrace principles of professional ethics, personal responsibility, and environmental stewardship?”

Grand mean, all responders and all outcomes: 88%

b) Student written comments (Dept. Only).

Students are asked to state the “Best thing remembered about the MSCE Program” and the “Worst thing remembered about the MSCE Program.” These comments are provided only to department faculty. As summary of the results is provided below in Item d).

c) Additional numeric results.

Program/ Option choice:	General	2 (67%)
	WREE	1 (33%)
Technical area of study choice:	Geomatics	0
	Geotechnical	0
	Structural	1 (33%)
	Water/ env.	2 (67%)
	Transportation	0
Culminating Experience Choice:	Project	3 (100%*)
	Thesis	0
	Comp. exam	0
Off-campus employment during graduate studies:	Full-time	0
	Part-time	2 (67%)
	None	1 (33%)
Full-time employment offer upon graduation:	Yes	1
	No	1
	N/A**	1
Employment offer starting salary:	No. of Responses	1 (33%)
	Starting salary	\$55,000

* Among participants in the survey:

** Those who responded “N/A” were likely already employed.

d) Discussion of Strengths, Weaknesses, & Student Preferences and Employment (Exit survey):

- **Numeric Results:** Students who responded to the survey as a group perceive that they have largely attained the learning outcomes (1, 2, 3, 4, 5, & 7+ 8 combined), although there is room for improvement.
- **Written comments:** Students who responded to the survey as a group expressed:
 - **Positive opinions** of learning, small class size, faculty and staff support, and experiences working in the lab.
 - **Poor opinions** on the availability and selection of graduate courses. This opinion is largely the result of having four subject areas of coursework that students can concentrate in and having a relatively small graduate program. Growth in program enrollment would be the best way to mitigate this situation. One student was not happy about having to take some coursework that he/she was not interested in, however, the student recognized that this is necessary for a well-rounded education.
- **Culminating experience.** Projects remain the most popular culminating experience.
- **Student employment and salary.** The majority of students are employed while they are in graduate school (long-term trend; data not shown). This reality consumes considerable time and effort and competes for their time in the classroom and studying, resulting in fewer courses per semester and longer time in graduate school.

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:

- 1) Course Offerings. Courses continue to be developed and formally proposed, however, the number of courses that can be offered are limited by instructor availability and minimum student enrollment targets.
- 2) 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. This effort will continue in AY 2016-17.
- 3) Graduate Student Instructor Training. Two or three faculty members spent time training well-performing graduate students to become instructors of laboratory course sections.

B. Assessment:

- 1) Program Goals Revisions. Program Goal 2 was revised as follows (addition underlined):
Describe and explain, beyond the undergraduate level, the scientific principles involved in the planning, ~~mapping~~, analysis, and/or design of the built environment, or in the mapping and measurement of it.

- 2) Learning Outcome Revisions. None this cycle.

- 3) Student Exit Survey. Three questions were added to the Student Exit Survey to gain information on survey respondent's program/option choice, subject area emphasis and the nature of their employment offer as indicated below. The results were presented above.

Which program did you complete? (check one) MSCE [] WREE []

*What area of concentration, if any? (check one or two) Geomatics[] Geotech.[] Structural[]
Water/ Env.[] Transport.[]*

Is the nature of your employment or employment offer civil engineering? Yes[] No[]

5. Changes Under Consideration.

A. Program

- 1) Strategic Plan. A MSCE Strategic Plan is needed. A recruitment plan, developed in AY 2014-15, is one component of a strategic plan.
- 2) Curriculum. Work with the CE and GME Advisory Boards to review curriculum relevancy, sufficiency, and responsiveness to current industry and public sector employer needs.
WREE course content, titles and numbering. As noted previously, WREE-oriented faculty are continuing discussions to overhaul WREE curriculum (titles, content, numbering).
- 3) New Course Proposals. The CE program has topics courses (CE 191T and 291T) that have been taught two or more times that need to be formally proposed.
- 4) Catalog changes. Changes to the program description in the General Catalog are warranted. Two markups have been developed that need to be presented to graduate faculty for review.
- 5) Admission criteria. A policy needs to be developed with respect to evaluating applicants who have earned a 3-year BS degree for applicants with (a) a 3-year BSCE degree and (b) BS in geomatics engineering.
- 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.
- 7) Web pages updating: The MSCE web page needs updating.

- 8) Recruitment Committee :
- a) View and discuss recorded webinar: Enrollment Management for Graduate Programs: Best Practices in Marketing, Recruitment & Retention
 - b) Develop recruitment plan and action plan; present it to dept.
 - c) Update MSCE & WREE brochures and preparation of other elements of a mailing package to employers of potential student prospects. Rebecca assistance desired. Perhaps wait until new faculty officially on-board.
- 9) Grad. Faculty Group list updating;

B. Assessment

- 1) 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.
- 2) 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.
- 3) 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.
- 4) Student Exit Survey. Consideration is being given to modifying two questions as follows:

Existing: Did you work off campus while pursuing your MSCE? [] Full time [] Part time [] No

Proposed: Where you employed while pursuing your MSCE? [] No [] Yes, [] On campus [] Off campus; [] Full time [] Part time

Existing: Do you have a full-time job offer?[] No [] Yes

Proposed: Do you have a full-time job offer following graduation? [] No [] Yes
- 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) Alumni and employer surveys: Alumni and employer surveys have 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: See if we can get PE and PLS license attainment data from the State board or NCEES; See if can get data on students who went on to earn a doctorate degree. This information may be useful for assessment.

6. Assessment Activities Planned for the 2016-17 Academic Year.

<u>Activity</u>	<u>Learning Outcomes to be Assessed</u>
Instrument 1 – CE 210 Research Methods	6 & 7
Instrument 2 -- Questions in specific courses	2 & 3
Instrument 5 – Alumni survey	All (1 – 7)

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

The most recent program review was conducted in the 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 summarized below along with their status.

Action Item 1: Develop the Student Outcome and Assessment Plan (SOAP)

Status: Completed in 2009.

Action Item 2: Prepare a Strategic Plan Exclusive for the Graduate Program.

Status: Pending. A Strategic Plan for the Civil Engineering program as a whole, both undergraduate and graduate programs, existed in 2008 and an effort was conducted in the 2010-11 timeframe to develop one college-wide. Elements of a strategic plan exclusive for the MSCE Graduate Program are being developed. One element, a Recruitment Plan, was developed in the fall of 2014 and several parts of it have been implemented. Implementation of the remaining parts is a current program priority as is development of additional elements of a strategic plan.

Action Item 3: Make CE 291T, Research Methods, a permanent course and clarify that it is the only means of fulfillment the graduate writing requirement.

Status: Completed in 2011 (now CE 210).

Action Item 4: Develop office/desk space for graduate students.

Status: Pending.

Action Item 5: Invest in the program's transition. [*The number of faculty and students the MSCE Program was growing in 2008*]

Status: On-going. The College has made several important investments in the MSCE program since 2008, including,

- hiring new faculty members; providing release time for the program coordinator/ assessor;
- providing faculty release time for course development and research;
- investing in laboratory renovations and equipment enhancements; and
- sponsoring graduate student TA and RA positions and tuition fee waivers.

Additional investments that, if made, would further strengthen the program include,

- Allow work done by faculty in CE 180B, CE 190, CE 290, CE 298, and CE 299 to be counted towards each year's 24 WTU of teaching load. This would free-up faculty to focus more on research, recruitment and scholarly activities.
- Release time for faculty to engage in research projects that increase graduate student research opportunities, presentations at conferences, master's degree projects and theses, and authorship of scholarly papers.
- finding a room for graduate students to work, study and develop relationships with other students.
- Additional sponsorship for graduate student TA and RA positions and tuition fee waivers for highly qualified applicants.
- MSCE Web site upgrade.
- Advertisement of the MSCE program and WREE option.

End of M.S.C.E. Assessment Report AY 2015-16