California State Polytechnic University, Pomona



Academic Program Review - Self-Study
College of Engineering

MS Civil Engineering

Construction Engineering and Management Option
Environmental Engineering and Water Resources Option
Geotechnical Engineering Option
Structural Engineering Option
Transportation Engineering Option

AY 2021-2022

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TABLE OF CONTENTS

1 INTRODUCTION 3
1.1 Program Overview 3
1.2 Mission, Vision & Values 3
1.3 History 5
1.4 Inclusive Polytechnic Education 7
1.5 Credit Hour 8
2 PROGRAM QUALITY 10
2.1 Student Profile at Admission and Enrollment 10
2.2 Curriculum and Pedagogy 13
2.3 Student Retention and Graduation Rates 19
2.4 Assessment of Student Learning 21
2.5 Student Support, Satisfaction and Services 44
2.5.1 Co-Curricular 44
2.5.2 Academic Advising 44
2.5.3 Student Satisfaction 47
2.6 Stakeholders 48
3. FACULTY 51
3.1 Overview of Faculty 51
3.2 Faculty Support 55
4. UNIVERSITY SUPPORT AND RESOURCES 56
4.1 Personnel 56
4.2 Facilities and Space 56
4.3 Library 63
4.3.1 Select Journal titles 63
4.3.2 Databases 63
4.3.3 Reference and Instruction Statistics 63
4.4 Other Campus Resources 64
4.5 Budget 65
5. CONCLUSION 69
5.1 Main program strengths 69
APPENDICES 70
Appendix A - List of International Institutions 71
Appendix B - Student Learning Outcomes Rubrics 73
Appendix C - Laboratories 79
Appendix D – CE Strategic Plan 88

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1 INTRODUCTION

1.1 Program Overview

This Program Review addresses the Master of Science in Civil Engineering program in the Civil Engineering Department at Cal Poly Pomona, which includes the following options:

- Construction Engineering and Management
- Environmental Engineering and Water Resources
- Geotechnical Engineering
- Structural Engineering
- Transportation Engineering

1.2 Mission, Vision & Values

The following provides a summary of the vision, mission, and values of the university, college, and department/academic program(s).

UNIVERSITY

Mission - We cultivate success through a diverse culture of experiential learning, discovery, and innovation.

Vision - Cal Poly Pomona will be the model for an inclusive polytechnic university that inspires creativity and innovation, embraces local and global challenges, and transforms lives.

Values:

Academic Excellence – We demonstrate academic quality, relevance, and excellence through our teaching, learning, scholarship, and creative activities with student-centered faculty in an evidence-based culture.

Experiential Learning – Our polytechnic identity fosters an integrative approach to education through collaboration, discovery, learn-by-doing, and innovation. Our approach encourages reflection, informed risk-taking, and continuous learning.

Student Learning and Success – We are deeply committed to educational experiences and supportive services that engage our students, enhance personal well-being and growth, provide career opportunities, and foster ethical citizenship.

Inclusivity – Our diversity across multiple dimensions reflects and enhances our community. We are welcoming and respectful, and we value diversity.

Community Engagement – We nurture mutually beneficial and meaningful relationships with community partners and stakeholders.

Social and Environmental Responsibility – As global citizens, our individual and collective actions reflect our commitment to one another, society, and the environment.

COLLEGE OF ENGINEERING[1]

Mission - Prepare students for industry and advanced studies by implementing an inclusive polytechnic philosophy through collaborative teamwork, innovation, entrepreneurship, and professional integrity.

Vision - The Cal Poly Pomona College of Engineering's learn by doing education prepares engineers to transform imagination into reality.

Values - Core values are the basis upon which we strategize, make decisions, and interact with each other and our stakeholders. The following values represent what is important to the College of Engineering and how we support our vision and shape our culture. These principles guide our internal conduct and external relationships to ensure we stay true to our mission and provide a critical foundation for developing the goals and strategies.

- **People-Centered** - We invest in people and celebrate success.
- **Collaborative** - We create an environment of collegiality, ownership, and engagement.
- **Forward-Thinking** - We strive to be proactive, creative, and innovative.
- **Transparent** - We are committed to maintaining an environment of open, honest, and inclusive communication.
- **Bold** - We value grit, risk-taking, and learning from challenges.

CIVIL ENGINEERING DEPARTMENT

Mission - The MSCE program is intended to serve both full-time and part-time graduate students who have a BSCE or closely related undergraduate degree in order to strengthen their knowledge and understanding of civil engineering principles and practices. The program is primarily intended for students who currently are, or intend to become, practicing civil engineers, and thus focuses on the application of these principles and practices to real-world problems encountered by professional civil engineers.

Another purpose of the program is to facilitate applied research on relevant civil engineering topics. Such research should 1) serve societal needs by addressing contemporary issues, 2) contribute to the professional development of both students and faculty, and 3) provide preparation for further academic study and research for those students who wish to pursue a Ph.D.

Vision - We excel at delivering an inclusive, practice-oriented, world-class Civil Engineering education that changes people's lives.

[1] Source: https://www.cpp.edu/engineering/about/mission.shtml

1.3 History

College History
The College of Engineering at Cal Poly Pomona was founded in 1957. The first Dean, Dr. Harold Skamser, led the development of the original programs based on needs identified by local employers, which resulted in a hands-on practice-oriented college. The 1962 Cal Poly Student Handbook noted the College's focus on "practical application of the engineering art using principles learned in fundamental courses." Engineering has grown to become the largest college on campus, with seven departments offering 11 BS and 7 MS degree programs. The College of Engineering has offered an MSE (Master of Science in Engineering) degree for nearly thirty years. Initially, this program included specialty tracks in the various engineering disciplines, including civil engineering. In the late 1990s, the College separated degree programs, including the MSEE (Electrical Engineering) and MSME (Mechanical Engineering).

Master of Science Civil Engineering (MSCE) Program History
The Civil Engineering Department was founded in 1961 and graduated its first class in 1963. A State-funded MSSE (Structural Engineering) program began in 2001. The Civil Engineering Department obtained approval on July 27, 2006, to change the name of its MS program from MSSE to MSCE, converting Structural Engineering into an emphasis of the MSCE program. Geotechnical Engineering and Transportation Engineering were added to the MSCE program in 2006. Later, in 2015, the MSCE program grew with the approval of the Environmental and Water Resources (EWR) emphasis.

Recent program changes and achievements
Since the first MSCE inception, the Department's educational philosophy is to provide a combination of theory-based and practice-oriented curriculum that prepares students for immediate entry into engineering practice or Ph.D. studies. This philosophy is consistent with those of the College of Engineering and the University. The program has not been reviewed since established. Over the last seven years, significant improvements in the program have been focused on adding options to the MSCE program and managing the growing enrollment demand on the program.

During the semester conversion process, all emphases were converted into options and in Fall 2018 the Construction Engineering and Management option was added to the MSCE program. Currently, the MSCE program has five options:

- Construction Engineering and Management
- Environmental and Water Resources
- Geotechnical Engineering
- Structural Engineering
- Transportation Engineering

Most recently, the MSCE curriculum has been reviewed and approved as an outcome-based program to demonstrate compliance with the CSU (California State University) Executive order 1071. The new outcome-based curriculum will be in effect in the Fall of 2022.

The average graduate enrollment over the past six years has been 105 students and is currently (Fall 2021) -143 students which makes the program one of the largest MSCE programs in the CSU system. Cal Poly Pomona is an HSI (Hispanic Service Institution) and currently, the MSCE

program serves a diverse population (**Table 1.1**). This demographic is composed of 36% of female and 64 % of male students. The Department grants an average of 34 (6-year average) MSCE degrees per year; in 2019-2020 the program awarded 31 MSCE degrees. This is possible by having 24 tenure and tenure-track faculty to serve the diverse student population. There is no doctoral degree program.

Table 1.1 *- Ethnic groups of the currently active MSCE program students.*

Ethnic Group	Percent
Hispanic	34.3
White	21.7
Asian	21.7
Non Residents	14.7
Unknown	3.5
Black/African American	2.8
Two or more races	0.7
American Indian/ Alaskan Native	0.7

The fall 2021 number of active students is shown in **Table 1.2**. The Graduate Committee actively recruits potential graduate students twice a year in the Fall and Spring event from the Civil Engineering Department BS CE program.

Table 1.2 *- Active students per MSCE option in fall 2021*

	Active Students
Option	Fall 2021 (10/29/2021)
Structures	58
Environmental and Water Resources	27
Transportation	24
Construction Engineering and Management	18
Geotechnical	13
Unspecified	3
Total	143

All five options are offered through the Civil Engineering Department at Cal Poly Pomona and share many attributes. Four of the five options (Structures, Transportation, Construction, and Geotechnical) target one specific area within Civil Engineering, and one option integrates the environmental and the water resources branches of Civil Engineering, which makes the option unique in the region. All options provide common learning outcomes through a variety of courses. Out of the 30 required units, 18 units (60%) are courses sharing common core learning outcomes, and 12 units (40%) are elective courses, as detailed in Section 2 (Program Quality), Sub-section 2.2. Completion of the MSCE degree requires a culminating experience, which could be either a Master's Thesis, a Master's project, or a comprehensive examination.

The comprehensive exam was introduced in fall 2016 to improve the graduation rate. Many of the Masters' students in the program are working professionals and have had difficulties in handling

a Masters' project or a thesis time commitment. The comprehensive exam gives these working professional students and other students with extra-curricular commitments, the opportunity of independently study to complete the degree culminating requirement.

The Department and the College aim at growing the Masters' program and ensuring its sustainability while also improving its overall quality. The most recent faculty hires, such as Dr. Simeng Li in the Environmental and Water Resources Group; Dr. Jeyoung Woo in the Construction group; and Dr. Ali Shafiee, and Dr Mehrad Kamalzare in the Geotechnical group, were critical for the sustainable growth of the program in terms of breadth and depth of course offerings.

1.4 Inclusive Polytechnic Education

A summary of how the MS in Civil Engineering program aligns to the elements of the Cal Poly Pomona Inclusive Polytechnic Education is provided in **Table 1.3**. The table shows the different learning experiences provided through the curriculum, and how they relate to the inclusive learning elements of the CPP Polytechnic Education.

We consistently review the course offering and contents to ensure that up-to-date practices are implemented in class and cutting-edge tools and discoveries are presented within the learning environment. The diversity of Program Activities of **Table 1.3** is key in ensuring that students receive an inclusive Polytechnic Education that addresses global contemporary issues. Aside from traditional lectures, Master's Projects, and Theses, the addition of seminars, technical literature reviews, and technical proposal writing give students the chance to get to look at diverse and multi-disciplinary perspectives on the subjects of study. Some students deliver external technical presentations to conferences, or submit papers to technical journals. Lab activities and web-based resources, such as professional educational videos, are also incorporated into the curriculum to provide students with a strong hands-on and IT technology experience. Even if there are no official graduate student organizations, the graduate students can participate voluntarily in activities held by the undergraduate professional chapters and clubs.

***Table 1.3**- Alignment of Program Activities to the Inclusive Polytechnic Education*

Department Activity (Curricular and Co-Curricular)	Elements of Inclusive Polytechnic Education							
	Application of Knowledge	Critical Thinking & Problem Solving	Creativity, Discovery, & Innovation	Diverse & Multi-Disciplinary Perspectives	Integration of Technology	Collaborative Learning	Community & Global Engagement	Professional & Career Readiness
Lectures	x	X			x			
Seminars	x			x				
Labs					x	x		
Field trips		X					x	
Web-based resources					x			
Individual class projects			x					x
Team class projects			x			x		x
Peer reviews	x	X				x		
Technical literature reviews		X	x	x				
Technical proposals			x	x	x			
External technical presentations							x	x
Writing technical papers							x	x
Outreach activity						x	x	
Teaching Assistance	x	X						x
Master's Project	x	X	x	x	x		x	x
Master's Thesis	x	X	x	x	x		x	x
Comprehensive Exam	x	X						x

1.5 Credit Hour

As of July 1, 2011 federal law (*Title 34, Code of Federal Regulations, sections 600.2 and 600.4*) requires all accredited institutions to comply with the federal definition of the credit hour. For all CSU degree programs and courses bearing academic credit, the "credit hour" is defined as "the amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

- One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or
- At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution, including laboratory work, internships, practical, studio work, and other academic work leading to the award of credit hours."

A credit hour is assumed to be a 50-minute period. In courses in which "seat time" does not apply, a credit hour may be measured by an equivalent amount of work, as demonstrated by student achievement.

Homework is assigned on a weekly basis or per topic, and it covers subjects presented in class as well as new subjects or other perspectives on the presented subjects. This way, students can expand their knowledge beyond the class material, and develop a personalized education experience, which keeps them more engaged, and strengthen their engineering judgment.

Periodic tests or projects are required for the students to evaluate their knowledge and help them manage the time dedicated to the classwork. Recorded videos and hybrid modules are also implemented to engage students before class activities, and to prepare them ahead of time for meaningful class discussions.

All of these out-of-class activities ensure that the students have a minimum of two hours of out-of-class student work per one hour of classroom instruction.

2 PROGRAM QUALITY

2.1 Student Profile at Admission and Enrollment

The following data in **Table 2.1** provides admission trends and were compiled using data requested from the Office of Academic Research and Resources. Some of the data may be missing due to students not reporting information.

Table 2.1 *- Admission trends*[2]

	Fall 2020	Fall 2019	Fall 2018	Fall 2017	Fall 2016
Applied	**162**	**68**	**116**	**63**	**105**
Gender					
Male	116	55	76	47	80
Female	46	13	40	16	25
Not Reported	0	0	0	0	0
URM Status					
URM	31	12	16	9	9
Non-URM	36	16	31	13	30
Not Reported	95	40	69	41	66
1st Generation Status					
1st Generation	44	12	27	11	22
Not 1st Generation	17	13	20	10	16
Not Reported	101	43	69	42	67
Admitted	**104**	**48**	**75**	**41**	**71**
Gender					
Male	73	37	52	32	59
Female	31	11	23	9	12
Not Reported	0	0	0	0	0
URM Status					
URM	31	12	15	9	9
Non-URM	36	16	31	13	30
Not Reported	37	20	29	19	32
1st Generation Status					
1st Generation	44	12	26	11	22
Not 1st Generation	17	13	20	10	16
Not Reported	43	23	29	20	33
Enrolled	**59**	**27**	**44**	**18**	**36**
Gender					
Male	38	21	31	13	30
Female	21	6	13	5	6
Not Reported	0	0	0	0	0
URM Status					
URM	27	11	15	13	9
Non-URM	32	16	29	5	27
Not Reported	0	0	0	0	0
1st Generation Status					
1st Generation	39	11	25	10	20
Not 1st Generation	14	13	19	7	15
Not Reported	6	3	0	1	1

*Note: Students who did not report their demographics are counted as “Not Reported”. Under-Represented Minorities are indicated as URM.

Table 2.2 and **Figure 2.1** provide enrollment trends for the graduate program.

[2] ARAR Office data request

***Table 2.2** – Enrollment Data in the Major*[3]

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021 current
Civil Engineering	114	115	101	97	89	114	143

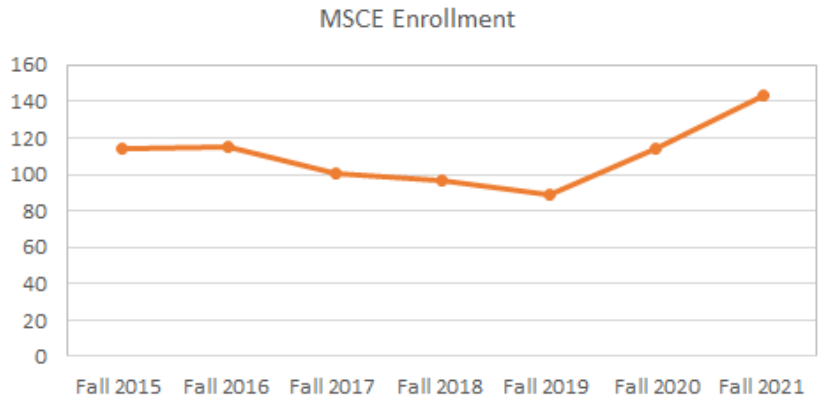


***Figure 2.1** – Student Enrollment over the past six years* [4]

The MSCE program is intended for students who already have a BS degree in civil engineering. Successful applicants will be admitted to the programs either unconditionally or with conditions imposed on them. To receive unconditional admission, an applicant must satisfy all three of the below criteria:

1. The applicant must hold a baccalaureate degree from a civil engineering program accredited by ABET.
2. The applicant must have achieved a grade point average of at least 3.00 (out of 4.00) in all undergraduate upper-division coursework in mathematics, science, and engineering and, additionally, in all coursework attempted with graduate standing.
3. Additional requirements may be imposed by individual options of the MSCE program.

Conditional admission may be granted in cases in which the applicant's academic preparation for graduate study is such that criteria 1) and/or 2) above are not satisfied. In such cases, the applicant is required to submit recent test scores of the Graduate Record Examinations (GRE), letters of recommendation, and other documents attesting to the applicant's aptitude for graduate studies. When an applicant is admitted conditionally, the conditions to be met are explicitly stated on the Program of Study the students submit once they enroll in the Program. If these conditions are not satisfied, the student may be disenrolled.

The MSCE program with 5 different options currently has 143 students. Part of the strategic plan of the Civil Engineering department is the sustainable increase of enrollment in the program while making the College of Engineering and CE Department vision a reality. The strategic plan has identified focus areas that are supported by specific goals and identified strategies to support the CE department to achieve them. Specifically, **Focus area 5** targets the graduate program.

[3] Source: Tableau Enrollment Headcount Dashboard
https://analytics.cpp.edu/#/site/production/views/EnrollmentDashboard/HeadcountFTES?:iid=1
[4] Source: Tableau Enrollment Headcount Dashboard
https://analytics.cpp.edu/#/site/production/views/EnrollmentDashboard/HeadcountFTES?:iid=1

Focus area 5: Graduate Program

Goal: The CE Graduate Program is the preferred educational choice for professionals to expand their knowledge and the value they bring to industries worldwide.

Strategies:

a. Strengthen the pipeline of high-quality CE recruits for our graduate program.
b. Implement a continuous improvement program that assesses the needs of our prospective graduate students and industry and implement changes from this research.
c. Identify best graduate classes to advise undergraduates to take that will introduce students to the benefits of furthering their education through an advanced degree.
d. Create a graduate degree information session to expose students to the difference between undergraduate and graduate programs.

With the goal and strategies mentioned above in mind, the following efforts are being done to attract students that are prepared and will succeed in the program.

Recruitment Efforts:

a. The main source of students for the CPP MSCE program is the CPP CE undergraduate program. The CE Graduate Committee organizes two recruitment sessions, one in the fall and one in the spring semester, to invite students to apply. Faculty teaching MSCE courses are invited to present program information and MSCE experiences, and students can talk to them and ask specific questions.
b. During the recent COVID19 pandemic, the information sessions have been virtual and students from other BS CE programs have been able to join the virtual information sessions.
c. The CPP College of the Extended University, Global Education Institute has supported the CE Department in developing relationships with Chinese universities, which has provided a continuous inflow of qualified international applicants. (See **Appendix A** for a comprehensive list of institutions).
d. Starting winter 2021, a flyer will be distributed within the ASCE LA, San Bernardino, and Orange County Student Chapters to recruit students for the MSCE program. The flyer will be also emailed to CE Departments from different local universities that have a BS in Civil Engineering program.

Program Applicants:

a. Applications review - each MSCE option has one or more faculty members reviewing the applications submitted and ensuring that the students meet all the admission requirements and special attending is placed to the grades obtained for the courses that are pre-requisites or fundamental for the graduate-level courses.
b. Conditional acceptance - students that may not have the desired GPA, or a pre-requisite course can be conditionally accepted if the reference letters and other accompanying documents demonstrate that they will be successful in the MSCE program. Usually, students accepted in this category need to obtain a GPA of 3.0 or above in the first 9 units of the graduate courses. In most cases, all courses set as deficiencies need to be completed before the graduate courses are enrolled.

In fall 2021, the CE Graduate Committee determined that the goal is an admission of 70-95 students/year, based on the breakdown shown in **Table 2.2** below, which also shows the estimated total enrollment and the maximum number of Project and Thesis culminating

experiences that can be offered based on the current faculty. Such enrollment will pose a challenge in the course offering for the CE 5020 class, which is common to all the options. On top of the two sections of the class that are currently offered, there will be a need to add two more sections per year. In addition, to avoid an overabundance of Master's Projects and Theses, the comprehensive exam will be promoted in advising sessions to improve the retention and graduation rates as an option to graduate within 2 to 3 years.

***Table 2.2** - Admission goals and Project/Thesis offering*

Program Option	Students/year	Total enrollment	Max # Projects/Theses
Construction	10-15	20-25	15
EWR	15-20	45-50	15
Geotech	15-20	45-50	10
Structure	25-30	75-80	25
Transportation	15-20	45-50	15
Total	**80-105**	**230-255**	**80**

2.2 Curriculum and Pedagogy

Curriculum Overview. Our practice-oriented Master of Science in Civil Engineering (MSCE) program builds upon an undergraduate education and facilitates more advanced study in one of the branches of civil engineering. The program consists of 30 semester units of coursework, and all graduate courses are offered in the late afternoon or evening. In all the five offered options, students are required to take at least 18 units of core courses, addressing fundamental theory and analysis, while the remaining technical elective courses address advanced design topics and the application of problem solving skills to engineering problems. A detailed overview of the curricula for the five options is presented in **Section 2.4**.

Curriculum Enhancements. In the past seven years, the major curriculum enhancement was the expansion of the MSCE program with the addition of the Environmental and Water Resources (EWR) and the Construction Engineering and Management (CEM) options. This was a response to industry and young professional demands. These two options are the newest ones and both had added tenure track faculty. This has resulted in the addition of newer core and elective courses that have expanded the skills that graduate students enrolled in those options can acquire.

For example, in fall 2015 when it first started, the EWR option added many new electives that were unique to any other program in the region: CE 5261 Air Quality Engineering, CE 5271 - Unit Operations and Processes in Environmental Engineering, CE 5280 - River Mechanics. In Spring 2018, the EWR option added an elective course to teach geospatial technologies to the students in response to the land development industry suggestions (CE 5990 Applications of Geospatial Technologies for Practitioners). The CE 5990 designation refers to an experimental course, thus is offered as special topics first, and later if successful, it is moved to have a permanent number. In spring 2021, the EWR option offered the course CE 5990 Bioresources and Bioenergy Recovery, respectively. Unfortunately, due to the World pandemic, the enrollment was lower than what the college of engineering indicated, and the course was canceled. Most recently, the course CE 5990 Low Impact Development for Water Resources was opened, and it will be offered in spring 2022. The EWR option is constantly developing new courses to keep up with industry demands, supporting the scholarly work of faculty members, and bringing experienced

professionals to teach. Lastly, our MSCE EWR students can also take one or two elective courses outside of the MSCE EWR option and from other colleges if relevant to their professional development in the environmental and water resources field. However, such non-EWR option courses need to be approved by the MSCE EWR academic advisor before students enroll them.

The CEM option started offering a course in the Fall 2018 semester, one required course, CE 5191, Construction Project Delivery Methods, and one elective course, CE 5171, Temporary Construction Structures. Then, the CEM option added more classes, and currently offers four required courses, 1) CE 5111, Construction Productivity, 2) CE 5131, Construction Risk Analysis, 3) CE 5141, Advanced Construction Project Management, and 4) CE 5191, Construction Project Delivery Methods. Also, the option offers four elective courses, 1) CE 5121, Construction Financial Management, 2) CE 5161, Underground Construction and Trenchless Technology, 3) CE 5171, Temporary Construction Structures, and 4) Construction Leadership and Ethics. Every semester, the CEM option offers a mix of core courses and elective courses, which cover both the theoretical concepts and the practical applications of the learnings. Similarly, other options have made smaller curriculum changes, and course content changes to ensure that students get up-to-date learning experiences and their professionals' skills are enhanced.

The comprehensive exam was an important curriculum enhancement for all the options except for Transportation. The objective was to provide another alternative to fulfill the MSCE degree requirements. The comprehensive exam helped the program to have a more flexible and inclusive curriculum for those students that, due to work, family, or personal reasons, have difficulties committing to a design or research project. As also discussed in the following, the comprehensive exam can help reduce the time of graduation (see Table 2.5).

Class Instruction and Pedagogy

Before the pandemic, most of the graduate courses have been offered as face-to-face lecture-based, with few of them offering the flipped classroom experience or having web-assisted instruction delivery mode. Web-assisted instruction is a combination of in-person instruction and asynchronous online work. All in-person instruction occurs during the course's scheduled days/times. The students will meet in-person 50% or more of a regularly scheduled conventional course. The class has some online components (materials, for example, or a support shell) but for which the Web does not play a significant role in assessment or contact time.

The flipped classroom experience guides and supports students to acquire content outside of face-to-face time. In this pedagogical approach, direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter.

The face-to-face experience- while the official instruction delivery is based on lecturing, faculty uses a lot of different tools and activities to enhance the classroom experience. Some classes are project-based, and students meet to discuss approaches and standards to use, and they mainly spend the class time working on their project development. Others use speakers from industry, or researchers, physical models to illustrate how the equipment works or what field samples look like. Fieldtrips to campus locations (CPP reverse osmosis treatment system) or nearby facilities or construction sites are organized (Metropolitan Water District construction sites and water treatment plants and laboratories) to provide a first-hand experience with design constraints and systems operation. Most courses require MSCE students to conduct a literature review of novel topics with associated oral presentations to share findings with classmates, which has helped our MSCE program students to develop a sense of community. Some courses give the option for

graduate students to attend undergraduate student final project presentations, giving them the opportunity to judge undergraduate students' work and provide feedback. Our faculty has strong connections with public agencies that field data has been shared (for example Caltrans) with faculty with permission to be used in course development and projects or thesis. These opportunities provide a real-world learning experience to the MSCE students.

Graduate students have also supported the department with outreach activities. They are always encouraged and invited to attend the CE Department student chapters associated with professional societies. Some graduate students find time to attend meetings and interact with undergraduate students, others present their projects or thesis work, and others have given career path talks to motivate students to attend graduate school. Some graduate students have had the opportunity to collaborate with senior project teams or undergraduate students conducting research. This collaboration has allowed more graduate students to collect research data for their thesis or to collect more field data for their projects. All students benefit from the collaboration; thus the learning experiences are enhanced.

Lastly, few of the MSCE students have been trained to provide instruction for some of the undergraduate laboratories, for example for the materials lab and the water quality lab courses. The instructor role has enhanced the hands-on experience of the MSCE students, it has helped them reinforce the fundamental knowledge of the field and it has provided networking opportunities for the MSCE students, especially to those that are not from Southern California or the US.

During the pandemic, the instruction was moved to be in fully synchronous mode. The synchronous mode was required by the university to preserve the student-faculty and peer-to-peer interactions. The Center for the Advancement of Faculty Excellence (CAFE) provided a plethora of training opportunities (pedagogy, equity, and inclusion in the online environment, use of software, active learning in the online environment, etc.), including webinars and courses, for all faculty to prepare them for the online instruction (https://www.cpp.edu/cafe/index.shtml). Some of the events were recorded to give later access to faculty that could not attend the live webinars. A list of the past and recorded webinars can be found at this link https://www.cpp.edu/cafe/programs-and-events/past-workshop-recordings.shtml

Strengths and Opportunities for Improvement

Strengths. The CPP MSCE program has many strengths that have allowed the program to grow and develop. The department has 24 full-time faculty that teach or are available to share their experience with our graduate students. The diversity of the faculty members reflects the diverse group of students in the program. All faculty members are well-connected with local and regional private industry and public agencies and are supported to connect their classroom experiences with real-world experiences. CPP is Student-Centered and faculty develops their courses and scholarly work around them. The MSCE program is physically located in a strategic area, where several counties merge (Orange County, LA County, San Bernardino County, and Riverside County). This prime location makes us an option for graduate school for professionals living and/or working in the above-mentioned counties. The College of Engineering and the Civil Engineering department has an existing reputation for high-quality engineering programs, and this helps attract many professionals.

Opportunities for Improvement. While our program is strong, there is always room to grow. Some of the opportunities that have been identified as potential areas for improvement are described in the following. In the past, many students have mentioned that they would like to have more hands-on experiences in the curriculum. Many of the students are working professionals

and they have challenges like driving to campus to attend class and manage their time between professional and academic demands. To date most of the hands-on experience is provided by the research thesis or design projects that some individuals seek. So far, only the curriculum of the geotechnical option includes a laboratory but in response to this need, the EWR option is now in the approval process of a new elective laboratory course.

Regarding the culminating experience, the addition of the comprehensive exam has helped to reduce the graduation time for some students. However, we have realized that many students prefer the Project option and due to their work demands, their graduation time extends significantly, so there is a need to promote more actively the comprehensive exam to achieve graduation in a shorter period. Advising the graduate students is another aspect where the program needs to identify creative ways to ensure that all graduate students have access to the information when needed. Currently, the graduate committee is looking into options on how to address this. The program has faculty assigned to provide academic advising for all graduate students, however, some students due to their work commitments do not have the time to meet with advisors and this has resulted in some misinformation regarding approved elective courses, and the program of study submission deadlines among other things.

The pandemic has exposed students and faculty to synchronous instruction. For many students, this has become an adequate solution to the pre-pandemic driving-to-campus during peak hours challenge. Many students have said that they would like to continue taking courses in synchronous or hybrid instruction modes to reduce the traffic-caused stress, and to have more energy to learn. While in spring 2022 CPP has scheduled most courses to be face-to-face, the CE department is seriously considering the possibility of creating some sections with an online component (synchronous, asynchronous, or HyFlex). All the changes mentioned above have supported the MSCE program efforts to prepare students to meet disciplinary and professional expectations.

Other challenges and opportunities come from the size of the sections and the demand for courses required and elective courses depending on the CE option. The Structural Engineering option, the oldest of the options, has the highest demand, which requires the core courses to be offered every year and sometimes every semester. While the elective course may or not be offered every year, there is always a high demand for a variety of structural courses.

For the MSCE program, potential bottleneck courses are CE 5020 - Applied Probability, CE 6950 Master' Project, CE 6960 Masters' Thesis, and the CE 6970 Comprehensive exam. CE 5020 is a required course for all options, and it has a high demand (see **Table 2.3** below). In the past, it was scheduled to be offered in fall terms only but since spring 2021 the course has been offered in the spring semester also to be able to satisfy the program demand. **Table 2.3** shows how the total capacity was increased from term to term, and how the demand doubled, requiring having the course offered every semester to prevent the course from becoming a bottleneck. CPP database considers this course a high enrollment course.

Table 2.3 - CE 5020 Applied Probability Demand.

Term	Class Capacity	Enrollment Total	# of Sections	Enrollment % of Capacity
Fall Semester 2019	24	33	1	137.50%
Fall Semester 2020	24	27	1	112.50%
Fall Semester 2021	30	31	1	103.30%
Spring Semester 2021	30	33	1	110.00%
Spring Semester 2022	30	21	1	70.00%

The CE 6950 Master Project, CE 6960 Masters' Thesis, and CE 6970- Comprehensive exam are potential bottlenecks for the program because since most of the students are working professionals, students find challenging to manage their time to complete a masters project or thesis in the time allotted by the program. For this reason, the CE 6990 continuation of master's project or thesis course was offered as an option for students needing more than one semester (MSCE project) or two semesters (MSCE Thesis) to complete the work required by the faculty advisor. **Table 2.4** shows the number of students enrolled in the CE 699 (quarter system) and CE 6990 (semester system) since winter of 2017. The total number of MSCE students needing more time to complete their project or Thesis was 62. For a program with an enrollment of 100 to 140 students, this enrollment indicates that over 40% of the students need extra time to complete their projects/thesis and may have issues balancing their time to complete projects/thesis and work. This is also shown in **Figure 2.2**, which highlights that only about 20% of the students graduate in 2 years while only 40% graduate in 4 years. Due to work-related challenges graduate students decide to take one or two courses per semester, other students take 2 to 4 semesters to complete the project or thesis, thus doubling or increasing, even more, the graduation time.

The CE 699/CE6990 course is a way to support students that need more time to finish their culminating experience. Faculty offering the sections are not compensated (receive units) for the time spent with students and work one-on-one with the students under their supervision. To the extent possible and within the CPP policies and practices, faculty and administration work with students that apply for summer tuition waivers or plan their final defense during evenings, weekends, or holidays to accommodate students' needs. In certain and non-common cases, when students have experienced hardships, a comprehensive exam has been approved instead of a project or thesis for continuation and culmination of the program. A decision like this must be approved by the Graduate Studies office.

Table 2.4 *- MSCE CE 699 or CE 6990 continuation course enrollment*

Term (Quarters)	Students enrolled	Term (Semesters)	Students enrolled
W 2017	8	F 2018*	6
SP 2017	9	SP 2019	9
F 2017	12	F 2019	8
W 2018	6	SP 2020	8
SP 2018	8	F 2020	3
		SP 2021	3
Total students: 80			

*First term of CE 6990 in the semester system

Besides the time management challenges, 74.5% of the students enrolled in the program preferred the project or thesis culminating options as shown in **Table 2.5**, reporting the number of students enrolled from fall 2019 to spring 2021 in each of the culminating options.

Table 2.5 *- MSCE program culminating options enrollment*

Fall 2019 to Spring 2021	CE 6950 Project	CE 6960 Thesis	CE 6970 Exam
Students	57	13	24
# Sections	36	10	13

All MSCE options, except the Transportation option, decided to offer the CE 6970 comprehensive exam. Students enroll in the course and take the exam towards the end of the semester. Students have two opportunities to pass the exam. The exam lasts between 3 to 4 hours maximum depending on the option. Faculty members rotate turns to offer the exam section but collaborate writing and grading the exam questions. Each option prepares an option-specific exam.

The MSCE options with less active students (geotechnical, CEM, and EWR) have courses with less demand and reduced enrollment. The college of engineering has a graduate program enrollment policy of 10 students. Thus, classes with low enrollment (less than 10) are canceled even if they are required courses. Thus, impacting the graduation rates. In cases like this, the CE department offers the canceled course the following semester if it is verified that the enrollment is higher than 10.
Course offerings through Spring 2023 can be found on the CPP MSCE website https://www.cpp.edu/engineering/ce/msce/index.shtml or the following options website:

- MSCE CEM: https://www.cpp.edu/engineering/ce/documents/msce-course-offerings-construction19-23.pdf
- MSCE EWR: https://www.cpp.edu/engineering/ce/documents/msce-course-offerings-ewr19-23.pdf
- MSCE Geotechnical: https://www.cpp.edu/engineering/ce/documents/msce-course-offerings-geotech19-23.pdf
- MSCE Transportation: https://www.cpp.edu/engineering/ce/documents/msce-course-offerings-transportation.pdf
- MSCE Structures https://www.cpp.edu/engineering/ce/documents/msce-course-offerings-structure19-23.pdf

The list of class offerings is frequently revised, especially if there has been a change or cancelation of a required or elective course. The department is constantly checking the course offerings and the enrollments and when needed faculty are asked to add elective(s) or required courses to ensure that students can graduate according to their plan.

2.3 Student Retention and Graduation Rates

The data about cumulative continuation and graduation rates, as obtained from IRPA, are shown in **Tables 2.6** and **2.7** below.

Table 2.6 *– Cumulative Graduation & Continuation Rates by Headcount*[5]

Year	Cohort Headcount	Cumulative Graduation & Continuation Rates							
		Within 1 Year		Within 2 Years		Within 3 Years		Within 4 Years	
		Cont.	Graduate	Cont.	Graduate	Cont.	Graduate	Cont.	Graduate
Fall 2005	5	2	0	2	0	2	0	0	1
Fall 2006	2	1	0	1	0	1	0	1	0
Fall 2007	24	19	0	7	0	7	4	2	7
Fall 2008	9	6	0	2	1	1	2	1	2
Fall 2009	23	18	0	9	5	4	9	3	12
Fall 2010	41	34	0	20	8	6	20	2	25
Fall 2011	40	29	0	9	13	2	20	2	21
Fall 2012	28	25	0	11	11	4	17	1	20
Fall 2013	37	31	0	17	7	8	19	1	22
Fall 2014	33	30	0	14	10	3	20	0	22
Fall 2015	36	25	0	13	9	5	21	1	24
Fall 2016	37	33	2	11	21	3	25	1	26
Fall 2017	18	14	2	7	8	1	11		
Fall 2018	44	36	0	11	22				
Fall 2019	27	22	0						
Fall 2020	59								

Table 2.7 *– Cumulative Graduation & Continuation Rates by Percentage*[6]

Year	Cohort Headcount	Cumulative Graduation & Continuation Rates							
		Within 1 Year		Within 2 Years		Within 3 Years		Within 4 Years	
		Cont.	Graduate	Cont.	Graduate	Cont.	Graduate	Cont.	Graduate
Fall 2005	5	40.0%	0.0%	40.0%	0.0%	40.0%	0.0%	0.0%	20.0%
Fall 2006	2	50.0%	0.0%	50.0%	0.0%	50.0%	0.0%	50.0%	0.0%
Fall 2007	24	79.2%	0.0%	29.2%	0.0%	29.2%	16.7%	8.3%	29.2%
Fall 2008	9	66.7%	0.0%	22.2%	11.1%	11.1%	22.2%	11.1%	22.2%
Fall 2009	23	78.3%	0.0%	39.1%	21.7%	17.4%	39.1%	13.0%	52.2%
Fall 2010	41	82.9%	0.0%	48.8%	19.5%	14.6%	48.8%	4.9%	61.0%
Fall 2011	40	72.5%	0.0%	22.5%	32.5%	5.0%	50.0%	5.0%	52.5%
Fall 2012	28	89.3%	0.0%	39.3%	39.3%	14.3%	60.7%	3.6%	71.4%
Fall 2013	37	83.8%	0.0%	45.9%	18.9%	21.6%	51.4%	2.7%	59.5%
Fall 2014	33	90.9%	0.0%	42.4%	30.3%	9.1%	60.6%	0.0%	66.7%
Fall 2015	36	69.4%	0.0%	36.1%	25.0%	13.9%	58.3%	2.8%	66.7%
Fall 2016	37	89.2%	5.4%	29.7%	56.8%	8.1%	67.6%	2.7%	70.3%
Fall 2017	18	77.8%	11.1%	38.9%	44.4%	5.6%	61.1%		
Fall 2018	44	81.8%	0.0%	25.0%	50.0%				
Fall 2019	27	81.5%	0.0%						
Fall 2020	59								

[5] Source: IRPA data request for Continuation and Graduation Rates
[6] Source: IRPA data request for Continuation and Graduation Rates

The current average persistence and graduation rates are shown in the following **Figures 2.2** and **2.3**, on a time range of one to four years. Based on the data, the graduation rate within 3 years, which is 150% of the usual time considered for the program), is 41%. The persistence rate after 3 years is 18%. The combination of graduation and persistence rates provides a measure of the success of the students enrolled in the program, which drops to approximately 60% after the 1st year and stays almost constant afterward.

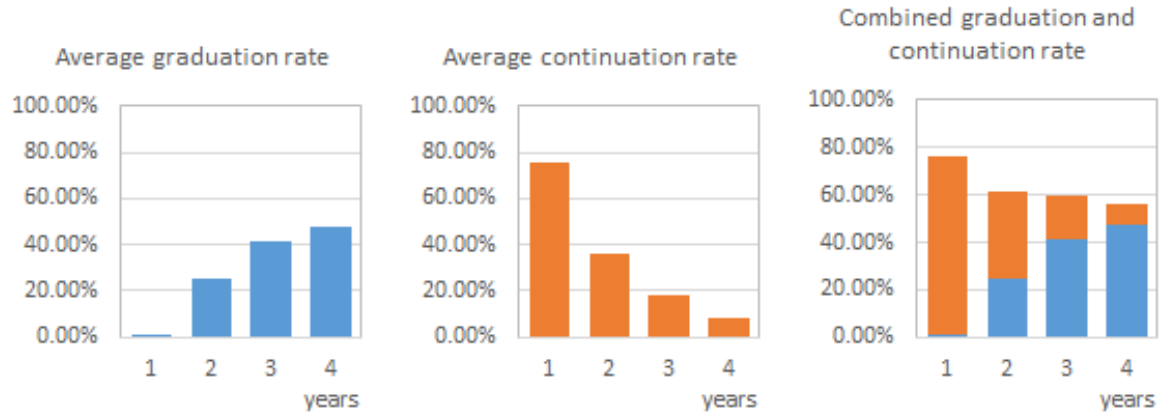


Figure 2.2 *- Graduation rates and continuation rates after 1, 2, 3, and 4 years.*

Many initiatives are currently implemented to support student persistence and graduation. The Program is transparent about the costs, and avoiding hidden fees is an incentive for low-income students. The course offering also supports working students, through online and evening classes. Faculty advising is consistently offered to help students create and follow their graduation plans. The program of study of the student shall be discussed and signed with a faculty advisor by the end of the second semester of enrollment. Additional services are offered through the Student Success office on campus. The initiation of the comprehensive exam is also an additional measure implemented with the first aim of facilitating the graduation of working students. A longitudinal analysis of the data, as shown in the below figures, shows an improvement in the graduation rate at the end of the third year over time, from below 20% in 2007 to around 60% for the 2017 cohort. The combined rate including continuation and graduation also shows an increasing trend, from 40% of the 2005 cohort to current values, around 70%.

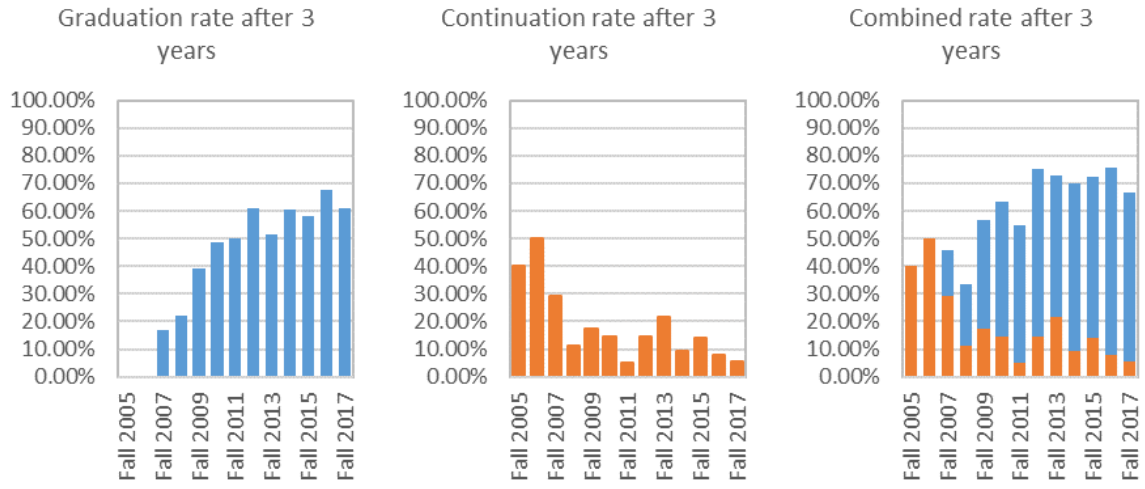


Figure 2.3 *- Graduation rates and continuation rates after 3 years.*

Despite the obvious improvements, additional measures are needed to increase these rates. To increase retention, advising sessions before registration have been recently implemented (fall 2021) for students continuing their master's studies. Through these advising sessions, the CE Graduate Committee reaches out to current students and invites them to join these sections to discuss their goals and their path to success.

2.4 Assessment of Student Learning

In summer 2021 to comply with the ordinance EO1071, the Civil Engineering Department adopted and adapted from ABET the following student learning outcomes. Upon completing their degree graduates of the MSCE program should be able to develop:

1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics
2. an ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions
3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
5. an ability to communicate effectively with a range of audiences
6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

All the courses offered in the MSCE program options are divided into two groups. Group A includes a list of courses from all options mapped to learning outcomes 1 through 3 related to theory analysis. Group B consists of a list of courses from all five options mapped to learning outcomes 4 through 6 related to design and engineering applications

The MSCE program complies with the CSU Executive order 1071 by requiring all graduate students to enroll in courses mapped to learning outcomes 1 through 3, which constitutes more than 50 percent of the program credit hours (16 credit hours out of the thirty credit hours) required to complete a degree in MSCE. Students select the remaining 14 units to satisfy the degree requirement from the list of elective courses shown in Group B. The curriculum matrices listed below demonstrate compliance with the criteria outlined in executive order 1071 for each MSCE program option.

Tables 2.8(a-e) provide the curriculum matrices and **Tables 2.9(a-e)** and **2.10**, as well as **Figure 2.4** provide details about the assessment plan developed to evaluate the achievement of the student outcomes.

Table 2.8a *– Curriculum Matrix – Construction Engineering and Management Option*

Total Units: 30					
Group A (Core Classes): Learning Outcomes 1 through 3 "Theory and analysis in civil engineering."			Group B (Elective Classes): Learning Outcomes 4 through 6 "Advanced design and problem-solving skills."		
Course Number	Title	Units	Course Number	Title	Units
CE 5020	Applied Probability Concepts in Civil Engineering	3	*CE 6950	Master's Project	3
CE 5131	Construction Risk Analysis	3	*CE 6960	Master's Thesis	6
CE 5111	Construction Productivity	3	*CE 6970	Comprehensive Examination	0
CE 5191	Construction Delivery Methods	3	CE 5161	Underground Construction and Trenchless Technology	3
CE 5121	Construction Financial Management	3	CE 5171	Temporary Construction Structure	3
CE 5141	Advanced Construction Project Management	3	CE 5181	Construction Leadership and Ethics	3
			CE 5310	GIS Applications in Civil Engineering	3
			CE 5430	Advanced Foundation Engineering	3
			CE 5440	Earth Retaining Structures	3
			CE 5451	Pavement Design and Construction	3
			CE 5491	Street Maintenance, Rehabilitation and Management	3
			CE 5990	Special topics for Graduate Students	3
			**CE 4031	Sustainable Buildings and Infrastructure	3
			**CE 4120/Lab	Construction Scheduling	2/1
			**CE 4171/Lab	Virtual Design Construction Management – BIM & Lab	2/1

* (Culminating experience satisfied by CE 6970, CE 6950, or CE 6960)
** (Up to 3 units of approved 4000-level course

Table 2.8b *– Curriculum Matrix – Environmental Engineering and Water Resources Option*

Total Units: 30					
Group A (Core Classes): Learning Outcomes 1 through 3 "Theory and analysis in civil engineering."			Group B (Elective Classes): Learning Outcomes 4 through 6 "Advanced design and problem-solving skills."		
Course Number	Title	Units	Course Number	Title	Units
CE 5020	Applied Probability Concepts in Civil Engineering	3	*CE 6950	Master's Project	3
CE5200	Environmental and Water Resources Seminar	2	*CE 6960	Master's Thesis	6
CE 5201	Environmental and Water Resources Research Methods	1	*CE 6970	Comprehensive Examination	0
CE 5210	Municipal Hydraulic Systems	3	CE 5271	Unit Operation and Processes for Environmental Engineering	
CE 5211	Applied Hydrology	3	CE 5220	Solid and Hazardous Waste Engineering	3
CE 5230	Bioresources and Bioenergy Recovery	3	CE 5280	River Mechanics	3
CE 5250	Advanced Water Treatment	3	CE 5290	Global Climate and Water Supply	3
CE 5260	Advanced Wastewater Treatment	3	CE 5261	Air Quality Engineering	3
			CE 5241	Environmental Remediation	3
			CE 5201	Environmental Chemistry	3
			CE 5310	GIS Applications in Civil Engineering	3
			CE 5990	Special topics for Graduate Students	3

* (Culminating experience satisfied by CE 6970, CE 6950, or CE 6960)
** (Up to 3 units of approved 4000-level courses)

Table 2.8c *– Curriculum Matrix – Geotechnical Engineering Option*

Total Units: 30					
Group A (Core Classes): Learning Outcomes 1 through 3 "Theory and analysis in civil engineering."			Group B (Elective Classes): Learning Outcomes 4 through 6 "Advanced design and problem-solving skills."		
Course Number	Title	Units	Course Number	Title	Units
CE 5020	Applied Probability Concepts in Civil Engineering	3	*CE 6950	Master's Project	3
CE 5400	Advanced Soil Mechanics I	3	*CE 6960	Master's Thesis	6
CE 5401	Numerical Methods in Geomechanics	3	*CE 6970	Comprehensive Examination	0
CE 5431/L	Subsurface Investigation and Characterization and Laboratory	2/1	GSC 4150/L	Engineering Geology II/Laboratory	2/1
CE 5480	Geotechnical Earthquake Engineering	3	CE 5440	Earth Retaining Structures	3
CE 5430	Advanced Foundation Engineering	3	CE 5451	Pavement Design and Construction	3
			CE 5470	Slope Stability and Earth Dams	3
			CE 5460	Rock mechanics	3
			CE 5491	Street Maintenance, Rehabilitation and Management	3
			**CE 4400	Foundation and Retaining Wall Design	3
			CE 5990	Special topics for Graduate Students	3

* (Culminating experience satisfied by CE 6970, CE 6950, or CE 6960)
** (Up to 3 units of approved 4000-level courses)

Table 2.8d – *Curriculum Matrix* – Structural Engineering Option

Total Units: 30					
Group A (Core Classes): Learning Outcomes 1 through 3 "Theory and analysis in civil engineering."			Group B (Elective Classes): Learning Outcomes 4 through 6 "Advanced design and problem-solving skills."		
Course Number	Title	Units	Course Number	Title	Units
CE 5020	Applied Probability Concepts in Civil Engineering	3	*CE 6950	Master's Project	3
CE 5501	Advanced Engineering Mathematics	3	*CE 6960	Master's Thesis	6
CE 5502	Structural Dynamics	3	*CE 6970	Comprehensive Examination	0
CE 5503	Finite Element Analysis	3	**CE 5504	Advanced Steel Design	3
CE 5541	Advanced Structural Analysis	3	**CE 5505	Advanced Reinforced Concrete Design	3
CE 5506	Seismic Design of Structures	3	CE 5500	Stability of Structures	3
			CE 5510	Theory of Plates and Shells	3
			CE 5520	Prestressed Concrete Design	3
			CE 5530	Advanced Timber Design	3
			CE 5561	Light Gage Steel Design	3
			CE 5480	Geotechnical Earthquake Engineering	3
			CE 5990	Special topics for Graduate Students	3

* (Culminating experience satisfied by CE 6970, CE 6950, or CE 6960)
** (One required course among CE 5504 and CE 5505)

***Table 2.8e** – Curriculum Matrix – Transportation Engineering Option*

Total Units: 30					
Group A (Core Classes): Learning Outcomes 1 through 3 "Theory and analysis in civil engineering."			Group B (Elective Classes): Learning Outcomes 4 through 6 "Advanced design and problem-solving skills."		
Course Number	Title	Units	Course Number	Title	Units
CE 5020	Applied Probability Concepts in Civil Engineering	3	*CE 6950	Master's Project	3
CE 5610 -	Design of Transportation Facilities	3	*CE 6960	Master's Thesis	6
CE 5620	Traffic Flow Analysis	3	*CE 6970	Comprehensive Examination	0
CE 5670	Intelligent Transportation Systems	3	CE 5681	Multimodal Traffic Analysis	3
CE 5681	Multimodal Traffic Analysis	3	CE 5691	Traffic Engineering	3
CE 5640	Transportation Planning and Management	3	CE 5451	Pavement Design and Construction	3
CE 5631	Transportation Systems Design and Operation		CE 5310	GIS Applications in Civil Engineering	3
			CE 5630	Public Transportation	3
			CE 5641	Transportation Administration and Policy	3
			CE 5650	Airport Engineering	3
			CE 5671	Traffic Safety Analysis	3
			CE 5681	Advanced Computer Programming in Civil Engineering	3
			CE 5691	Traffic Engineering	3

* (Culminating experience satisfied by CE 6970, CE 6950, or CE 6960)

Table 2.9a *– Alignment Matrix – Construction Engineering and Management Option*

College of Engineering
MS Civil Engineering - Construction Engineering & Management Option
Curriculum Matrix

	Student Learning Outcomes	Course Number																				Co-Curricular Support (if relevant)						
		Core Courses (18 units) Group A						Electives (12 units) Group B																				
		CE5020	CE 5131	CE 5111	CE 5191	CE 5121	CE5141	CE 5161	CE 5171	CE 5181	CE 5310	CE 5430	CE 5440	CE 5451	CE 5491	CE 5990	CE 4031	CE 4120/L	CE 4171/L	CE6950	CE6960	CE6970	Library	College Advising Center	University Advising Center	Writing Center	Career Services	Student Organization	Additional relevant resources
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics		I		D	M A																		X					
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	I		D			M A																X				X		
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	I			D	M A																			X				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors							I	D					D	D	D				M A	M A	M A							
	5. an ability to communicate effectively with a range of audiences.							I		D		D					D	D		M A	M A	M A							
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							I			D		D						D	M A	M A	M A	X			X	X		

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Last updated by program: 06/09/2021

Legend:
I = Introduction
D = Development
M = Mastery
A = Assessment Data Collected
X = Co-curricular Support (no data collection necessary)

Table 2.9b *– Alignment Matrix – Environmental Engineering and Water Resources Option*

College of Engineering
MS Civil Engineering - Environmental and Water Engineering Option
Curriculum Matrix

	Student Learning Outcomes	Course Number																		Co-Curricular Support (if relevant)						
		Core Courses (16 units) Group A						Electives (14 units) Group B																		
		CE5020	CE 5210	CE 5211	CE 5250	CE 5260	CE5200	CE 5271	CE 5220	CE 5280	CE 5290	CE 5261	CE 5241	CE 5201	CE 5310	CE 5990	CE6950	CE6960	CE6970	Library	College Advising Center	University Advising Center	Writing Center	Career Services	Student Organization	Additional relevant resources
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics		I		D	M A															X					
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	I		D			M A												X				X			
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	I			D	M A																X				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors							I	D					D	D		M A	M A	M A							
	5. an ability to communicate effectively with a range of audiences.							I		D		D					M A	M A	M A							
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							I			D		D			D	M A	M A	M A	X			X	X		

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Last updated by program: 06/09/2021

Legend:
I = Introduction
D = Development
M = Mastery
A = Assessment Data Collected
X = Co-curricular Support (no data collection necessary)

Table 2.9c *– Alignment Matrix – Geotechnical Engineering Option*

College of Engineering
MS Civil Engineering - Geotechnical Engineering Option
Curriculum Matrix

	Student Learning Outcomes	Course Number																Co-Curricular Support (if relevant)						
		Core Courses (18 units) Group A						Electives (12 units) Group B																
		CE 5020	CE 5400	CE 5401	CE 5431/L	CE 5480	CE 5430	GSC 4150/L	CE 5440	CE 5451	CE 5470	CE 5460	CE 5491	CE 4400	CE 5990	CE6950	CE6960	CE6970	Library	College Advising Center	University Advising Center	Writing Center	Career Services	Student Organization	Additional relevant resources
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics		I	D	M A															X					
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	I		D			M A												X				X		
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	I			D	M A															X				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors							I	D				D	D		M A	M A	M A							
	5. an ability to communicate effectively with a range of audiences.							I	D		D					M A	M A	M A							
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							I		D		D			D	M A	M A	M A	X			X	X		

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Last updated by program: 06/09/2021

Legend:
I = Introduction
D = Development
M = Mastery
A = Assessment Data Collected
X = Co-curricular Support (no data collection necessary)

Table 2.9d *– Alignment Matrix – Structural Engineering Option*

College of Engineering
MS Civil Engineering - Structural Engineering Option
Curriculum Matrix

	Student Learning Outcomes	Course Number																	Co-Curricular Support (if relevant)						
		Core Courses (18 units) Group A						Option-Electives (12 units) Group B																	
		CE 5020	CE 5501	CE 5502	CE 5503	CE5541	CE 5506	CE 5990	CE 5504	CE 5505	CE 5500	CE 5520	CE5530	CE5561	CE5480	CE6950	CE6960	CE6970	Library	College Advising Center	University Advising Center	Writing Center	Career Services	Student Organization	Additional relevant resources
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics		I		D		M A													X					
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	I		D		M A													X				X		
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	I			D	M A															X				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors							I	D	D		D				M A	M A	M A							
	5. an ability to communicate effectively with a range of audiences.							I	D	D				D		M A	M A	M A							
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							I			D		D		D	M A	M A	M A	X			X	X		

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Last updated by program: 06/09/2021

Legend:
I = Introduction
D = Development
M = Mastery
A = Assessment Data Collected
X = Co-curricular Support (no data collection necessary)

Table 2.9e *– Alignment Matrix – Transportation Engineering Option*

College of Engineering
MS Civil Engineering - Transportation Engineering Option
Curriculum Matrix

	Student Learning Outcomes	Course Number																			Co-Curricular Support (if relevant)						
		Core Courses (18 units) Group A						Electives (12 units) Group B																			
		CE5020	CE 5620	CE 5670	CE 5681	CE 5640	CE 5631	CE 5610	CE 5681	CE 5451	CE 5310	CE 5630	CE 5641	CE 5650	CE 5671	CE 5681	CE 5691	CE6950	CE6960	CE6970	Library	College Advising Center	University Advising Center	Writing Center	Career Services	Student Organization	Additional relevant resources
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics		I		D	M A																X					
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	I		D			M A														X				X		
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	I			D	M A																	X				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors							I	D					D	D			M A	M A	M A							
	5. an ability to communicate effectively with a range of audiences.							I		D		D				D		M A	M A	M A							
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.							I			D		D				D	M A	M A	M A	X			X	X		

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Last updated by program: 06/09/2021

Legend:
I = Introduction
D = Development
M = Mastery
A = Assessment Data Collected
X = Co-curricular Support (no data collection necessary)

Table 2.10 *– Overall assessment plan for all the options*

EO1071 Mapping - MS Civil Engineering
Updated 6.09.2021

Student Learning Outcomes		Core Course (3-9)	Option-Required Courses (15)				
		All Options	Structural	Geotechnical	Transportation	Env & Water	Construction
Theory Analysis	1. an ability to identify, formulate, and solve complex engineering problems by applying advanced principles of engineering, science, and mathematics.		CE 5501, 5503, 5506	CE5400, 5401, 5431/L	CE 5620, 5681, 5640	CE 5210, 5250, 5260	CE 5131, 5191, 5121
	2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	CE 5020	CE5502, 5541	CE5401, CE 5430	CE5670, CE 5631	CE 5211, 5200	CE 5111, 5241
	3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	CE 5020	CE5503, 5541	CE5431/L, 5480	CE 5681, 5640	CE 5250, 5260	CE 5191, 5121
			Option-Elective Courses (12)				
Design and Engineerng Applications	4. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	CE 6950, 6960, 6970	CE 5900, 5504, 5505, 5520	GSC 4150/L, CE5440, 5491, 4400	CE 5610, 5681, 5650, 5671	CE 5271, 5220, 5201, 5310	CE 5161, 5171, 5451, 5491, 5990
	5. an ability to communicate effectively with a range of audiences.		CE 5900, 5504, 5505, 5561	GSC 4150/L, CE5440, 5470	CE 5610, 5451, 5630, 5681	CE 5271, 5280, 5261	CE 5161, 5181, 5430, 4031, 4120/L
	6. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.		CE 5900, 5500, 5530, 5480	GSC 4150/L, CE 5451, 5460, 5990	CE 5310, 5641, 5691	CE 5271, 5290, 5241, 5990	CE 5161, 5310, 5440, 4130, 4140, 4171/L

* Student Learning outcomes are adopted from ABET Criterion 3 Student Outcomes (https://www.abet.org/accreditation/accreditation-criteria/)

Assessment Data Collection Timeline. The Civil Engineering Department started collecting assessment data in the AY 2020-2021. The data collection will be conducted annually thereafter by the CE Graduate Committee. A review cycle is completed after two years when results are shared with the Department for evaluating data and developing Curriculum improvement to close the loop. The first set of data was already discussed and shared with the department in fall 2021. Based on the collected feedback, the Graduate Committee will work on developing a full plan for the next six years in the spring 2022 semester.

The assessment and evaluation processes implemented by the program are depicted graphically in the flowchart of **Figure 2.4**. Three distinct processes are used to address:

1. Mission and program objectives
2. Student outcomes
3. Course objectives

The chart shows the main components of these processes and how information and tasks flow in a continuous cycle from student and alumni achievements to data collection, analysis, program changes, and back to students and alumni achievements. As shown in **Figure 2.4**, the processes include the program's key stakeholders: students, alumni, industry, and university faculty and administration.

Attainment of student outcomes by program students at the time of graduation is assessed and evaluated with direct measurement tools, through rubrics with performance indicators (**see Appendix B**). A summary of these results is provided in the following.

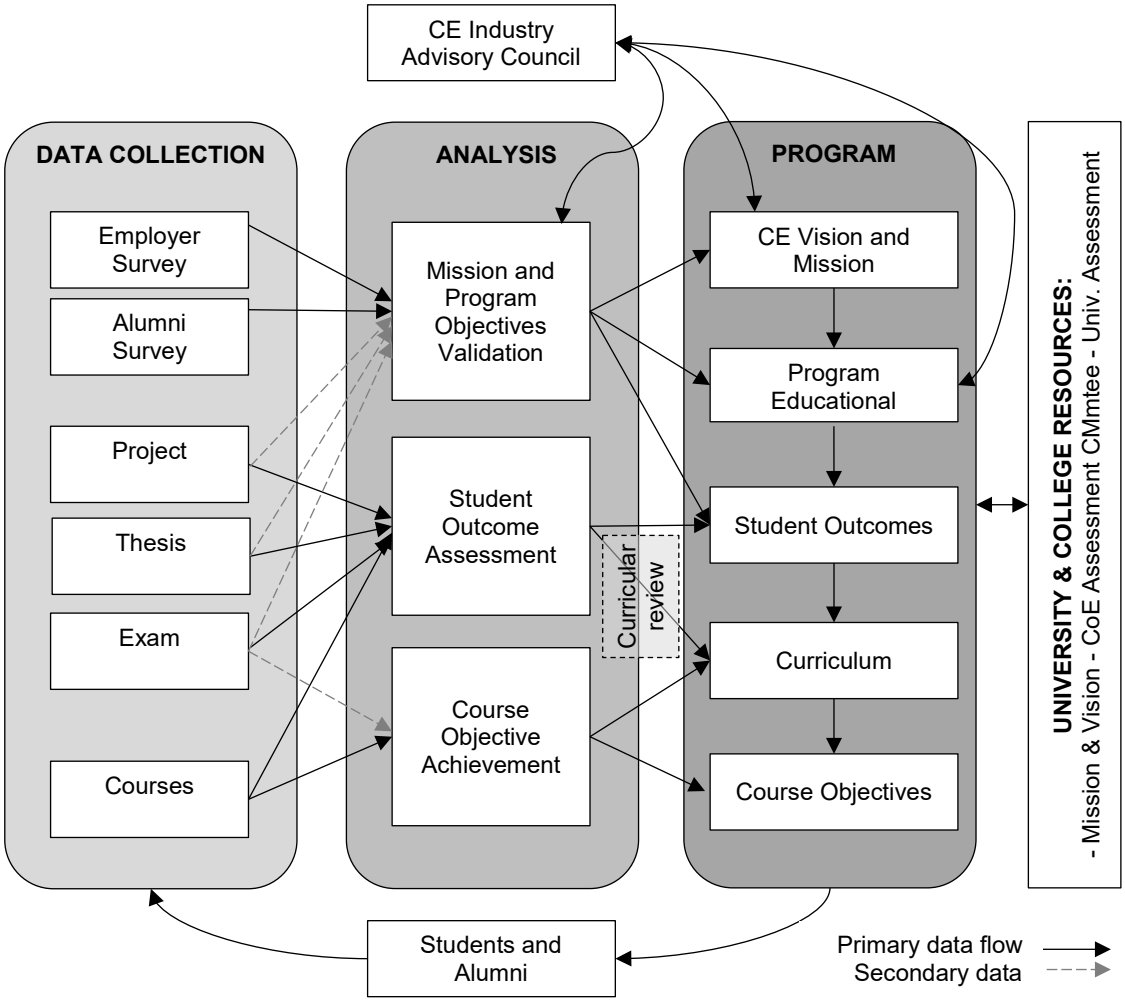


Figure 2.4 *- Outline of the Program Assessment Process that shows one full loop.*

Each of the Student Outcomes is assessed through three performance indicators, on a three-level Likert-scale (Developing-Proficient-Mastery), as shown in the following. Upon completing their degree graduates of the MSCE program should be able to develop:

Assessment process. The assessment rubrics were developed and applied for the first time in the program for the AY 2020-2021. The Graduate Committee members met to calibrate the results of the application of the rubrics to different courses. The results were discussed to agree on a consistent way of applying the rubric. After calibration, each member of the Committee assessed two or more courses and presented the results back to the Committee.

Based on the collected data, two levels of actions were identified: i) a student outcome "needs improvement" if the average of all the performance indicators drops below 85% or two or more individual performance indicators drop below 75%, and ii) a student outcome is considered a “watch area” if the average of the performance indicators per outcome is above 85%, but at least one of its three performance indicators drops below 75%.

The data were analyzed and is hereafter presented disaggregated per course and aggregated per outcome:

- the disaggregated data (per class) are used to identify specific needs within an individual course, while
- the aggregated data are used to evaluate the attainment of outcomes at the program level.

Since this is the first time the data collection and analysis were performed for the program, the main proposed actions to address areas of improvement are foundational tools. These tools are mostly targeting the improvement of the class materials, such as the development of transparent assignments, specific rubrics, and so forth.

A detailed analysis of the outcome is presented below.

STUDENT OUTCOME 1

Problem solving - an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Performance indicators

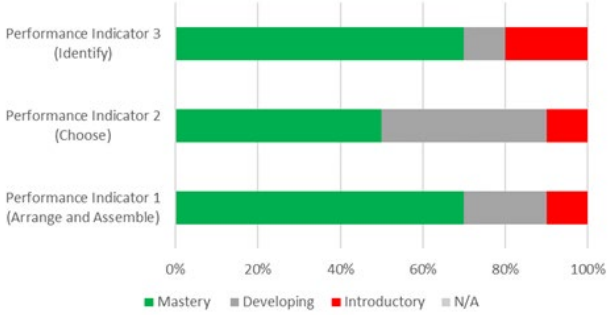
1. Plan a proper test set-up for a given engineering or a research problem.
2. Analyze test results and validate theoretical principles behind the experiment.
3. Develop a research plan to find a solution for engineering problems.

Achievement Levels

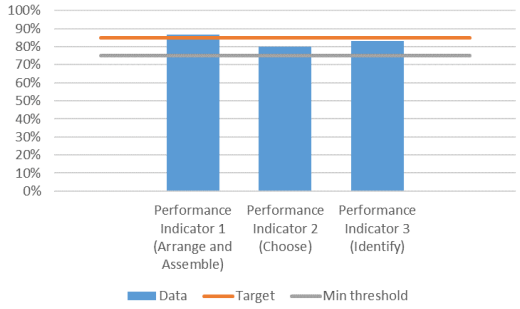
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

CE 5121 data



a



b

The first data collection only analyzed data from the CE 5121 course (Figure 2.5). In the current AY, additional data are being collected from different courses to complement the available data. Based on the analyzed data, student outcome 1 has an average level of achievement of 83% and therefore is identified as an area of improvement, which will be addressed through the development of transparent assignments. Transparent assignment design includes activities and assignments that are aligned to the cognitive levels of their learning outcomes, for in- and out-of-class time (ref: https://acue.org/courses/modules/aligning-activities-and-assignments-with-course-outcomes/). A set of different-levels activities targeting the different levels of knowledge identified in the Bloom's taxonomy (ref: https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/) are proposed to students to navigate properly through the class materials. The different levels of knowledge shall be presented in a sequence within the same assignment. The assignments will also include exemplary examples that students could use as a reference for their homework.

STUDENT OUTCOME 2

Experiment analysis - An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.

Performance indicators

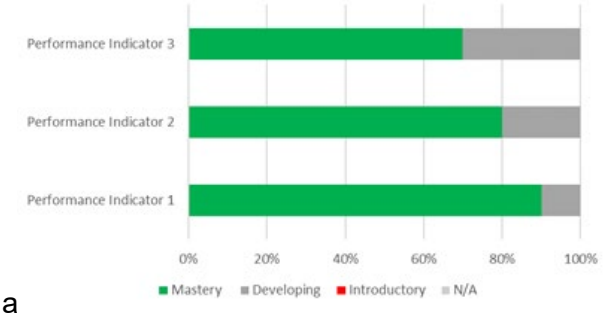
1. Arrange and assemble appropriate input and output parameters or alternatives.
2. Choose the correct approach/equation/formula.
3. Identify the proper mathematics, science, and engineering principles to find the output (i.e., quantitatively or qualitatively solve the problem).

Achievement Levels

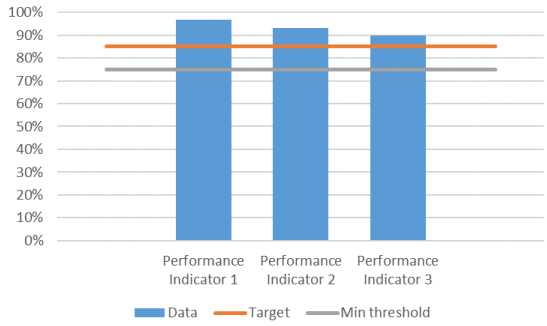
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

CE 5541 data

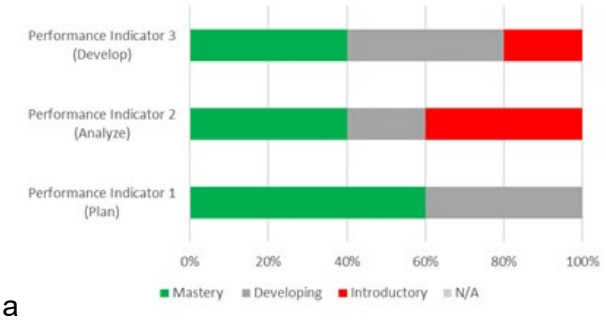


a

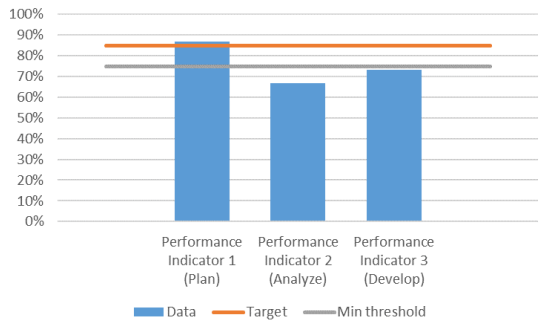


b

CE 5141 data

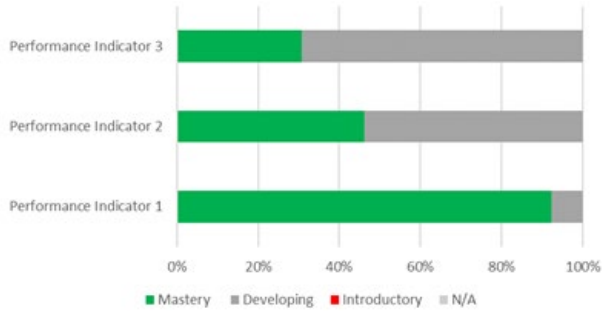


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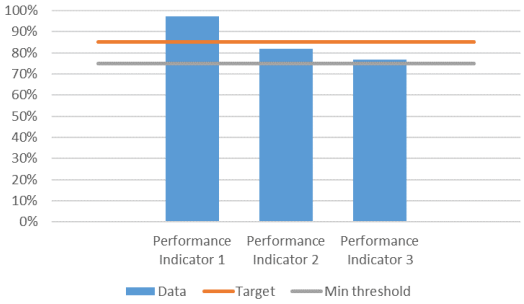


b

CE 5480 data

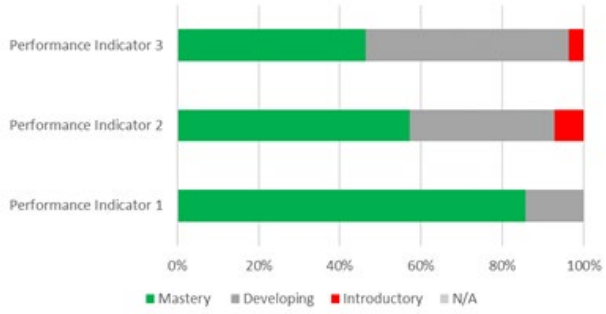


a

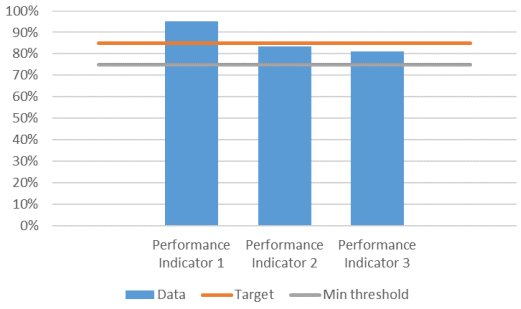


b

Aggregated data



a



b

Based on the analyzed data (Figures 2.6-9), student outcome 2 has an average level of achievement of 87%, which is satisfactory. However, for one specific course, CE 5141, the performance indicators 2 and 3 drops below 75%, making this outcome an area of improvement for that course. This is currently being addressed by adding real case data to the assignments so that students can make informed decisions based on realistic constraints.

STUDENT OUTCOME 3

Apply knowledge - An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Performance indicators

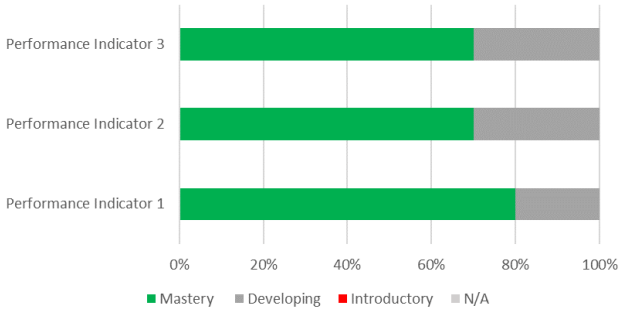
1. Identify and acquire new knowledge from external resources.
2. Apply newly acquired knowledge.
3. Select appropriate learning strategies (process to reach the correct solution/conclusion).

Achievement Levels

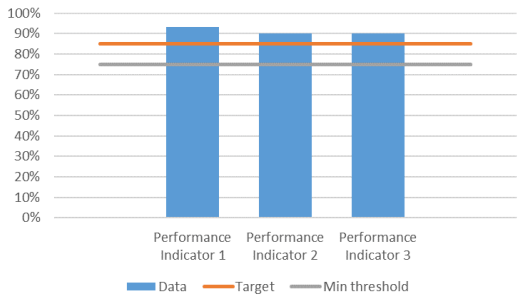
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

CE 5541 data

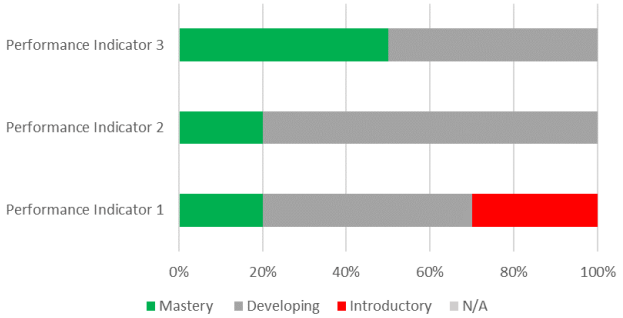


a

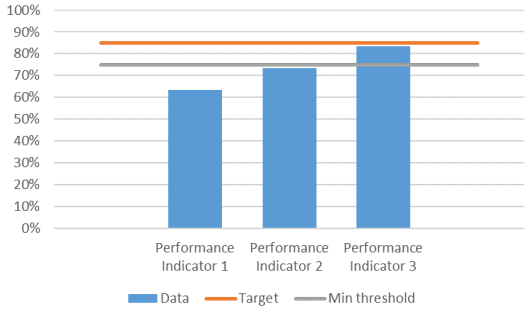


b

CE 5250 data

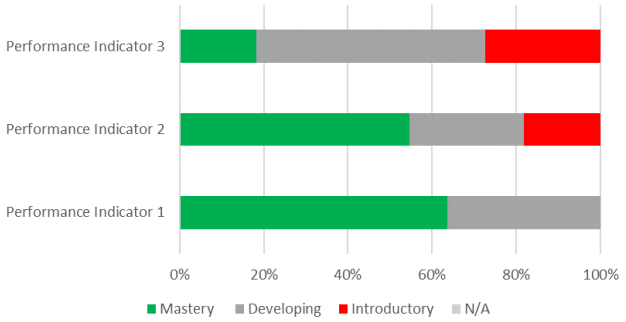


a

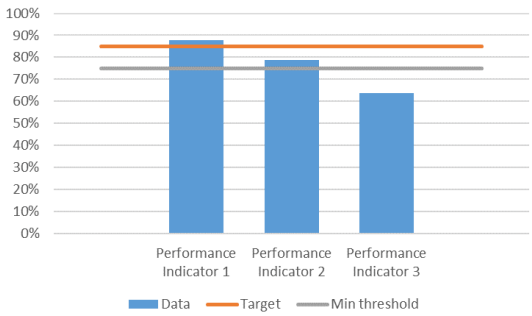


b

CE 5430 data

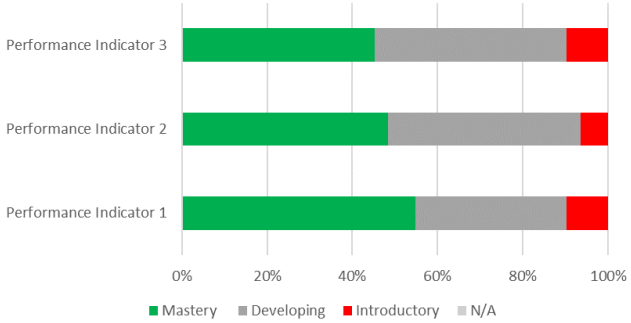


a

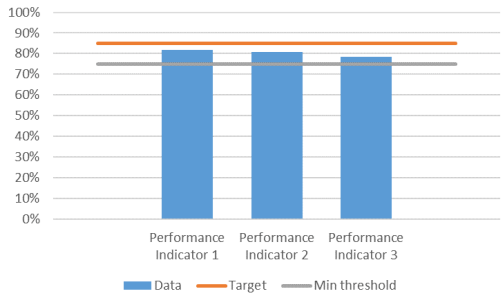


b

Aggregated data



a



b

Based on the analyzed data (Figure 2.10-13), student outcome 3 has an average level of achievement of 80%, and performance indicators 1, 2, and 3 are below the 75% target in some of the analyzed courses. The outcome is therefore identified as an area of improvement. For the CE 5250, the performance indicators 1 and 2 are below 75%. For the CE 5430 course, the performance indicator 3 is below 75%. This is currently being addressed by re-designing assignments and increasing resources by adding samples of real engineering reports to show students how data is handled and presented. The use of such examples is expected to help the students understand the expected levels of achievement, while at the same time requiring them to adapt the examples to their specific areas, which needs the use of appropriate resources to acquire and apply new knowledge.

STUDENT OUTCOME 4

Engineering design - An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Performance indicators

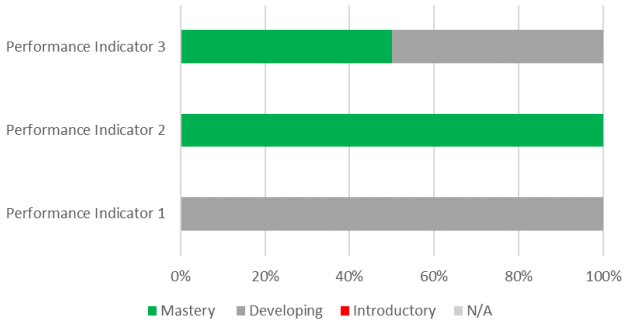
1. Use a design strategy and resources.
2. Develop alternative solutions.
3. Design a complete system and produce references.

Achievement Levels

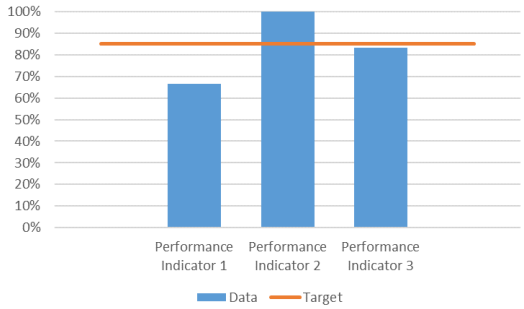
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

Aggregated CE 6950/60 data



a



b

Based on the analyzed data, student outcome 4 is an area of improvement since has an average achievement level of 83%, and performance indicator 1 is below the 75% minimum target. The data are collected from master's projects and theses. The analysis suggests that students might need more guidance through the process, especially for selecting design strategies and the use of appropriate resources. To address this area of improvement, the project and thesis advisors will provide students with introductory training, to explicitly address the main requirements and strategies that are expected for completion of such culminating experiences. This will be done at the time of submitting the work proposal, before the end of the semester before the beginning of the culminating experience.

STUDENT OUTCOME 5

Communication - An ability to communicate effectively with a range of audiences.

Performance indicators

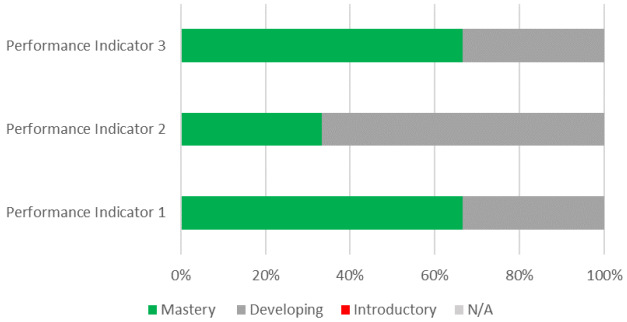
1. Compose technical narrative to describe an engineering problem.
2. Formulate central message /purpose.
3. Develop quality visual aids.

Achievement Levels

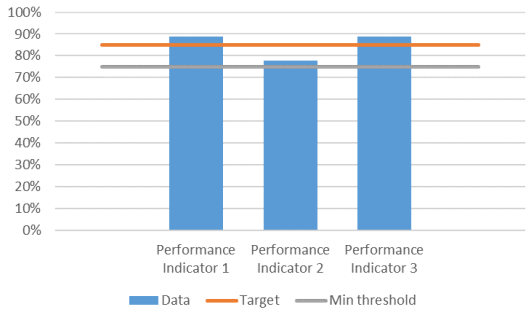
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

Aggregated CE 6950/60 data



a



b

Based on the analyzed data, which come from master's projects and theses, student outcome 5 meets the target average achievement level of 85%, but performance indicator 2 is close to the 75% minimum target. This outcome is not specifically considered a watch area, but even if no immediate action is needed, the project/thesis advisors will address possible future shortcomings by inviting students to reach out to our Library resources to identify possible improvement areas in their written communication skills. A more in-depth review of the technical literature could help the students identify appropriate means of formulating the central message and purpose of their project with the expected level of clarity and professionalism.

STUDENT OUTCOME 6

Professionalism & Ethics - An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Performance indicators

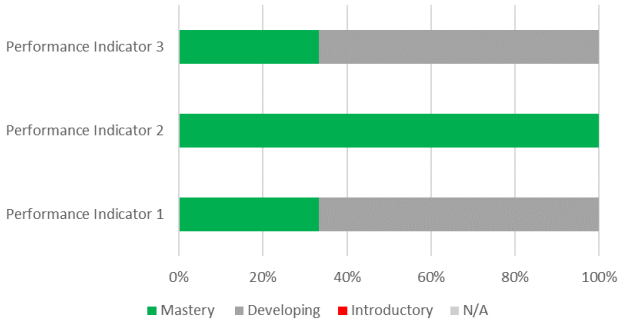
1. Identify engineering situation: identify ethical and professional responsibilities.
2. Analyze engineering solutions based on other perspectives and present his/her own perspective to the possible solutions.
3. Construct a solution considering global, economic, environmental, and societal contexts within the solution.

Achievement Levels

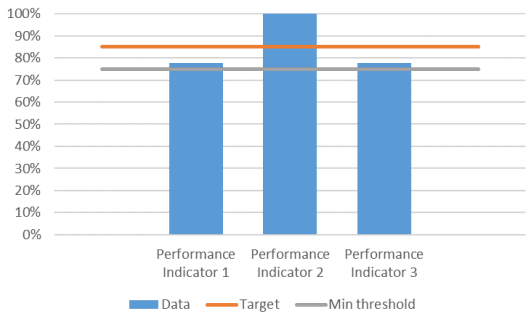
1. Mastery (green)
2. Developing (grey)
3. Introductory (red)

Desired Attainment Target - 85% (orange)

Aggregated CE 6950/60 data



a



b

Based on the analyzed data, from master's projects and theses, student outcome 6 meets the target average achievement level of 85%, but performance indicators 1 and 2 are close to the 75% minimum target. Even if this outcome is not considered a watch area, the project/thesis advisors were suggested to address possible future shortcomings by inviting students to specifically investigate in their literature review the ethical, global, and societal implications of their projects.

2.5 Student Support, Satisfaction and Services

2.5.1 Co-Curricular

The MSCE program does not have any graduate student chapter associated with professional societies. However, graduate students are always encouraged and invited to attend the CE Department undergraduate student chapters associated with professional societies. Some graduate students find time to attend meetings and interact with undergraduate students, others present their project or thesis work, and others have given career path talks to motivate students to attend graduate school. Some graduate students have also had the opportunity to collaborate with senior project teams or undergraduate students conducting research. This collaboration has allowed more graduate students to collect research data for their thesis or to collect more field data for their projects. All students benefit from the collaboration and the learning experiences are enhanced. The collaboration and interaction of the graduate and undergraduate students enhance the student-centered values of the department and their professional development.

Graduate students that are willing to engage in research projects can do it. They can complete a project, a thesis under the supervision of a professor. If the results are adequate for presentation and dissemination, the faculty advisor works with the students' preparing abstracts, full papers, and or presentations. Cal Poly Pomona has some travel funding to support students that have works accepted to local, regional, or national conferences.
The nature of the research projects depends on the expertise of the faculty members. Some work on computer-based modeling and some have field or laboratory projects. Many faculty members have internal and external funding for supplies and on a few occasions for stipends.

The students that don't work full time are usually engaged in student internship programs developed by the many public agencies near Cal Poly Pomona. The MSCE students are highly motivated by the learning environment and are usually driven to find opportunities within or outside CPP to develop further their professional skills. The CE department has obtained donations from the industry that sponsor a scholarship that is awarded to one graduate student of each option every academic year

2.5.2 Academic Advising

Every fall and spring the graduate committee holds an orientation session for all the admitted MSCE students. Orientation for all options happens on the same day, first there is a plenary session for all students to learn about policies and timelines as well as resources. The second part of the orientation occurs with a faculty member from each of the options that meet with the students accepted to the option and provides academic advising specific to the curriculum and courses to enroll for the first semester. To ensure that students have access to all the information later while they progress in the program, all the information provided during the orientation sessions is posted online on the department website and students are guided to find it and learn how to use it https://www.cpp.edu/engineering/ce/msce/index.shtml. The faculty listed below mainly gives ongoing option-specific academic advising. However, other faculty members in the department also provide advising if needed. Advising can take place during office hours or by appointment. During the pandemic, all the advising has been done via Zoom, which has been very convenient for graduate students. This format is being considered for future semesters as a way to supplement face-to-face advising and support students better.

The faculty advisor for the different options is listed on the MSCE website and are provided below:

- Graduate Coordinator, General questions: Dr. Wang (ylwang@cpp.edu) on Sabbatical during spring 2022, Dr. Salem (ysalem@cpp.edu).
- Construction Engineering and Management: Dr. Woo (jwoo@cpp.edu).
- Environmental and Water Resources: Dr. Palomo (mpalomo@cpp.edu).

- Geotechnical Engineering: Dr. Kamalzare (mkamalzare@cpp.edu).
- Structural Engineering: Dr. Lomiento (glomiento@cpp.edu), Dr. Vasconez (rvasconez@cpp.edu).
- Transportation Engineering: Dr. Cheng (wcheng@cpp.edu).

To support advising activities for all students, CPP has implemented a new system called CPP Connect. The systems have been used to advise undergraduate students, and starting fall 2021, it can be used to advise graduate students too. In this system, students can make appointments with advisors, and the advisor can create a report with details of the advising session for use in the future for another advisor https://www.cpp.edu/studentsuccess/cppconnect/index.shtml.

Each student must complete the MSCE contract (contracts can be seen in the links provided below) before the end of the second semester. The contract should include the option, the status of acceptance (conditional or unconditional), the GPA (3.0 required), the list of courses to fulfill the MSCE program requirements that include the selection of the culminating experience, and the term when they will be taken. The academic advisor reviews the contract signing off if approved. Usually, the faculty advisor works with students informally reviewing the contract to ensure that it is ready to be approved once it is submitted. Starting fall 2021 the contract approval process was routed using the OnBase/PolyDoc system, instead of the pdf document signing and email routing process and starting fall 2022 the contract will be replaced with a Degree Progress Report (DPR) which is a tool for tracking degree progress and graduation review.

Current contracts for each option can be found following the links below.
CEM: https://www.cpp.edu/engineering/ce/documents/msce/contract-construction-fillable.pdf
EWR: https://www.cpp.edu/engineering/ce/documents/msce/contract-ewr-22.pdf
Geotechnical: https://www.cpp.edu/engineering/ce/documents/msce/contract-geotech.pdf
Structures: https://www.cpp.edu/engineering/ce/documents/msce/contract-structural.pdf
Transportation: https://www.cpp.edu/engineering/ce/documents/msce/contract-transportation-19-20.pdf

Graduate students are accepted to a specific option, and they cannot change to other options on their own. If they desire to change to a different option than the one to which they were accepted, they need to submit an internal request to the graduate coordinator. The request must be reviewed by the faculty advisor of the option. If the academic advisor (a faculty member in the list provided above) approves the request, the student can submit an amendment to the original contract to change options and the student can take classes to make progress toward the new option. However, if students take a course or more for the new option and the change has not been approved, the courses will not be approved for credit towards the degree unless the option advisor approves them.

PeopleSoft / BroncoDirect
Resources and policies to help manage students through this process include the PeopleSoft / BroncoDirect software, The Three Strikes Policy, Academic Advisors, and Grading. The University uses Peoplesoft software (produced by Oracle) to manage most of its business processes. Students and faculty used to access Peoplesoft through a web-based front-end interface called BroncoDirect. However, the front end was removed in 2012 and the access is given directly through PeopleSoft yet most documents, Students, and Faculty refer to the web tool as “BroncoDirect”. Access is available 24/7 on or off campus from any computer with web access. In addition, selected staff and department chairs have direct access to the Bronco Interactive Dashboard (BID), which provides the ability to generate special reports and input data. Specific Peoplesoft / BroncoDirect services related to the evaluation of student performance including Academic History, Degree Progress, Requisite Checking, and Advising Holds.

Academic History. Appropriate staff, and faculty can easily view each student’s academic history through BroncoDirect. Students can also view their own academic history through BroncoDirect. The information

provided includes coursework completed, grades, GPA, academic standing, coursework in progress, registration for future quarters, registration hold information, etc. This information is invaluable when advising students.

Degree Progress. Each student's degree requirements, based on their major and curriculum year, are stored in Peoplesoft. The system continuously compares the coursework completed with these degree requirements and maintains a running tally of requirements met, requirements in progress, and requirements not yet met. Transfer credits also are properly recorded as completed coursework. Students and their faculty advisors can access a degree progress report for any student and quickly ascertain the coursework and other degree requirements that need to be completed.

Co-/Pre-Requisite Checking. Each semester, students register for their classes through BroncoDirect. The system is programmed to check for all prerequisites and corequisites and will not permit the student to register unless these requisites have already been satisfied or are currently in progress. This automated system has made it nearly impossible for students to enroll in courses for which they do not have sufficient requisite knowledge. However, students with deficiency courses can enroll in graduate courses since they have graduate standing status. Faculty advisors must track individual students with deficiencies ensuring that they are fulfilled.

Advising Holds. Students are considered to be on academic probation whenever their overall GPA or Cal Poly Pomona GPA falls below 3.0. To provide more proactive advising, Peoplesoft automatically places an advising hold on all students whose overall or Cal Poly Pomona GPA is less than 2.2. Such students cannot register for classes unless they first see their academic advisor. After counseling, the student fills out a special form that outlines a plan to raise his/her GPA. This form is signed by the advisor, and the hold is removed. This policy helps identify potential problems and often solves them before the student is placed on probation.

GPA. Students who have an overall, or Cal Poly GPA < 3.0 are placed on academic probation which should not last more than 1 semester. If a graduate student has attempted all the courses in an approved master's degree program with less than a 3.0 (B) average in contract courses, with less than a 3.0 (B) average in graduate work at Cal Poly Pomona, or with less than a 3.0 average in all upper-division and graduate work attempted while on graduate standing, the student's major department may (1) terminate the program, or (2) require the student to take additional courses in an attempt to raise the program grade point average to the minimum 3.0. When the student's major department recommends that he/she be allowed to do the latter, the additional courses selected must:

- Include at least two courses at the 5000-6990 level and total not fewer than 4-semester units.
- Apply directly to the student's master's degree objective, although they need not be drawn from offerings in the student's major department.
- Be new courses (courses previously completed but not originally listed in the master's degree program may not be used).
- If the student fails to earn the minimum 3.0 (B) grade point average on completion of the revised master's degree program as outlined above, the program may be terminated without award of the master's degree.
- Grades earned at another institution may not be used to offset grade point deficiencies in courses taken at this university.

All full-time engineering faculty have at least four office hours per week, and most are available for more than these minimum required hours. Students may meet with their advisor during regular office hours, or by appointment. Students also must see their academic advisor or the Graduate Studies office (see Section 4.4) to process academic petitions and other university paperwork.

2.5.3 Student Satisfaction

As part of the modernization, reorganization, and growth, in fall 2020 the department started the process of developing a new strategic plan with the support of the consulting firm K2OHSolutions. Part of the process included a focus group led by K2OHSolutions with current graduate students. Forty-three responses were provided in the focus group. The answers provided by the graduate students shown below were collected and aggregated by K2OHSolutions and provided to the CE department.

The questions asked and the summary of the responses are provided next.

1. In your opinion, how do you imagine a successful Civil Engineering Department for Cal Poly Pomona? (Are there metrics you would like us to use to measure success?)

   A successful program in Civil Engineering provides connections with other graduate students and local industry professionals. Provides skills that make students more competitive to obtain internships and a job before or right after graduation. Lastly, students indicated that a successful program offers a large number of elective courses that support diverse skills acquisition.

2. What made you want to study, and continue to study, at CPP in CE?

   The students indicated that they joined the program due to the reputation (rating) among students and because MSCE alumni are competitive in the job market. In addition, students commented that many CPP CE alumni are currently occupying public and private engineering positions in the region, and which gives CPP MSCE program a good reputation.

3. What can be done to make your experience better in the CE Department? Are we meeting your needs?

   Most comments provided were related to the challenges experienced by students due to the pandemic. The online test and quizzes taken from home and their format along with the remote use of software were the main issues mentioned. In fall 2021 the campus scheduled some courses in hybrid mode and in spring 2022 it is expected that all courses are back to the face-to-face delivery mode, thus the issues faced during the pandemic are expected to be part of the past. In addition, students mentioned that they would like faculty to increase availability for advising. Lastly, students suggested removing the 4 pm teaching block and starting later to give them the opportunity to finish their workday.

4. What do you need most from CE faculty?

The main comment was that students wanted more opportunities to work with faculty members conducting research projects.

5. When thinking about how we interact in the Civil Engineering Department, describe what behaviors ARE working well for you?

   Students indicated that it helped that most peers face the same challenges of working full time and going to school and that created a good dynamic. Students noted that the small classes helped develop relationships with other peers and faculty. In addition, they found that giving the opportunity to interact and make connections with undergraduate students was a positive experience. Students acknowledged that the CE department was open and flexible to support them in different ways. Lastly, students also noted that the faculty has an open-door policy, and they are always willing to provide guidance.

6. What do you see as future opportunities for the CE department? (Current and/or future long-term; perhaps compared to other universities)

Students indicated that they would like to have an elective course that provides knowledge related to the application of drone technology for the solution of Civil Engineering problems. Students indicated that it was good that the department currently offers a Professional Engineer (PE) preparation course, but they would like to see an Engineer-in-Training (EIT) prep-course for civil engineering.

7. What was your expectation when you joined CE (the program) and what do you think now?

   Most students indicated that all their expectations were met and that as they expected the standards in graduate school are higher than in the undergraduate program.

8. What haven't we covered that's important for you to share with the CE Department?

   The only comment made was that professors should make more time to write recommendation letters to students.

As part of the ongoing development of the MSCE program, the department plans to create an exit survey for graduating students. The CE Department will be working in the incoming academic year with the Office of Academic Assessment and Program Review developing the survey.

2.6 Stakeholders

The strategic plan process included focus groups with industry and alumni. Some of the professionals that provided feedback are members of the Civil Engineering Industry Advisory Council (IAC).The questions asked to the industry and alumni that participated in the focus groups conducted by K2OHSolutions are listed below. A total of 49 industry responses and 128 alumni responses were obtained. However, the feedback provided included information that mixed the graduate and undergraduate programs. As part of the ongoing development of the MSCE program, the department plans to create an exit survey for graduating students and a survey for MSCE graduates' employers. The feedback provided by the industry is shown first and it is followed by the alumni feedback.

Industry Feedback

- In your opinion, how do you imagine a successful Civil Engineering Department for Cal Poly Pomona? (Are there metrics you would like us to use to measure success?)

  A successful program in Civil Engineering provides hands-on experience, prepares students for design and construction, graduates problem solvers, and provides skills needed in industry practice. In addition, it includes new technology and communication skills in the curriculum. Such a program should ensure that the Civil engineering practicing principles are upheld regardless of the environment and through the professional career of their alumni. Lastly, graduates should be able to put themselves in the shoes of the client to understand the problem and to propose the best solution for the community.

- What is the Department of Civil Engineering known for?

  The program is known for producing graduates with hands-on knowledge, problem thinking skills, and abilities to work with diverse groups. In addition, the program is known for the industry experience that most faculty have.

- What could be done to make your experience better with the CE Department?

  Industry indicated that the following actions could be addressed to improve the experience in the program.

- Increase the number of part-time faculty with industry experience.
- Include industry in the program curriculum discussions.
- Teach new software but concentrate on teaching basic principles to ensure students understand what is happening.
- Support students understanding that in practice there are many solutions for the same problem and solutions need to be practical.

- What do you need most from CE faculty?

  Industry indicated that faculty could support them with the following:
  1. Promoting leadership in any engineering position at any level.
  2. Promote the idea of striving for the best and not necessarily the cutting edge.
  3. Promote innovative thinking to serve public needs.

- What do you see as future opportunities for the CE department? (Current and/or future long-term; perhaps compared to other universities).

  Industry indicated that they wanted that the department to examine what draws MSCE students to Stanford or UC Berkeley, as well as to capitalize on the fact that it is the largest CE department in the nation.

- What was your expectation when you joined CE (the program) and what do you think now?

  Industry members were brief indicating that they were expecting to be engaged with the Department to understand the programs offered.

<u>Alumni Feedback</u>

- In your opinion, what does a successful Civil Engineering Department look like at Cal Poly Pomona?
  - Alumni indicated that a program is successful if the following practices are followed.
  - Faculty having high and constant contact with students. Alumni indicated that at CPP the time that faculty spends with student organizations and student activities has resulted in high involvement of large number of students in the program and in extracurricular activities. Such activities support the student's skills development and their marketability.
  - A program that works with alumni, industry and professional societies to shape relevant and new curriculum.
  - A program with graduates that possess a high level of hands-on experience that are ready to work.
  - A program with graduates that can adapt to new situations and that are open to receiving feedback. A program that provides real-world practice to prepare students to face societies' challenges.

- What is the Department of Civil Engineering known for?

  The department is known for:
  - Graduating the most engineers in the region.
  - Graduating professionals that are work ready.
  - Being the largest one in the nation.
  - Having more professors with academic experience instead of industry experience.
  - Promoting internships as part of the extracurricular experiences.

- What do you see as future opportunities for the CE department? (Current and/or future long-term; compared to other universities)
    - Future activities/opportunities included: more alumni-student interactions. Supporting the development of students' strengths makes them unique to stand out from the competition.
    - Including new curriculum like tunneling, and environmental impact among others. Use more interdisciplinary work and curriculum opportunities.
    - Supporting the development of people and team skills.

- What was your expectation when you joined the CE program and what do you think now?
    - Having a general civil engineering training provided skills that opened opportunities in different CE branches in the workplace.
    - The quality of the degree exceeded expectations and the cost was not comparable to larger institutions.
    - The amount of work given was not expected but helped develop engineering work ethic.

- The After Thought Question: What haven't I asked you about today or what haven't we covered that's important for you to share with the CE?
    - Program should put emphasis on the importance of taking the EIT before graduation.
    - Development of a stronger network of alumni should be done.

3. FACULTY

3.1 Overview of Faculty

Primary disciplinary areas of faculty within the CE program
The MSCE program is fortunate to have a diverse and well-qualified faculty who support the program's mission. The program has four categories of faculty

1. Full-time tenured or tenure track faculty: these faculty are involved in all aspects of the program including teaching, advising, service, and scholarly work. In addition, all faculty members hold a Ph.D. degree in civil engineering or a closely related field.
2. Full-time lecturers: These faculties are primarily involved in teaching, but some may be also actively involved in their service, advising and scholarly work.
3. FERP faculty: FERP faculty is former tenured faculty who have retired but continue to teach part-time through the Faculty Early Retirement Program (FERP). They are involved in teaching and service. Retiring faculty have the option of participating in the FERP program for up to five years.
4. Part-time faculty: these are practicing professionals who are hired to teach specific classes. They are involved in teaching, but occasionally they can serve as Committee Members for Projects and Theses.

The program reviews the qualifications of both the full-time and part-time faculty to ensure that the composition, size, credentials, and experience of the faculty are adequate to cover the program curriculum. There are a total of 20 full-time tenure/tenure track faculty, and one full-time non-tenure-track faculty member teaching graduate courses. Three or more full-time faculty members are actively engaged in each of the five technical options and no parts of the program are critically dependent on any one individual, as shown in **Table 3.1** below.

Portion of course work taught by part-time faculty
Part-time faculty is used to provide expertise in areas not thoroughly covered by full-time faculty and to supplement in areas already covered by regular faculty. Part-time faculty supplement regular faculty in a broad range of classes across the curriculum. To maintain the quality of instruction, part-time faculty members are generally required to have the same professional credentials as regular faculty, appropriate professional registration, and advanced degrees. Since all part-time faculty members are practicing professionals, they bring knowledge of the current state of practice to the program. This is particularly advantageous in design classes. The total number of courses taught by part-time faculty is 19 % of the total course offering (based on fall 2020-spring 2021 AY).

Program growth
The Civil Engineering program has been growing in the past six years, both in terms of faculty (Total Full Time Equivalent-Faculty ratio increased from 28.70 in 2015 to 31.60 in 2020) and students (Full Time Equivalent-Student ratio increased from 503.2 in 2015 to 724.4 in 2020). **Figures 3.1** to **3.4** provide data over six years on the historical Full-Time Equivalent-Faculty, Full Time Equivalent-Student, Student to Faculty Ratio, and Major to Faculty Ratio.

Please note that the data for the following contains information for both undergraduate and graduate programs, as it is indicative of the full-time workload for faculty. **Figure 3.4** provides some details about the major to faculty ratio. The growth in the student-to-faculty ratio evidences the need for new full-time faculty hires, to contribute to the growing undergraduate programs, and to sustain the larger graduate program options, as well as to contribute to the growth of the smaller options.

Table 3.1 - *Faculty members that are active in the MSCE program options*

Faculty Name	CEM	GEO	EWR	STR	TRA
Abellera, Lourdes V	x		x		x
Andrei, Dragos	x	x	x	x	x
Cho, Jinsung	x				
Cheng, Wen					x
Gad, Ghada	x				
Gershfeld, Mikhail				x	
Kamalzare, Mehrad		x			
Lamb, Kenneth W			x		
Li, Simeng			x		
Lomiento, Giuseppe				x	
Mora, Omar E			x		
Palomo Martinez, Monica			x		
Perez, Felipe J				x	
Shah-Fairbank, Seema C			x		
Sharbatmaleki, Mohamadali			x		
Shafiee, Ali		x			
Vasconez, Rosa				x	
Wang, Lisa Y				x	
Wu, Xinkai					x
Woo, Jeyoung	x				
Zhang, Yongping					x

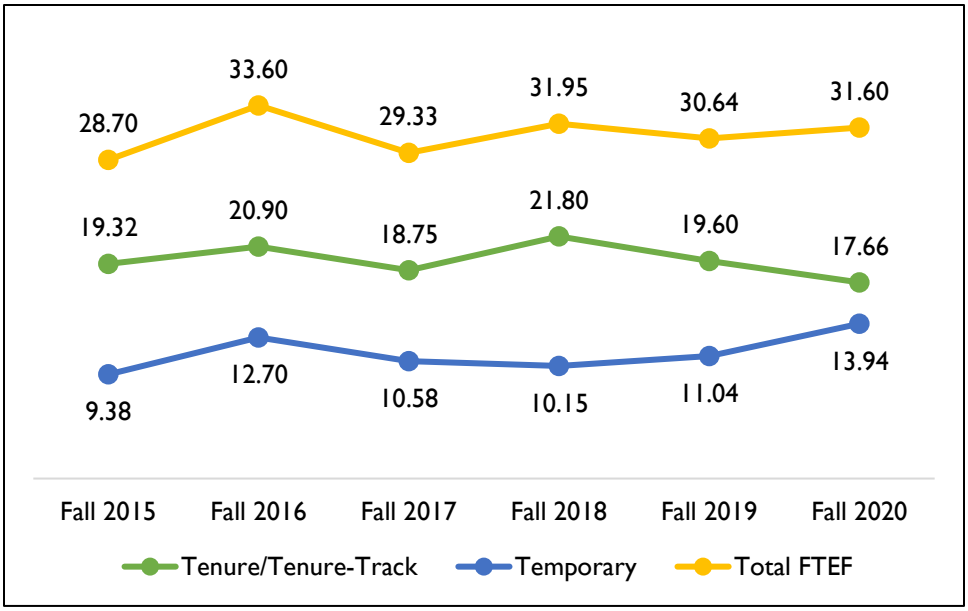


Figure 3.1 *– Full Time Equivalent-Faculty (FTE-F)*[7]

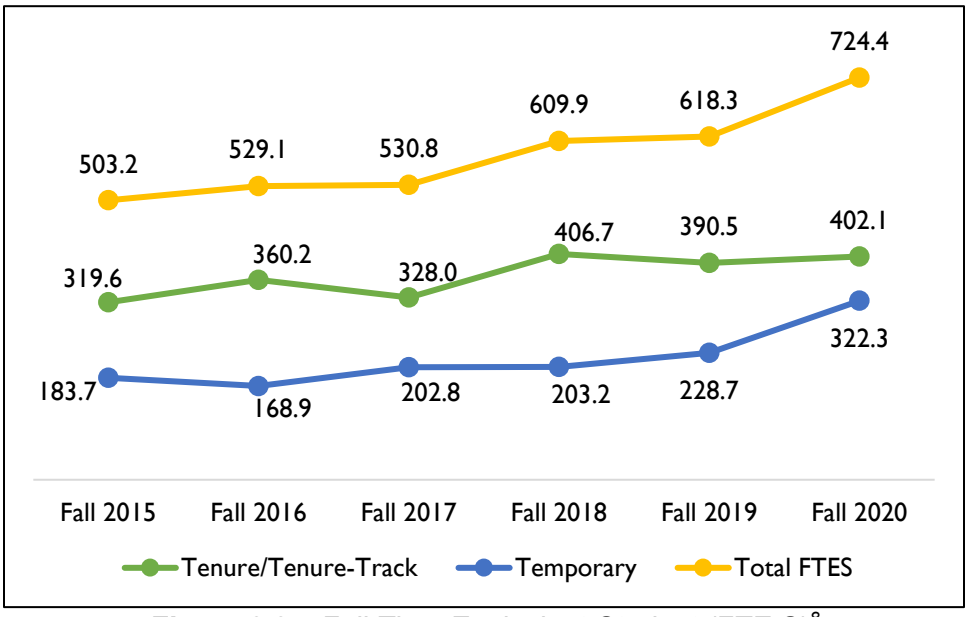


Figure 2.2 *– Full Time Equivalent-Student (FTE-S)*[8]

[7] ARAR "FTE-Faculty with Status Detail Tenure-Track and Temporary Faculty", Falls 2011-2020 Report https://www.cpp.edu/arar/campus-data/fte_faculty_with_status_detail-tenured_tenure-line_and_temporary_faculty_falls_2011_to_2020.pdf

[8] ARAR "FTE-Faculty with Status Detail Tenure-Track and Temporary Faculty", Falls 2011-2020 Report https://www.cpp.edu/arar/campus-data/fte_taught_with_percentages_by_tenure-line_and_temporary_faculty_falls_2011_to_2020.pdf

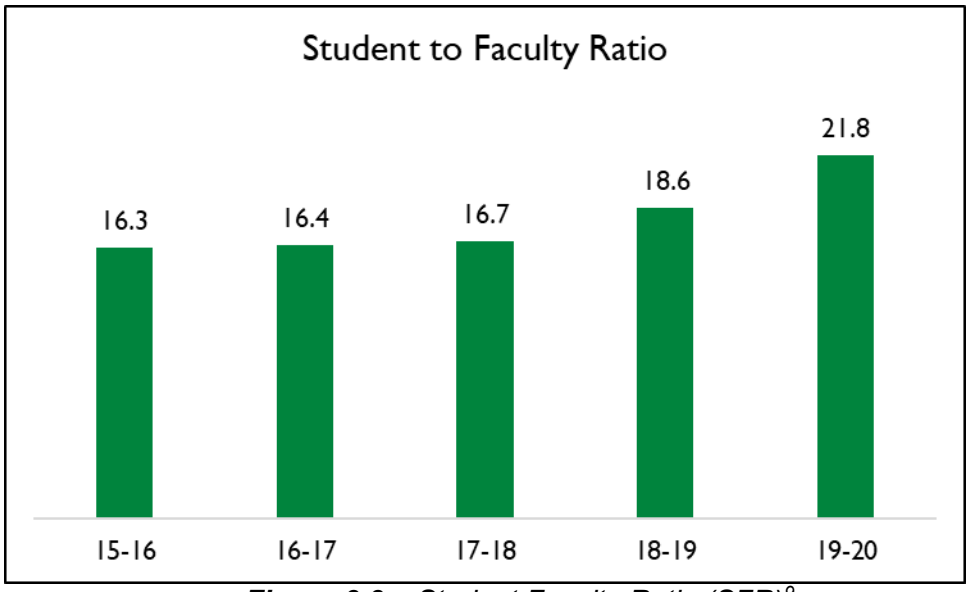


Figure 3.3 *– Student Faculty Ratio (SFR)*[9]

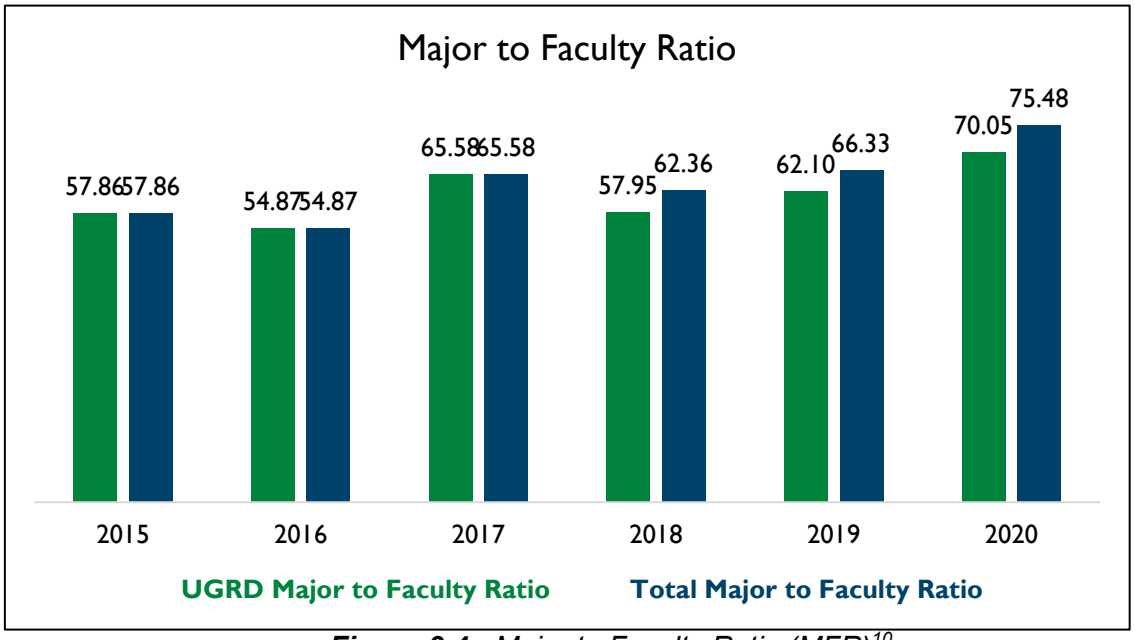


Figure 3.4 *- Major to Faculty Ratio (MFR)*[10]

*Note: 2015-2017 are for undergraduates only since that was the only data collected for those years.

[9] ARAR "Student Faculty Ratio (SFR)" Report https://www.cpp.edu/~arar/campus-data/student-faculty-ratio.shtml

[10] ARAR "Major to Faculty Ratio", Falls 2011-2020 Report https://www.cpp.edu/arar/campus-data/major_to_faculty_ratio_falls_2011_to_2020.pdf

3.2 Faculty Support

There are several initiatives at the Department level to promote faculty professional development. The Department supports a Mentor-Mentee program for new faculty, which helps them to get familiar with the Department, College, and University, policies, and resources, ultimately contributing to the faculty's success. The DRTPC (Department Retention Tenure Promotion Criteria) is the main document that states expectations for full-time faculty throughout their entire academic career.

The Department has been also supportive by providing assigned time to faculty involved in service activities if aligned with their professional development and the strategic Department's goals.
Initiatives to promote scholar activities include the institution of an ad-hoc committee to identify funding opportunities in all the different technical areas, as well as providing travel funding for participation in conferences, technical meetings, professional organizations, and so forth.
A recent strategic planning initiative has been carried out to identify new opportunities for faculty professional development, which will be implemented in the years to come. Faculty has paid sabbatical leaves and summertime off to further seek opportunities to expand their technical expertise.

Faculty Hiring and Retention. The College of Engineering is addressing this problem in a number of ways. We are proactively requesting searches for new tenure-track faculty. For example, during the 2021-22 search cycle (for new positions to begin in Fall 2022), the Civil Engineering Department received approval for one new tenure-track faculty line. We are hiring non-tenure-track full-time lecturers to fill key teaching positions. Some of these individuals are experienced professionals who took an early retirement to become Professional Practice Professors in the Civil Engineering Department.
These strategies are bringing the staffing problem under control, but this process will take time. Although this is a period of transition for the college, it also is an opportunity to develop a strategically-selected faculty with the expertise we need. In many ways, this is a more desirable situation than having a fully-staffed college, but being locked into specific technical areas and not being able to pursue new fields.
The department employs various strategies to retain current qualified faculty. Assigned time may be granted in the first year of employment to allow new faculty members to spend time developing their teaching and research. The Faculty Center for Professional Development offers a variety of workshops to assist faculty to improve their teaching skills and to support other aspects of faculty professional development. The university offers sabbatical leave opportunities for faculty on a periodic basis. The retention, tenure, and promotion review process includes classroom peer evaluations. These evaluations provide feedback to faculty on ways to improve their teaching.

Support of Faculty Professional Development. The Center for the Advancement of Faculty Excellence (CAFE) is a wonderful source of professional development support for faculty. CAFE coordinates, and supports programs that assist faculty members in improving their teaching abilities and achieving their own professional goals. CAFE Advisory Committee is dedicated to improving instruction to enable student learning, promoting collegial relations, enhancing faculty vitality, and supporting research, scholarship and service. Goals include the following:

- Advancing innovative, effective instruction throughout the University,
- Further development of high-quality teaching and extending our expertise on teaching and learning for diverse students.
- Enhancing faculty vitality at all career stages and promote collegial relations by offering a variety of excellent programs and opportunities through CAFE and increasing faculty participation in those programs and activities.
- Advancing research, scholarship (especially around teaching and learning and civic engagement), creative, and other professional activities of the faculty, increasing faculty productivity.
- Assisting departments in recruiting high-quality faculty and to orient and support new faculty, ensuring their retention, advancement, and success at Cal Poly Pomona.

4. UNIVERSITY SUPPORT AND RESOURCES

4.1 Personnel

The Department of Civil Engineering has one full-time administrative assistant who works for the chair of the department and for other faculty when time permits. Most faculty do their own word processing. The department also has a full-time technician who services laboratories but is not responsible for the computer laboratories. The computer laboratories are maintained by the College of Engineering computer support staff.

4.2 Facilities and Space

Office, Classrooms, and Laboratories
The college's facilities are conveniently located in buildings 9, 13, and 17 which surround an open area called the Engineering Meadow. The vast majority of facilities supporting the civil engineering program are located in buildings 9 and 17, with only one lab located in building 13.

Offices
Building 17 is the newest engineering facility and houses offices for all the full-time faculty members. Full-time faculty are provided individual private faculty offices sized according to the state standard. Currently all civil engineering faculty members have their own office d. The program has gone through a multi-year phase of upgrading office furniture with modular furniture which provides more efficient use of space and supports the service to students. Part-time faculty share multi-use offices located in Buildings 9 and 17.

Classrooms
The majority of the department's graduate lectures occur in Building 9 which houses the Dean's Office, faculty from electrical engineering, classrooms, and computing facilities. Currently, the Water Analysis, Hydraulics, Structural, Concrete, Geotechnical, Transportation, BIM, Surveying, and all the computer Laboratories are housed in Building 17.

Classrooms are assigned at the College-level, which means that all large classes are assigned large classrooms that are not necessarily in the Engineering facilities. However, almost all civil engineering classes occur in civil engineering facilities. Computing facilities within the College and on campus are all linked by a high-speed network and are accessible to the students from anywhere on campus, and at home. These facilities connect the student to outside databases and encourage scholarly activities of the students and the faculty alike. All classrooms are equipped with overhead projectors. Most, but not all, have document cameras. After the COVID- 19 pandemic, some rooms have been equipped with technology to be able to record classes.

Laboratories
While most of the laboratories are mainly used for undergraduate activities, graduate students have access to them for research or other projects. The Civil Engineering program uses the facilities listed in **Table 4-1**.

Table 4.1 *- Civil Engineering Department Laboratories*

Building	Room	Laboratory Name	Floor Area (ft^2)	Comments
17	1671	Geospatial Engineering	1467	Existing laboratory
17	1675	Geospatial Research	258	Existing laboratory
17	1679	Surveying and Geomatics	763	Existing laboratory
17	1679A	Surveying Storage	200	Existing laboratory
17	1672	Water Analysis	979	Existing laboratory
17	1676	Concrete Material & Analysis	800	Existing laboratory
17	1468	Fluids and Hydraulics	3265	Shared with Mech. Eng.
17	1480	Geotechnical Engineering	1370	Existing laboratory
17	1660	Structural Mechanics	1166	Existing laboratory
17	2676	Infrastructure Design/BIM	960	Existing laboratory
17	2670	Sustainable Land Development	960	Existing laboratory
17	2646	Transportation Systems Design	1200	Existing laboratory
13	1114 C and D	Project Fabrication	798	Existing laboratory
		TOTAL	14,186	

Assessment of Equipment in Laboratories

The purpose of, and equipment in, each of the twelve laboratories are described in Appendix C. New equipment and software have been acquired over the last seven years and all new equipment is listed with the newest equipment underlined. The section below describes how the laboratories are updated and maintained.

Laboratory Development Plan

Since 2011, the civil engineering department started a laboratory revitalization process with fundraising and proposal submission to replace old equipment, expand capabilities of current equipment, and acquire novel equipment. Each technical area (structural, transportation, etc.) have worked together on the preparation of internally and externally funded proposals and participated in college and department fundraising activities that had the purpose to update the laboratories equipment. Needs and goals have been set by each technical area. Faculty members from different technical areas were successful in bringing funding for equipment from internally funded programs (ex., CPP SPICE program), from external funded efforts (ex., Department of Education PPOHA), and fundraising activities (ex., $150,000 for the environmental and water resources laboratories). The CE Department plans to continue these efforts to further enhance the laboratory capabilities and fulfill the student experiential learning opportunities.

In addition, during the revitalization of the laboratories the faculty members and the technicians have worked together to remove and discard old equipment from the laboratories. Italicized and underlined items in the preceding laboratory descriptions indicate equipment acquired since 2011. The department has upgraded much of the laboratory equipment in recent years, and many of these upgrades have been significant: like the replacement of all the computers in rooms 17-2646, 17-2670, 17-2676. Improvements will continue as the faculty members continue their involvement with industry, research, and development activities within and outside Cal Poly Pomona.

Lastly, the Civil Engineering department developed a department-wide student safety training program to ensure the safety of students using laboratories for teaching or other research/special project activities. All laboratory directors are in charge of administrating the safety training and of keeping the records up to date in a Shared location. The Department Safety Director is in charge of overseeing that all the safety training and practices in the department are observed. In addition, the water analysis laboratory added a student technician to support the safety of the laboratory users. This allowed us to establish open-laboratory hours to ensure that students working in the lab are always supervised.

Computing Resources

College and University Facilities

Instructionally related computing resources are provided by the College of Engineering and by other entities across campus are listed below.

College of Engineering Computing Resources
Computing resources within the College of Engineering are managed by the Dean's Office in collaboration with the individual departments. These resources are primarily designed to support our undergraduate and graduate degree programs with the hardware and software needed by the various courses. College IT staff maintain these resources. These resources consist of the following:

- Infrastructure: dedicated wired and wireless networks for the college.
    - Wired networks span Buildings 9, 13, and 17 for all lecture rooms, conference rooms, computer labs, and offices.
    - Wireless network access to cover engineering complex and nearby spaces.
    - Multiple logical subnets to segregate resources based on their functionalities: servers, computing labs, printers, and network controllable devices, research labs/offices, faculty/staff offices, and wireless mobile devices.

- Servers: unified authentication and authorization servers to serve the needs of students, faculty, and administrative staff. There are 41 servers actively serving the college. Server categories include:

    - Windows domain controllers
    - File servers
    - Print servers
    - Software License servers
    - Database servers
    - Remote desktop servers
    - Data and system backup servers
    - Virtual private network servers
    - Application/Web servers
    - Virtual system servers
    - High performance cluster-based servers
    - Workstation deployment servers
    - Development and test environment servers
    - Building entrance and door management and monitoring severs
    - Security deployment and auditing servers

- Computing laboratories: dedicated computing facilities for teaching, learning, and academic research purposes. There are 21 laboratories furnished with computer systems which can be accessed by all engineering students, faculty, staff, and authorized guests.

    - 09-119: 13 workstations - ECE basic/power electronics lab
    - 09-205: 31 workstations - ECE general purpose lab
    - 09-253: 25 workstations - ET general purpose lab
    - 09-409: 43 workstations - ECE general purpose lab
    - 09-431: 12 workstations - ECE basic electronics lab
    - 09-435: 15 workstations - ECE microcontroller lab
    - 09-503: 12 workstations - ECE ASIC design lab
    - 09-507: 12 workstations - ECE computer networks lab
    - 09-523: 15 workstations - ECE communications and biomedical lab
    - 17-1467: 12 workstations - ME System Dynamics lab
    - 17-1671: 25 workstations - CE Geospatial Information Systems lab

- 17-2103: 31 workstations - ARO Flight & Systems Design lab
- 17-2107: 31 workstations - CME Process Simulation lab
- 17-2238: 12 workstations - ME Research/Special Projects lab
- 17-2646: 15 workstations - CE Transportation Systems Design lab
- 17-2654: 41 workstations - IME Graphics & Spatial Visualization lab
- 17-2660: 30 workstations - ME Mechanical Design & Analysis lab
- 17-2664: 11 workstations - ARO Vehicle & Systems Team Design lab
- 17-2670: 30 workstations - CE Sustainable Land Development lab
- 17-2676: 29 workstations - CE Infrastructure Laboratory/BIM

These computer laboratories are unlocked and available during normal business hours. When classes are not scheduled, they are available to any engineering student. In addition, with faculty permission, engineering students may access these laboratories 24/7 using their Bronco access card.

- Instrumentation laboratories: engineering labs with computers integrated or connected to the equipment. The computer functionalities include data download, data acquisition, data analysis, visualization and simulation, embedded control system, etc.

  - 09-101: Lighting lab
  - 09-102: Photonics & Imaging lab
  - 09-529: Microwave lab
  - 13-1114: Dynamic Structures lab
  - 13-1229: Supersonic Wind Tunnel lab
  - 13-1426: Subsonic Wind Tunnel lab
  - 17-1114: Materials Engineering lab
  - 17-1123: Unit Operations lab
  - 17-1223: Transport Processes Projects lab
  - 17-1455: Strength of Materials lab
  - 17-1468: Fluids and Hydraulics lab
  - 17-1480: Geotechnical Engineering lab
  - 17-1628: Thermal Fluids lab
  - 17-1659: Computer Integrated Manufacturing lab
  - 17-1660: Structural Mechanics lab
  - 17-1663: Systems lab
  - 17-1679: Geomatics and Surveying lab
  - 17-2626: Human Engineering lab

- Faculty and staff computing systems: laptop, tablet, and desktop computer systems. The college serves approximately 158 computers allocated to faculty and staff members.

- 127 laptop/tablet/desktop computers used by faculty: systems are configured with commonly used office productivity software and other mandatory discipline related software

- 31 laptop/tablet/desktop computers used by office and technical staff. System and software configuration to provide interchangeability and reliable computing service

- Document reproduction services: printing, copying, and scanning services. Student accessible printers

are available in the engineering offices and building alcoves. Integrated printing, copying, and scanning services are available to all faculty and staff via high-performance multifunction imaging systems located in convenient offices in Buildings 9 and 17.

- Special software and license distribution services: delivering and monitoring student access to major engineering software under special educational license agreements. They include:
    - Microsoft products included in the Microsoft Imagine program.
    - Bentley Systems, Incorporated software packages.
    - Autodesk design software.
    - National Instruments LabVIEW and Multisim packages
    - SOLIDWORKS software package.

The College of Engineering IT staff also provides special application development: on-demand application development to support academic and administrative purposes (college value-added database, remote file access, integration of special instruments, etc.)

Software
The College of Engineering maintains software titles listed in Table 4.2.

Table 4.2 - *College of Engineering Software*

Advanced Aircraft Analysis	GMS	Power Tools for Windows
AeroTURN	Google Earth	PowerWorld Simulator
Agilent BenchLink	GRLWEAP	Primavera P6
Agilent IntuiLink	Groundwater Vistas	PRO/II
Alertus Desktop	HCS 2010	ProModel
ANSYS	HeavyBid	PSCAD
AGi32	HEC-HMS	PuTTY suite
ArcGIS	HEC-RAS	Python
Arena	Interactive Groundwater	Quanser - QUARC
AspenOne	Kinect for Windows	QuicNet Pro
Autodesk AutoCAD Civil 3D	LabVIEW	R
Autodesk Navisworks Manage	LEGO MINDSTORMS	RealWorks Survey Advanced
Autodesk Revit	LINGO	ROBOLAB
AutoTURN	LMS Imagine.Lab	Rocscience
B2 Spice	LPILE	SAFE
Bentley ContextCapture	Mastercam	SAP2000
Bentley CulvertMaster	Mathematica	Satellite Tool Kit
Bentley FlowMaster	MATLAB	SolidWorks
Bentley Inroads	Microsoft Office	SPSS
Bentley MicroStation	Microsoft Expression Web	Synchro Pro 4D
Bentley SewerCAD	Microsoft Project	Tera Term Pro
Bentley StormCAD	Microsoft Visio	Thermo-Calc
Bentley WaterCAD	Microsoft Visual Studio	TRACE 700
Bluebeam Revu	MPLAB IDE	Trafficware

Cadence PSD	MSC Adams	TransCAD
Centracs	MSC FEA	Trimble Business Center
COMSOL Multiphysics	NASA Marshall Space Transportation	Trimble Geomatics Office
Desktop Aeronautics	NEiNastran	VISSIM
Duct Designer	NX Nastran	VISTRO
EAGLE Layout Editor	Onscreen Takeoff	VISUM
Eclipse	OpenChoice Desktop	WMS
EPANET	Oracle DB	Working Model 2D
ERDAS Imagine	Orbit Determination Tool Kit	Xilinx ISE
ETAB	Pipe	Xilinx Vivado
FreeFlyer	PIPE-FLO	Xming

Campus Computing Resources
Computing resources are primarily provided by the Division of Information Technology (IT). These include business process services as well as direct support for students and faculty.

The following core services are available 24 hours a day, 7 days a week, except during standard maintenance hours, which are Thursdays, 9:30 PM to 12:00 midnight, and Sundays, 5:00 AM to 8:00 AM:

- BroncoDirect/PeopleSoft
- Canvas
- MyCPP Portal
- Electronic mail
- File Storage
- Web Services
- Internet connectivity to and from the campus

Major outages are posted on a website and are communicated via email, unless the outage precludes it. The Classroom Technology team provides limited technical support of classroom-related issues after the standard business hours of 8:00 AM to 5:00 PM.

Resources for Faculty
The Center for the Advancement of Faculty Excellence (CAFE) www.cpp.edu/cafe/index.shtml and Studio 6 provides assistance to faculty for their online instructional needs. Studio 6 is a high-tech facility designed to allow faculty to work closely with instructional designers and multimedia production specialists for the development of online courses and instructional materials. For more information on Studio 6, go to https://www.cpp.edu/cafe/about-us/studio-6.shtml.

The Classroom Technology team provides faculty and staff support services for all classroom audio/visual equipment needs, including portable computer carts, projection systems, and TV/DVD/VCR carts, as well as overhead transparency projectors. The Classroom Technology team also offers tutorial and consultation services to faculty, staff, and students regarding the use of equipment. For information on the Classroom Technology team, go to
https://www.cpp.edu/it/client-services/services/svc-class-lab.shtml

The Cal Poly Pomona IT Service Desk provides faculty help with a variety of services, including password resets, mobile device configuration, software licensing, BroncoDirect/PeopleSoft and Blackboard usage, as well as dispatching a technician for on-site assistance in classrooms. For more information about the Cal Poly Pomona IT Service Desk, go to
https://www.cpp.edu/it/services.shtml

Computer Labs for Students
In addition to the computer labs provided by the College of Engineering, the University has campus-wide computer labs which are open 8:00 AM until 5:00 PM in the Computing Commons (Building 98, Room C5-13), and Mondays through Fridays from 9:30 AM until 5:00 PM in the Campus Center (Building 97, Room 121). For more information on the Campus Center lab, go to https://www.cpp.edu/env/landscape-architecture/academic-student-resources/technology-resources.shtml .

The University Library has computers, scanners, printers, copiers, and group study rooms equipped with computer technology. These are supported by the Student Tech Desk, which is part of IT. For more information on the University Library's available technology, go to https://www.cpp.edu/it/client-services/services/svc-class-lab.shtml. For more information on the University Library's hours of operation, go to https://www.cpp.edu/library/index.shtml

Students who need to use a computer on campus when these labs are closed can visit the 24-hour lab in the University Library. The 24-Hour lab is located on the first floor and requires a Bronco Access Card to enter. For more information on this lab, go to https://libguides.library.cpp.edu/library-services-available-covid19.

Guidance
Laboratory Manuals
Each Laboratory has a detailed instruction manual for laboratory procedures and exercises. The manual details each exercise exactly as it is to be performed. Thus, students who do not complete the exercise in class can complete it in their own time without an instructor present.

Safety Manuals and Safety Training
Each Laboratory has a safety manual which is given to students at the beginning of the quarter. All laboratory directors are in charge of administrating the safety training and of keeping the records up to date in a Shared location. The Department Safety Director is in charge of overseeing that all the safety training and practices in the department are observed. In addition, the water analysis laboratory added a student technician to support the safety of the laboratory users. This allowed establishing open-laboratory hours to ensure that students working in the lab are always supervised.

Laboratory Access
Nearly all of the civil engineering laboratories may be accessed through a swipe-card system. Students with a legitimate need to access these laboratories are authorized to open them using their Bronco ID card. A computer system logs the name of each person that opens a lab. This system has proven to be a successful means of providing both access and security.

Maintenance and Upgrading of Facilities
Funding to maintain and upgrade facilities is available in varying amounts, depending on the budget. In Fiscal Years of 2015 to 2017:

- Department Chairs solicited lab and classroom upgrade proposals from faculty
- Proposals submitted by the department chairs to the dean
- $450,000 invested in Spring 2016 to purchase vitally needed equipment
- $50,000 for 123 new tables in 5 computer labs in Fall 2016
- Student Success Fee Funds + College Funds used for a variety of classroom technology and computer lab upgrades

Maintenance is provided by the College of engineering technicians and the student technician with the coordination of the faculty laboratory directors. Most of the laboratory courses have a student fee that supports

the maintenance cost of the equipment. Upgrading has been supported by the college of engineering and the internal CPP funding programs.

4.3 Library

. The University Library supports student learning through a wide variety of services. The Reference and Instruction Department aids students in accessing the library's rich information resources and helps students develop information skills that not only serve their immediate research needs but also prepare them for graduate studies, careers, and lifelong learning. Librarians use a variety of methods, including course-integrated library instruction, special workshops, and personal assistance in-person or via email, chat, phone, or by appointment, instructional guides, tutorials, and a FAQ.

The Circulation Desk is located on the 2nd floor of the library and is open all hours that the library is open. Library staff help in tracking down missing materials, placing holds on materials checked out to another borrower, renewing your materials, paying fees, and updating patron records. Other services include checking out Course Reserve materials, Document Delivery, and hold requests items.

The Civil Engineering Subject Librarian, who is a tenure-track senior assistant librarian, works with the faculty and students of the MS in Civil Engineering Program. Below are some of the resources used by the librarian to support this program.

4.3.1 Select Journal titles

The library provides program-supporting subscription access to the following key journals:

- Mechanical Systems and Signal Processing
- Transportation Science
- Journal of Structural Engineering
- Journal of Composites for Construction
- Journal of Bridge Engineering
- Journal of Water Resources Planning and Management
- Journal of Materials of Civil Engineering
- Journal of Computing in Civil Engineering
- Structural Concrete
- Journal of Hydraulic Engineering

4.3.2 Databases

Here are some key databases used for MS in Civil Engineering:

- ASCE Library
- Civil Engineering Database (ASCE)
- Compendex
- Web of Science Core Collection
- Science Direct

Other useful databases can be viewed here: https://libguides.library.cpp.edu/az.php?s=77585

4.3.3 Reference and Instruction Statistics

Librarians and library staff assisted students and faculty with research questions related to MS in Civil Engineering during the period under review.

- 2016/17 – 3 questions

- 2017/18 – 2 questions
- 2018/19 – 0 questions
- 2019/20 – 4 questions
- 2020/21 – 3 questions

Library instruction was provided to the MS in Civil Engineering program in the following ways:

- 2016/17 – 1 instruction session
- 2017/18 – 0 instruction sessions
- 2018/19 – 1 instruction session
- 2019/20 – 0 instruction sessions
- 2020/21 – 1 instruction session

Library Research Tutorials Usage by MS in Civil Engineering:

- 2016/17 – 3 uses
- 2017/18 – 3 uses
- 2018/19 – 2 uses
- 2019/20 – 1 use
- 2020/21 – 1 use

Library Research Guides Usage by MS in Civil Engineering:

- 2016/17 – 310 views
- 2017/18 – 311 views
- 2018/19 – 106 views
- 2019/20 – 209 views
- 2020/21 – 487 views

The information above shows that graduate students are frequently using the library databases while there were only a few requests for guidance to learn how to research literature. In some courses, the faculty invites the engineering librarian to one of the graduate courses to give a quick tour of the library resources and to help them get started with the literature search for an assignment. The journals and databases available in the library are sufficient to allow students to complete their research assignments. All the listed journals and databases are consulted by the students in the different options, while more could be added at present none of the listed should be removed or replaced.

4.4 Other Campus Resources

The CSU has reasonable policies on sabbatical leaves. To qualify, the candidate presents a written proposal, endorsed by the Dean, to the university's Professional Leave Committee documenting the purpose of the leave and identifies in the proposal specific accomplishments contemplated. The value of the leave to both the individual and the university must be clear. The length of the sabbatical can vary from one semester to one year, with remuneration varying accordingly. Also available are difference-in-pay leaves. Leaves are granted by the President upon recommendation of the Professional Leave Committee and the Vice President for Academic Affairs. A candidate is eligible to receive a sabbatical every seven years. Faculty travel funds are available to support faculty travel to professional conferences and other professional activities. Faculty submit a request for funding, including an explanation of the professional activity and how it relates to their ongoing professional development.

The Center for the Advancement of Faculty Excellence (CAFE) is a wonderful source of professional development support for faculty, CAFE is dedicated to supporting faculty in their multi-faceted roles of learner-centered teaching, research and creative activities, and service to the university and community.

The Center provides resources, support, and programs for faculty to advance innovative, effective instruction for diverse students throughout the University. The Faculty Center works in close partnership with eLearning in this endeavor. The goals of Faculty Center include the following:

- To provide opportunities and resources for faculty to create and maintain collegial, collaborative relationships and to maintain vibrancy at every stage of the faculty career.
- To provide resources and programs to advance research, scholarship, creative activities, and other professional activities of the faculty.
- To assist departments in recruiting high-quality faculty and in orienting and supporting new faculty to encourage their retention, advancement, and success at Cal Poly Pomona.

The eLearning team provides professional development for faculty with specific attention to incorporating technology into effective teaching practices. eLearning provides workshops and campus conferences, a week-long summer institute, individual or departmental instructional design consultation, multimedia learning object development, the "Studio 6" computer lab for faculty, and supports the use of the Quality Matters framework for creating effective online, hybrid, and technology-enhanced face to face courses, http://elearning.cpp.edu. In addition, the College of Engineering offers teaching workshops throughout the year, specifically for engineering faculty.

The Office of Research, Innovation, and Economic Development Office oversees the direction and guidance of the University's research mission. It is responsible for policy formation and oversight related to the research processes as well as training in the ethical conduct of research. The office promotes the creation and maintenance of a university environment that maximally encourages and supports research productivity. In addition, the office coordinates patents and technology marketing rising from inventions by university faculty.

Additionally, the Graduate Studies office is the office that processes programs of study, graduate academic petitions, and receives thesis and project signatures before graduation for most programs. The office supports faculty and students with daily tasks, training and academic petitions.

4.5 Budget

Process Used to Establish the Program's Budget

The college and departments use State and Foundation funding, each of which has its processes and procedures. State funds are provided by taxpayers from the state general fund and by students through payment of tuition and fees. Funds generated through charitable donations and grants, or contracts are managed through the Cal Poly Pomona Foundation, Inc. Both use a fiscal year that starts on July 1. The Civil Engineering total budget for the past five fiscal years is shown in Table 4.3. The various sources of funding are described below.

***Table 4.3** - Civil Engineering Department annual budget*

Fiscal Year	2017	2018	2019	2020	2021
Civil Engineering	3,105,364	3,265,438	3,495,512	3,311,186	2,128,187

State Funds

The State of California supports the California State University (CSU) annual operating expenses from its general fund. The CSU Chancellor's Office and the Board of Trustees provide an annual budget request and

work with the state legislature and the governor to establish the annual Support Budget for the twenty-three (23) campus system which includes Cal Poly Pomona. Funding to the campuses is driven by enrollment targets. Funding each year is identified as permanent or one-time, with corresponding implications on use. For additional information, see: http://www.calstate.edu/budget/.

Student fees and tuition are collected on campus. California residents receive support from allocated state funds and non-residents pay the full cost of education. The fee schedule is available at: http://www.cpp.edu/~student-accounting/tuition-fees/.

Campus allocations to the five university divisions are determined by the University President to achieve enrollment targets, fund university operations, and support successful academic outcomes for students. Base and one-time budgets are adjusted annually in response to enrollment targets and strategic priorities. In reviewing support budgets, it is important to note that benefits and utilities are budgeted and managed as a campus-wide pool. University budget information: http://www.cpp.edu/~fas/budget/index.shtml

The College of Engineering is one of 8 colleges supported by the Academic Affairs division budget, along with the University Library and other support functions. The Provost and Vice President for Academic Affairs set the budget in collaboration with the college deans and members of her leadership team to support enrollment goals, student success, and university priorities. College deans manage their budgets to an annual enrollment goal, typically stated in terms of full-time equivalent students (FTES). College budgets are updated annually to assure that funding is provided for both the permanent and temporary faculty needed to achieve this goal, as well as funding for support staff and operating needs. The faculty provides input to the budget process through service on university committees, the Academic Affairs division budget advisory committee, and within their colleges and departments. Budget information for Academic Affairs: https://www.cpp.edu/cppira/annual-budget-process.shtml.

In recent years, the College of Engineering transitioned from a centralized budgeting and accounting process where the various department expenses were all managed at the Dean's Office, to a more decentralized system. Each department receives both an FTES allocation and a funding allocation and is provided with substantial discretion on how to optimally use these funds while still meeting the FTES goal.

Accounting services are provided by the university budget office, and all departments have online access to the finance dashboard, which provides up-to-date information on each account. The college has a financial and personnel analyst who oversees the various accounts and reports to the Dean, as well as an assistant budget analyst to support ongoing accounting needs. At the end of the fiscal year, a small amount of carry-over is usually permissible.

Foundation Funds

The Cal Poly Pomona Foundation is a public-benefit charitable-educational organization under the provisions of the California Revenue and Taxation Code, Section 23701(d) and the United States Internal Revenue Code, Section 501(c)(3). As a recognized auxiliary of the California State University, the Foundation conforms to the regulations established by the Board of Trustees of the California State University and approved by the California State Director of Finance, as required by the California Education Code, Section 89900. The University's administrative organization supervises the Foundation, as required by Title 5, California Code of Regulations, Section 42402.

All philanthropic donations and revenue from contracts and grants are managed through the Cal Poly Pomona Foundation. The various academic departments and the college each have multiple foundation accounts, which are managed separately from the state accounts. In cases where faculty (who are state employees) work on externally funded projects, the foundation reimburses the state for his/her time, and or the faculty are employees of the foundation.

Use of Funds
Virtually all administrators, faculty, and staff in the College of Engineering are state employees and thus are paid with state funds. These payroll expenses consume the largest percentage of the state budget. We occasionally hire foundation staff employees, typically to work on specific externally-funded projects.

Routine maintenance, custodial and landscape services, utilities, employee benefits, and other similar expenses are paid from other budgets, and thus do not impact the College or department budgets. Some state funding is available for laboratory equipment maintenance and upgrades. These expenses are also paid from philanthropic fundraising and contracts and grants. Both of these sources of funding are growing, especially in the College of Engineering.

Self-Support Summer Session
In addition to the course offerings during the academic year, Cal Poly Pomona also offers regular courses during the Summer. Until 2008, these summer classes were financed using state funds, just as during the academic year, and faculty were issued special summer contracts to teach these classes. However, beginning in 2009, the summer session was converted to a self-support model. Students continue to take the regular courses but are not subsidized by the taxpayers. The summer fees cover the marginal costs of the summer session, which conserves our state funds for use during the academic year. These self-support summer classes are managed through our College of the Extended University and are taught by our regular full-time and part-time faculty under contract with the CEU.

Support of Teaching
The Department or COE funds graders which are available on a case-by-case basis, especially for larger sections. A variety of pedagogical and instruction-technology workshops are available through the Center for the Advancement of Faculty Excellence (CAFE): http://www.cpp.edu/~facultycenter/index.shtm. The College of Engineering offers several teaching workshops throughout the year as well.

Provision of Resources
Major capital improvements, such as new buildings, are normally funded through state bonds, and thus are financed separately from the university's operating budget. In some cases, such projects instead funded in part by philanthropic contributions. During the past 7 years, there has not been a major capital improvement in the Civil Engineering Department.

Adequacy of Resources
During the 1960s and 1970s, the State of California provided comparatively generous funding for higher education. Student fees were very low, and there was little need for external funds. The University of California, California State University, and California Community College systems flourished during these years, with significant enhancements in academic programs and facilities. However, in the late 1970s, the inflation-adjusted funding per student from the state general fund began to decline, and this trend has continued over the subsequent decades. Most other states have experienced a similar trend.

One of the consequences, both in California and elsewhere, has been a steady shift in the cost of education to the students. CSU tuition and fees have increased. The CSU tuition and fees are still below the national average for similar institutions (about $7,000 per year for a full-time student), but continue to increase nearly every year.

Unfortunately, the increase in student tuition and fees has not been sufficient to offset the decline in taxpayer support. Thus, it is becoming increasingly necessary to rely on other sources of funding. As a result, the various CSU campuses, including Cal Poly Pomona, have been placing much more emphasis on philanthropic fundraising. Our fundraising efforts have grown from almost nothing to become an entire division with about 46 employees. The University Advancement Division staff have worked collaboratively with the deans, department chairs, and faculty, and this work has produced substantial increases in philanthropic giving (both

cash and in-kind gifts). In addition, the university recently completed an over $160 million capital campaign. We believe these efforts are a key part of the strategy for offsetting the loss of state funding. Many of the laboratory improvements in the college since 2015 AY have been the result of our external fund-raising efforts.

Another major source of external funding is indirect costs from externally funded contracts and grants. Once again, this work was minimal 20 years ago, but has grown substantially and is becoming an important source of revenue as well as providing opportunities for scholarly work among faculty and students. The Office of Research and Sponsored Programs, headed by the Associate Vice President for Research, Innovation and Economic Development provides support for these activities.

The Student Success fee initiated in Fall Quarter 2013, provides financial support to areas of the campus that have a significant impact on student retention and graduation. It creates additional funding for new programs and improves information technology services to help students. All registered students at Cal Poly Pomona pay the Student Success Fee each term. The fee provides additional course sections, increases tutorial services and library hours, enhances wireless and technology support, and provides additional funding opportunities for student clubs and activities.

The university's strategy of increased tuition substantially increased philanthropic fundraising and increased externally funded contracts and grants have thus far been effective in offsetting the loss in taxpayer subsidies. Over the longer term, this strategy promises to provide a sound financial basis for the university, particularly for the College of Engineering.

The Civil Engineering department obtained its operating budget from the state funds that are centrally managed at the dean's office. The department budget covers the salary of the tenured and tenure track faculty and the salary of the part-time adjunct faculty members. The salary of the department coordinator and the department technical staff is part of the fixed budget that the University faculty affairs office allocates. The state budget also covers the compensation of student assistants that are hired to assist instructors.

In addition to the faculty salary, there is a line on the budget that covers faculty travel to conferences and other relevant professional development activities; the funds allocated to this line fluctuate from year to year, depending on the state budget. The consumable supplies used to run our labs are covered by separate funds, usually student success fees. The operating budget also covers the supplies and the cost of running commercial software in our computer labs. The maintenance of different equipment in our lab facilities has its designated line in our state operating budget. Internal grants funded by the University usually cover the upgrade of the equipment of our labs.

In addition to the state funds, the department relies on foundation accounts to support extra curriculum activities and student competitions. The foundation accounts are also used to support the needs of large classes with student assistants. The foundation is often used to acquire and maintain lab equipment that the state funds do not cover.

The department budget from the state and the foundation are used to support the department's main mission, which is to offer a quality undergraduate and graduate education to our students. The department currently focuses on closing the grade point average (GPA) gap between the underrepresented minority (URM) students and the non-URM. The department has several initiatives to reduce the GAP in the success marker courses, such as statics and mechanics of materials for the URM students. The department can benefit from additional resources to revise the curriculum and add lab components, develop videos, and acquire equipment to improve department performance in these success marker courses. The additional funds will also be used to support department faculty via stipend to work in the curriculum development and assessing the success marker courses.

5. CONCLUSION

5.1 Main program strengths

One of the strengths of the MSCE Program is the variety of options and a diversified pool of faculty and instructors in terms of technical areas. Having five different options makes the program appealing for students seeking a well-rounded education. Students can take elective courses from different options to complement their main area of interest with subjects that could help them succeed in their professional development.

The faculty body includes industry professionals and full-time faculty that can provide a well-rounded education through exposure to different theoretical/practical research projects and cutting-edge professional projects. Students can choose from three different culminating experiences offered by the program (Thesis, Project, and Comprehensive Exam) to successfully complete their degree culminating experience requirements based on their personal needs, professional goals, and interests.

This State-funded program combines affordability with high-quality education and a course-offering schedule that is compatible with the needs of working professionals. The location of the Campus between LA, San Bernardino, Riverside, and Orange Counties makes this program appealing for a large pool of professionals and continuing students.

Finally, all the courses are taught by either full-time faculty (81% of the sections) or part-time faculty (19% of the sections), which provides the students with a high degree of interaction with instructors, instead of Teaching Assistants.

5.2 Opportunities for improvements, actions taken, and evidence of success

There is an identified need for an improved recruitment process. The Program identified growth goals for the next years, which can only be achieved by reaching out to a wider and more diverse pool of applicants. **Action**: the department is currently updating the marketing material and the distribution pathways (for instance including distribution through the young professional chapters in the surrounding counties), as well as increasing the number of recruitment events (in-person and virtual). **Evidence of success within 6 years**: attract and enroll students that are well suited to succeed in the program, with a total enrollment increase to about 80 students per year, evenly distributed between the different options.

Graduation and retention rates shall also be improved, as data show that the current graduation rate increased over the past years but is still below 50% (after 3 years). **Action**: advising sessions were added starting from fall 2021 to reach out to students that are not progressing through their curriculum. Through these advising sessions, the Graduate Committee members help students identify the coursework and culminating experience that would best fit their needs, goals, and interests. **Evidence of success within 6 years**: student graduation rate will increase above 75% (after 3 years).

The assessment data show that some student outcomes are in need of improvement, while others are watch areas. **Action:** The coordinated work between the Graduate Committee and the Department will address the observed improvements needed and are working on closing the loop with appropriate curricular changes. Some of the proposed changes include: (i) development of transparent assignment to help the students meet the various levels of outcomes in individual classes; (ii) the incorporation of real-world data into team and individual assignments and projects. **Evidence of success within 6 years:** increase the level of student achievement at or above the set target (as presented in **Section 2**) for all the performance indicators.

APPENDICES

Appendix A - List of International Institutions

List of the Chinese Institutions that GEI sent to
Civil Engineering Department for Promoting CPP's Civil Engineering Program

No.)	Institutions (in Chinese)	Institutions (in English)
1	内蒙古农业大学	Inner Mongolia University of Agriculture
2	大连理工大学	Dalian University of Technology
3	大连交通大学	Dalian Jiaotong University
4	东南大学	Southeast University
5	中国矿业大学	China University of Mining and Technology
6	常州大学	Changzhou University
7	江苏大学	Jiangsu University
8	东华理工大学	East China University of Technology
9	泰山学院	Taishan University
10	湖北工业大学	Hubei University of Technology
11	湖北文理学院	Hubei University of Arts and Sciences
12	桂林理工大学	Guilin University of Technology
13	长江师范学院	Changjiang Normal University
14	石河子大学	Shihezi University
15	徐州工程学院	Xuzhou University of Technology
16	浙江科技学院	Zhejiang Institute of Science and Technology
17	大连大学	Dalian University
18	五邑大学	Wuyi University
19	江苏海洋大学	Jiangsu Ocean University
20	南阳理工学院	Nanyang Institute of Technology
21	广东工业大学	Guangdong University of Technology
22	大连民族大学	Dalian University for Nationalities
23	安徽新华学院	Anhui Xinhua College
24	武昌首义学院	Wuchang Shouyi College
25	东南大学成贤学院	Chengxian College of Southeast University
26	南昌理工学院	Nanchang Institute of Technology
27	浙江大学宁波理工学院	Ningbo Institute of Technology, Zhejiang University
28	大连理工大学城市学院	Dalian University of Technology City College
29	贵州大学	Guizhou University
30	青岛工学院	Qingdao University of Technology
31	齐鲁理工学院	Qilu Institute of Technology
32	北方工业大学	Northern Polytechnic University
33	河北大学	Hebei University
34	内蒙古工业大学	Inner Mongolia University of Technology
35	江苏科技大学	Jiangsu University of Science and Technology
36	南京工业大学	Nanjing University of Technology
37	河海大学	Hohai University
38	南通大学	Nantong University
39	苏州科技大学	Suzhou University of Science and Technology

40	绍兴文理学院	Shaoxing College of Arts and Sciences
41	贵州大学	Guizhou University
42	齐齐哈尔工程学院	Qiqihar College of Engineering
43	**西安思源学院**	Xi'an Siyuan College
44	**湖北商**贸学院	Hubei College of Commerce and Trade
45	**西安培**华学院	Xi'an Peihua College
46	**黄山学院**	Huangshan College
47	重庆文理学院	Chongqing College of Arts and Sciences
48	**淮阴工学院**	Huaiyin Institute of Technology
49	**常州工学院**	Changzhou Institute of Technology
50	**安阳工学院**	Anyang Institute of Technology
51	**江**苏师范大学	Jiangsu Normal University

Appendix B - Student Learning Outcomes Rubrics

SO 1

Problem solving - an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Performance indicators	**1-Introductory**	**2-Developing**	**3-Mastery**
Plan a proper test set-up fora given engineering ora research problem.	Systematic plan is unclear most of the time of data gathering; experimental datacollection, equipment selection are disorganized and incomplete.	Organization of experimentalplan is acceptable but does not recognize entire scope of the laboratory exercise, therefore data gathering is overly simplistic (not all parameters affecting the results are included).	Always formulates a clear experimental plan of data gathering to attain the stated laboratory objectives (develops a plan, tests a model, checks performance of equipment).
Analyze test results and validate theoretical principal behind the experiment.	Makes minimal attempt torelate data to theory.	In general, needs some guidance in applying appropriate theory to data,may occasionally misinterpret physical significance of theory or variable involved and may make errors in conversions.	Independently analyzes andinterprets data and validatethe appropriate theoretical principals.
Develop a research plan to find a solution for an engineering Problem.	Sometimes seeks additionalinformation – mainly from the textbook or the instructor.	Most of the time seeks reference material from a few sources beyond manual,textbook or instructor.	Cleary identifies all steps needed to develop a complete solution – steps areorganized correctly with details and justifications.

SO 2

Experiment analysis - An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgmentto draw conclusions.

Performance indicators	**1-Developing**	**2-Proficient**	**3-Mastery**
Arrange and assemble appropriate input andoutput parameters or alternatives.	Only able to arrange and present 50% to 75% of thekey inputs and outputs. Units are either incorrect ornot presented.	Arrange/show 75 to 90 % of the key inputs and outputs. There is a use of appropriate units. Assumptions are stated when necessary. OR Provide 90% or more of thekey inputs and outputs, butthey are not presented clearly and or lacking units.	Arrange/show 90% or moreof the key inputs and outputs parameters. Thereis a use of appropriate units. Assumptions are stated when necessary. Alternatives are providedwhen asked of them.
Choose the correct approach/equation/formula.	Choose 50% to 75% correctequations (i.e. did not include all the equations/approaches necessary) or lack of presentation.	Choose all necessary equations/approaches needed to solve the problem. Has an error in oneequation or there is uncertainty as to what the student is presenting	Makes appropriate inferences based on thatinformation. Clearly present and correctly choose all necessary equations or approaches needed to solve the problem. (Note: Anyone can determine what they plan to solve.)
Identify the proper mathematics, science, andengineering principles to find the output (i.e. quantitatively or qualitatively solve theproblem).	Identify 50% to 75% of thenecessary outputs accurately.	Clearly present and identify 75% to 90% of the necessaryoutputs accurately. Significant figures are notaccounted for.	Clearly present and identifyall the necessary outputs requested accurately. Theyuse significant digits.

SO 3

Apply knowledge - An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Performance indicators	1-Introductory	2-Developing	3-Mastery
Identify and acquire new knowledge from external resources.	Begin to look beyond knowledge acquired in classroom.	Adequately acquire and identify external resources and assess the quality, credibility, and validity of acquired information.	Expertly acquire and identify the best possible external resources and assess the quality, credibility, and validity of acquired information.
Apply newly acquired knowledge.	Make some connection of course content to assigned-tasks, but makes errors in application of concepts.	Connect new knowledge to assigned-tasks but make minimal or superficial meaning of the applied concepts.	Expertly connects new knowledge to assigned-tasks, draw meaningful conclusions and makes insightful connections.
Select appropriate learning strategies (process to reach the correct solution/conclusion).	Poor selection of approach to identify, acquire, integrate and apply the new knowledge.	Partially selecting a systematically and logically oriented approach to identify, acquire, integrate and apply the new knowledge.	Selecting a systematically and logically oriented approach to identify, acquire, integrate and apply the new knowledge.

SO 4

Engineering design - An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Performance indicators	1-Introductory	2-Developing	3-Mastery
Use a design strategy and resources.	Use a design strategy with guidance, such as following aprevious example, with minimal or incorrect use of engineering resources such as manuals, standards, and codes.	Use a design strategy. Can follow and adapt a previous example competently, through the adequate use of engineeringresources such as manuals, standards, and codes.	Develop a design strategy,and improve on what has been done before, through the efficient use of engineering resources such as manuals, standards, and codes.
Develop alternativ e solutions.	Develop and compare multiple solutions, but doesnot usually arrive at the adequate result, with minorconsideration to economic, safety, environmental and other realistic constraints.	Develop and compare multiple solutions, and arriveat adequate result, with some consideration to economic, safety, environmental and other realistic constraints.	Develop several potential solutions finding optimum results considering economic, safety, environmental and other realistic constraints.
Design a complete system and produce references.	Design is complete system, but procedures and equations are not documented or referenced.	Design a complete system, but some procedures and equations are documented orreferenced.	Design a complete system. Produce a design procedurewith documentation and references.

SO 5

Communication - An ability to communicate effectively with a range of audiences.

Performance indicators	**2-Introductory**	**3-Developing**	**4-Mastery**
Compose technical narrative todescribe an engineering problem.	There is some but inconsistent accuracy and/orinappropriate use of technical language.	There is sufficient and accurate use of technicallanguage.	There is sophisticated/skilled,use of technical language.
Formulatecentral message /purpose.	Central message is understandable but insufficiently developed withsupporting material (e.g., not often repeated/ memorable).	Central message is welldeveloped.	Central message is compellingand very well developed with supporting material (e.g., precisely stated, appropriately repeated, memorable).
Develop quality visual aids.	Presentation of graphics wasfair. Figures and data not clearly understandable. Material did not flow smoothly. Contrast was poor.	Presentation was good; lacked some clarity. Took some concentration to understand. Contrast could be improved.	Graphical presentation was outstanding; clear and lucid. Easy to read and understand.Figures were clear, data easy to follow.

SO 6

Professionalism & Ethics - An ability to recognize ethical and professional responsibilities in engineering situations and make informedjudgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Performance indicators	1-Introductory	2-Developing	3-Mastery
Identify Engineering Situation: identify ethical and professional responsibilities.	Identify some evidence of knowledge of the engineering situation (ethical/professional), causal connections between problems and engineering. Engineering impacts not madeclear or only one context considered.	Identify several impacts of theengineering situation (ethical/professional) and its relation to engineering, showing understanding of more than one context.	Identify the main problem (ethical/professional) clearly oraccurately and addresses implicit or embedded engineering situation and their relations.
Analyze engineering solutions based on other perspectives and present his/her own perspective to the possible solutions.	State an engineering solution but is unclear or simplistic and obvious; recognizes the engineering solutions of otherstake but cannot articulate those solutions or properly evaluate the solution.	State specific position and acknowledges different sides ofthe engineering solution and attempts to consider the complexity of the subject matter; however, the analysis of solutions developed by other(s) are sometimes overly simplified.	State specific position considering the complexity of the engineering solution and acknowledging numerous solutions developed by others; accurately note limitations of the solutions by providing arguments/evidence to supportthem; recognize limits to one's own view as well.
Construct a solution considering global, economic, environmental, andsocietal contexts within the solution.	Clearly construct relevant information associated withone of the following areas: global, economic, environmental, and societalcontexts.	Clearly construct relevant information associated withtwo of the following areas: global, economic, environmental, and societalcontexts, considering some but not all the positive and negative impacts.	Clearly construct relevant information associated with three of the following areas: global, economic, environmental, and societal contexts, considering positiveand negative impacts.

Appendix C - Laboratories

Geospatial Information Systems Laboratory (Room 17-1671)

- Laboratory Director: Omar Mora
- Laboratory Sponsor: Intergraph Corporation

The following tasks are taught in this laboratory:

- Visualization and Animation
- Surface Modeling
- Alignment Design
- Template Design
- Roadway Modeling
- Cross-Section and Volume Calculations
- Oracle Data Base Design
- Geographical Information System Design
- SQL Query Development
- Data Base Table Design
- Feature and Attribute Linkage Design
- Photogrammetry Model Management
- Photogrammetric Model Setup
- Photogrammetric Aerial Triangulation
- Photogrammetric Manual Digital Terrain Model Data Collection
- Photogrammetric Automatic Digital Terrain Model Data Collection
- Photogrammetric Feature Collection
- Orthophoto Production
- Briefing of GPS field crews
- GPS pre-planning
- Download of GPS receivers
- Comprehensive Design Projects
- Subdivision Design
- 3D Modeling
- Laser Scanning
- The laboratory also contains various structural and water analysis software to support open laboratory sessions.

This laboratory has the following equipment and software:

- Hardware
    - 25 Dell 530 computers with 19 inch monitors, 1 GB ram, 40 GB hard drive, 80 GB hard drive, 3D labs 5110 video card and 100baseT network card.
    - Stereo-viewing glasses
    - HP 5000N laser printer with 11x17 capability
    - 1 – Proxima projector and screen
    - HP 650C plotter
- Software
    - Bentley MicroStation
    - Bentley Inroads
    - Intergraph IrasC
    - Intergraph ImageStation Photogrammetric Manager
    - Intergraph ImageStation ISAT
    - Intergraph ImageStation Stereo Display
    - Intergraph ImageStation Data Collection
    - Intergraph ImageStation Feature Collection

- Intergraph Orthophoto Pro
- Intergraph Automatic DTM Collection
- Intergraph Geomedia
- Intergraph SmartPlant Review
- Trimble Geomatics Office
- AutoCad Land Desktop
- ArcGis

Geospatial Research Laboratory (Room 17-1675)

- Laboratory Director: Omar E. Mora

The following tasks are completed in this laboratory:

- Processing of image data
- Processing of laser scanning data

This laboratory has the following equipment and software:

- Hardware
  - 2 Dell Optiplex 9020: Intel Core i7-4790 CPU,16 GB DDR,1 TB HDD, AMD 2GB video, Windows 7
  - 2 Dell 23" monitor and soundbar
  - 1 Dell Optiplex 9020: Intel Core i7-4790 CPU, 32 GB DDR, 2 TB Solid State Hybrid Drive, NVIDIA Quadro K2200 4GB, NVIDIA 3D Vision 2, Windows 7
  - 2 3D Ready (120Hz) Acer 24"GN246HL Monitor
  - 1 MS Kinect for Windows Developer Bundle
  - Stereo-viewing glasses
- Software
  - Bentley MicroStation
  - Bentley Inroads
  - Intergraph IrasC
  - Intergraph ImageStation Photogrammetric Manager
  - Intergraph ImageStation ISAT
  - Intergraph ImageStation Stereo Display
  - Intergraph ImageStation Data Collection
  - Intergraph ImageStation Feature Collection
  - Intergraph Orthophoto Pro
  - Intergraph Automatic DTM Collection
  - Intergraph Geomedia
  - Intergraph SmartPlant Review
  - AutoCAD Civil 3D
  - ArcGIS
  - Quick Terrain Modeler (QTM)

Surveying and Geomatics Laboratory (Room 17-1679)

- Laboratory Director: Allan Ng

The following tasks are completed in this laboratory:

- Storage of surveying equipment
- Briefing of field crews
- Comprehensive Design Projects

Surveying Laboratory Equipment Room (Room 17-1679A)

- Laboratory Director: Allan Ng

The following tasks are completed in this laboratory:

- Storage of surveying equipment

- Briefing of field crews
- Senior projects

The laboratory has the following equipment:

- 2 Trimble 3300 total stations
- 2 Trimble 3600 total stations
- 2 Trimble 5000 total stations
- 2 Trimble 5600 robotic total stations
- 4 Trimble S5 robotic total stations
- 2 Trimble S7 robotic total stations
- 6 Leica TS02 total stations
- 2 Trimble RMT 606 360° remote target
- 6 Trimble multitrack targets
- 15 tripods
- 12 Prism poles
- 12 Reflectors
- 6 Leica Digital Levels
- 2 Trimble Digital Levels
- 5 Set Automatic levels
- 6 level rods and accessories
- 11 metric level rods and accessories
- 12 Motorola walkie talkies
- 2 Trimble Trimmark 3 GPS external radios
- 3 Trimble 4000 GPS receivers
- 3 Trimble Geodetic compact L1/L2 plus ground plane antennas
- 4 Trimble 5700 GPS receivers
- 2 Trimble Zephyr Geodetic GPS antennas
- 2 Trimble Zephyr GPS antennas
- 4 Trimble TSCe data collectors
- 6 Trimble TSCe 3 data collectors
- 2 Trimble GPS fixed height tripods
- 1 Trimble GX Laser scanner

Fluids and Hydraulics Laboratory (Room 17-1468)

- Laboratory Director: Kenneth Lamb

The laboratory has the facilities to perform the following tests:

- Flow Rates
- Energy loss in pipes
- Minor losses
- Pipes in parallel
- Pipes in series
- Pump characteristics
- Velocity and flow measurements in open channels
- Critical depth and hydraulic jump
- Velocity profiles
- Culvert Inlet Performance

The laboratory has the following equipment:

- Pipe rack
- 12” x 35’ acrylic flume
- Pump Assembly
- Turbine meter
- Venturi system
- Electronic watt meter.
- Pump assembly with 500gpm motor
- Turbine meter, model 8002, 25-300 gpm
- FQ 100 totalizer
- Pressure gages
- Magnetic Flow meter
- Lab scale conventional water treatment plant systems
- Lab scale Reverse Osmosis system

Geotechnical Engineering Laboratory (Room 17-1480/1480A)

- Laboratory Director: Mehrad Kamalzare

The laboratory has the facilities to perform the following tests:

- Moisture content (oven method)
- Grain size distribution by sieve (4 complete sets)
- Grain size distribution by hydrometer (10 complete sets)
- Plastic Limit (8 complete sets)
- Liquid limit (4 complete sets)
- Hydraulic conductivity by constant head method (4 constant head permeameters)
- Proctor compaction (5 complete sets)
- Field density (sand cone method - 5 complete sets)
- Direct shear (1 machines with 3 sample holders)
- Ring shear
- Unconfined compression
- Consolidation (4 simultaneous tests)
- Sand Equivalent
- ***Trailer Mounted Drill Rig***
- ***Triaxial Testing Equipment***

The laboratory also has the following lab and field equipment:

- Geomatic three-station direct shear machine with automated data collection system
- 8 – Geomatic consolidometers
- Wykeham-Farrance ring shear machine
- 4 – Geonor constant-head permeameters
- Slope Indicator inclinometer probe, readout unit, and cable
- Slope Indicator SONDEX probe
- Groundwater observation well probe
- Sieve shaker
- 2 – thermal ovens
- 2 – microwave ovens
- Kneading compactor
- Hand augering and soil sampling equipment

Computer hardware and software consists of:

- 2 – Dell GX110 800 MHz computers for data collection
- Geomatic direct shear data collection

The laboratory also includes an array of basic testing equipment, including liquid and plastic limit devices, hydrometers, sieves, Proctor compaction molds, sand cone devices, hand tools, etc. Other equipment, such as a CPT probe and an SPT sampler are used as classroom exhibits.

Structural Mechanics Laboratory (Room 17-1660)

- Laboratory Director: Felipe Perez

The laboratory has the facilities to perform the following tests:

- The behavior of beams, frames, arches, trusses and bridges
- The behavior of elements on shake table

The laboratory has the following equipment

- Seven universal test frames used to mount prototype beams, frames, arch, truss and bridges
- Multi-channel data acquisition system
- Multiple strain gauges mounted on prototype specimens to measure strain
- LVDT’s (displacement transducers) mounted on specimens to measure deflection
- Rotation meters mounted on specimens to measure rotation
- Digital scales
- Rebarscope basic with Rebarlink software for rebar location and bar size determination

- V-meter MK IV Ultrasonic pulse velocity system for finding voids and cracks.
- Low-impact digital rebound hammer for concrete compressive strength analysis
- Enerpac manual pump and cylinder (20-ton capacity)
- ***Quanser x-y Shake Table III:- Bi-axial shake table with 120 kg payload at ±1.0g peak acceleration, table size is 40" x 25", computer driven motions and data acquisition***
- ***MTS Tabletop Instructional Shake Table: - Uniaxial shake table with 25 lb payload with ±1.0g acceleration, table size is 17" x 13", data acquisition system***

In addition, a Magnus HPM-1 universal test frame with accessories and hydraulic ram system is located in Building 13, and can be used to load beams and other structural elements.

Water Analysis Laboratory (17-1672)

- Laboratory Director: Mónica Palomo

This laboratory has equipment to perform the following tests:

- Turbidity
- Apparent and true color
- Total and chlorine
- Iron
- Conductivity
- Dissolved solids (TDS)
- Total coliform bacteria (MPN, membrane and Colilert methods)
- Microbial investigation
- Alkalinity, acidity, pH
- Total, calcium and magnesium hardness
- Dissolved oxygen (DO)
- Temperature
- Jar test
- Biochemical oxygen demand (BOD)
- Total solids
- Suspended solids
- Settleable solids
- Ammonia nitrogen
- Nitrate nitrogen
- Nitrite nitrogen
- Chemical oxygen demand (COD)
- Sulfate
- Total organic carbon

The laboratory has the following equipment

- 2100 N Turbidity meter Reverse osmosis demonstration unit
- Benchtop pH meter
- Benchtop meter with DO, temperature and ORP probes
- Jar Test -apparatus
- Electronic balance
- Incubator
- New Oven
- Muffle furnace
- Microscope and ancillary equipment
- COD and TOC digesters
- Emergency eye wash and shower
- Filtering apparatus for TDS/SS

- Filtering apparatus for membrane filter coliform test
- Vacuum pumps
- Desiccator
- Autoclave
- ***Sharp LC 70" TV and computer with wireless connection -CruciaL 16GB Memory and SS Hard Drive to display information to students and visitors***
- ***Beckman Coulter centrifuge***
- ***Maxq 2000 digital Orbital Shaker***
- ***DR 6000 UV VIS Spectrophotometer***
- ***Dionex ICS-1100 and ICS 2100 Ion Chromatography***
- ***Ion chromatograph AS-DV Auto sampler***
- ***Shimadzu TOC-LC with an auto sampler***
- ***IDEXX sealer and lamp***

Concrete Analysis Laboratory (Room 17-1676)

- Laboratory Director: Rosa Vasconez

The laboratory has the facilities to perform the following tests:

- Stress-strain behavior of synthetic materials
- Aggregate bulk unit weight, moisture content, specific gravity, California Bearing Ratio
- Asphalt concrete compaction, curing, and Marshal stability
- Portland cement concrete slump, compressive strength, split tensile strength, and flexural strength

The laboratory also stores the following field equipment:

- Ovens
- Heat plate
- ELE Versatester 30 M
- Concrete air entrainment measuring instrument
- Light weight roller
- Mixing pans
- Slump cones
- Cylinder molds
- Aggregate storage bins
- Concrete test hammer
- Electronic precision balance
- Asphalt concrete compaction equipment

Transportation Laboratory (Room 17-2646)

- Laboratory Director: Xinkai Wu

The following tasks are completed in this laboratory:

- Transportation analyses and designs
- Comprehensive Design Projects

This facility has the following equipment:

- 10 Dell GX 260 computers
- HP 5000N laser printer (11x17 capability)
- HP color plotter
- 1 Proxima projector

This facility has the following computer software

- Aquifer Test
- ArcGIS (Geographical Information System)
- Aries (Intelligent Transportation Systems)
- AutoCAD 2004 (CAD)

- AutoTurn (Roadway geometric Design)
- CAICE (Civil design)
- Cube (Transportation Planning)
- ETABS (Structural analysis)
- gINT (Geotechnical data reduction and boring log preparation)
- GMS (Groundwater Modeling)
- HEC-RAS (Hydrology)
- InRoads Suite (Civil design)
- Matlab (General analysis)
- Microsoft Office (Word processing, spreadsheet, etc.)
- Microsoft Visual Studio (Programming)
- Microstation v8 (CAD)
- PCA Mats (Mat foundation analysis)
- QuicNet (Intelligent Transportation Systems)
- R (Statistic analysis)
- SAP 2000 (Structural analysis)
- Solidworks 2004 (CAD)
- STEDWin/PCSTABL (Earth slope stability analysis)
- Synchro (Traffic modeling and simulation)
- TransCAD (Transportation Planning)
- VISSIM & VISUM (Traffic modeling and simulation)
- Visual Nastran (Finite Element Modeling)
- Watershed Modeling System
- Winflow

This facility has the following transportation systems equipment

- Dell GX 280 computer
- 2 traffic controller testers (one for NEMA and one for Type 170)
- Radar gun
- 2 pneumatic traffic counters
- 6 NEMA traffic signal controllers
- 5 Type 170 traffic signal controllers
- Traffic controller cabinet
- Manual board traffic counter
- Planimeters and drafting equipment
- Reference documents, including highway and street design manuals, standard specifications, standard public works drawings
- Cal Poly Pomona Intelligent Transportation System (ITS). The Cal Poly Pomona ITS consists of six McCain 170 and 2070 controllers to simulate the traffic control strategies on Temple Avenue, City of Pomona.
- AVL-Based Bronco Shuttle System. The Automatic Vehicle Location (AVL)-based Bronco Shuttle system has been developed and deployed on Cal Poly Pomona school buses. The system provides a live ITS testbed so that students can retrieve real time data of buses for analysis. Video-Detection Demo System. Iteris has donated Cal Poly Pomona a video-detection system. This system uses imaging processing technologies to detect vehicles for traffic controls at intersections. This system has been used in the CE509 Intelligent Transportation Systems course.
- Upgraded Computers and Plotter. All the computers have been updated since last ABET visit thanks to the grants received from the University. A new plotter has been purchased. The computers and the plotter support transportation-related courses.
- VPN Connections to IEN and RIITS. The VPN connection to Integrated Exchange Network (IEN) of Los Angeles County Public Works allows students to view and use traffic control data (real time) of cities within Los Angeles County. The Connection to Regional Integrated Intelligent Transportation System

(RIITS) allows students to access real time data of multi-transportation systems (freeway systems, ramp meters, buses, traffic control system, incident monitoring system, etc) within Southern California.

- A set of Transportation-related software packages. Transportation-related software packages have been obtained either through research grants, outside donations, or inside support from the Department. The primary software packages that support transportation courses are:
- Traffic Simulation Software VISSIM an VISUM (purchased through outside donations) Traffic Timing and Simulation package Synchro (Purchased through research grants)
- Traffic Control System Centracs (donated by Econolite)
- Traffic Control System QuicNet Pro (donated by McCain)
- Traffic Control System CTNET (Donated by Caltrans)
- Noise Analysis Model (INM 7.0 purchased by the Department)
- Transportation Modeling Software Cube (donated by Citilabs)
- Autodesk AutoCAD Civil 3D (purchased by the Department)
- Bentley InRoads and InRail (purchased by the Department)
- Other Transportation Engineering Equipment
- Speed Gun
- Traffic Control System Simulators
- Tube-based traffic counters and related software
- Manual Traffic Counters
- Solar Powered Signal (donated by JSF Inc.)
- A full set of school signs for demonstration (donated by Item Ltd.)

Infrastructure Laboratory/BIM (Room 17-2676)

- Laboratory Director: Jinsung Cho

The following tasks are completed in this laboratory:

- Basic CAD training – MicroStation
- Computer Programming – Visual Basic and HTML
- Structural Engineering Design
- Ground Water Modeling

The laboratory has the following equipment and software:

- Hardware
    - 28 Dell Optiplex GX280, 3.4 GHz processor, 16.0 GB RAM
    - HP 5000N laser printer with 11x17 capability
    - 1 Proxima projector with screen
- Computer software
    - ArcGIS (Geographical Information System)
    - AutoCAD 2017 (CAD, MS ProjectNaviswork Manage, Revit Architecture)
    - Bluebeam Software (Construction Estimating)
    - ETABS (Structural analysis and design)
    - GMS (Groundwater Modeling)
    - Haestad StormCAD (hydraulic modeling)
    - Haestad WaterCAD (hydraulic modeling)
    - InRoads Suite (Civil design)
    - Matlab (General analysis)
    - Microsoft Office (Word processing, spreadsheet, etc.)
    - Microsoft Visual Studio (Programming)
    - MicroStation v8 (CAD)
    - PCA Mats (Mat foundation analysis)
    - Primavera6 (Construction Scheduling)
    - Rockscience (Geotechnical Analysis)
    - SAP 2000 (Structural analysis and design)

- Solidworks 2004 (CAD)
- STEDWin/PCSTABL (Earth slope stability analysis)

Sustainable Land Development Laboratory (17-2670)

- Laboratory Director: Xinkai Wu

The Sustainable Land Development Laboratory was created in 2007 utilizing space that was previously assigned to another department. This new laboratory was made possible by $83,000 in donations from thirteen local corporate sponsors.

The following tasks are completed in this laboratory:

- Basic CAD training – MicroStation
- Computer Programming – Visual Basic and HTML
- Structural Engineering Design
- Ground Water Modeling

The laboratory has the following equipment and software:

- Hardware
  - 28 Dell Optiplex 745, 3.4 GHz Dual Core processor, 16.0 GB RAM
  - HP 5000N laser printer with 11x17 capability
  - 1 Proxima projector with screen
- Software
  - ArcGIS (Geographical Information System)
  - AutoCAD 2004 (CAD)
  - ETABS (Structural analysis and design)
  - GMS (Groundwater Modeling)
  - Haestad StormCAD (hydraulic modeling)
  - Haestad WaterCAD (hydraulic modeling)
  - InRoads Suite (Civil design)
  - Matlab (General analysis)
  - Microsoft Office (Word processing, spreadsheet, etc.)
  - Microsoft Visual Studio (Programming)
  - MicroStation v8 (CAD)
  - PCA Mats (Mat foundation analysis)
  - SAP 2000 (Structural analysis and design)
  - Solidworks 2004 (CAD)
  - STEDWin/PCSTABL (Earth slope stability analysis)
  - TransCAD (Transportation Planning)
  - VISSIM & VISUM (Traffic modeling and simulation)

Project Fabrication Laboratory (Room 13-1114)

- Laboratory Director: Giuseppe Lomiento

The special projects laboratory is used for the annual concrete canoe and steel bridge projects, as well as other student projects that require fabrication. It is equipped with indoor and covered outdoor workspace, drilling and sawing tools, air compressors, steel frames tensioning systems, tool and materials storage space, etc.

Appendix D – CE Strategic Plan



Civil Engineering

The 2021-2026 Strategic Plan

Final Draft

For Internal CE Department Use Only
Includes draft strategies from initial plan development

Final Draft

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Contents

Introduction 4

Strategic Plan Framework 5
A Framework for the Future: Focus Areas and Goals 7
FOCUS AREA: PROGRAM QUALITY 8
FOCUS AREA: COMMITMENT TO CONTINUED CULTURE IMPROVEMENT 8
FOCUS AREA: EMPOWERING THE TEACHER-SCHOLAR MODEL 8
FOCUS AREA: CURRICULUM ENHANCEMENT AND IMPROVEMENT 9
FOCUS AREA: GRADUATE PROGRAM 10
FOCUS AREA: INDUSTRY ENGAGEMENT 10
Strategic Plan Alignment with the College Plan 11
Strategic Planning Process 12
Acknowledgments 13

Final Draft

Introduction

The Civil Engineering Department (CE) is one of seven exceptional departments within the College of Engineering (COE) at Cal Poly Pomona (CPP). CE is a leader in polytechnic education, where hands-on learn-by-doing is the foundation of a broad-based educational experience. We have one of the largest undergraduate Civil Engineering programs in the United States and produce approximately 15 percent of young civil engineers in California. Our CE faculty and staff are committed to preparing students to succeed in their chosen field. We offer undergraduate degrees in Civil Engineering (BSCE), with options in general civil, environmental, and geospatial engineering, and in Construction Engineering and Management (BSCEM). We also offer a Master of Science degree in Civil Engineering (MSCE) with options in construction engineering and management, environmental and water resources, geotechnical, structural, and transportation Engineering. To meet the challenges of an evolving society, we provide practice- oriented civil engineering education that fosters personal, professional and social responsibility; technical excellence and creativity; and effective communication, teamwork and leadership. Aswe move forward, we will excel in offering an inclusive, practice-oriented, world class Civil Engineering education that changes people's lives.

> "It is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs and homes to men [and women]. Then it elevates the standards of living and adds to the comforts of life. That is the engineer's high privilege."
>
> -Herbert Hoover

Yasser S. Salem, Ph.D
Department Chair and Professor

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Strategic Plan Framework

On February 23, 2021 the CE strategic planning team began its work to conduct an inclusive and collaborative process that will ultimately guide the department direction in the coming years and ensure alignment with the strategic initiatives of the college and the university.

Focus groups and interviews were conducted with faculty, staff, students, alumni and industry partners to gain a thorough understanding of the current situation and desired future outcomes of this department. In total, nearly 1,000 comments were analyzed to develop a draftplan.

The vision, mission, and values established as part of the COE strategic plan hold true for its departments and all members of the organization. But departments within a college or organization have essential roles and responsibilities in making the vision reality. The primary functions of this strategic plan are two-fold: 1) to understand the unique role of CE in helping to fulfill the COE strategic plan and, 2) to articulate what the college-wide core values mean for CE's decision-making and organizational interactions. It is only through clear understanding of both that allows the department to then set clear, specific goals and management strategies needed to realize its strategic objective. The plan serves as the CE strategic objective from 2021to 2026. The goals described in this plan will better define the role that hands-on learning and research has in preparing students for careers in Civil Engineering, promote a supportive and inclusive culture and focus on partnerships that provide high quality facilities to further faculty and student success through research and learning.

2 The COE Vision

Cal Poly Pomona College of Engineering's learn by doing education prepares engineers to transform imagination into reality.

3 The COE Mission

Prepare students for industry and advanced studies by implementing an inclusive polytechnic philosophy through collaborative teamwork, innovation, entrepreneurship and professional integrity.

CE Strategic Objective

We excel at delivering an inclusive, practice-oriented, world class Civil Engineering education that changes people's lives.

4 Core Values

Core values are the basis upon which we strategize, make decisions, and interact with each other and our stakeholders. The values of *People Centered, Collaborative, Forward-Thinking, Transparent, and Bold* represent what is important to the whole of the College of Engineering.

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Core values need to be integrated into every interaction, process and function. CE has added desired cornerstone behaviors to the college core values statements to help shape our envisioned culture. These principles guide our internal conduct and external relationships to ensure we stay true to our strategic objective and provide a critical foundation for developing the goals and strategies necessary to achieve our vision.

People Centered

5 'We invest in people and celebrate success."CE Desired Behavior(s)

Strive for excellence in all that we do to ensure a quality education.

Create a safe learning environment.

Celebrate people to recognize them for accomplishments and success.

Collaborative

6 "We create an environment of collegiality, ownership, and engagement."CE Desired Behavior(s)

Create a welcoming environment through active listening, open mindedness, and responsiveness to others' needs.

Leverage our strengths.

Forward-Thinking

7 "We strive to be proactive, creative, and innovative."CE Desired Behavior(s)

Embrace testing and learning in an agile way.
Learn from the past to create a better future.

Generate buy-in for new ideas to understand feasibility.

Transparent

8 "We are committed to maintaining an environment of open, honest, and inclusive communication."

CE Desired Behavior(s)

Maintain a resource sharing environment.

Model expectations about roles and responsibilities.

Make informed and data-driven decisions.

Balancing innovative solutions with responsibility for our stakeholders.

Bold

9 We value grit, innovation, risk-taking, and learning from challenges.

CE Desired Behavior(s)

Empower others to be innovative, creative and curious.

Encourage diverse talents and contributions.

Explore and be open to new technology.

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A Framework for the Future: Focus Areas and Goals

The focus areas and goals described in this section address existing and developing issues, challenges and opportunities that we have identified as most important to the current and future vitality of education. These goals resulted from a thorough analysis of department practices, opportunities, challenges and organizational member values, including faculty, staffand student input.

Each focus area is supported by one or more goals and a number of strategies which in turn are supported by planned actions. Goal statements are deliberately written to define the intended accomplishments or conditions. In this way, organizations create a clear roadmap to success and establish the framework to get there. Detailed operational plans will be developed and implemented annually in support of the goals outlined here.

10 Goal #1:

CE is a nationally ranked program where engineering students develop skills that demonstrate professional excellence in our discipline.

11 Goal #2:

CE is a welcoming and supportive environment for students, faculty, and staff.

12 Goal #3:

CE continues to implement effective systems and fosters opportunities for faculty and staff to work efficiently and grow professionally.

13 Goal #4:

CE engages in research and innovation as the means to support the teacher-scholar mode

14 Goal #5:

CE delivers a cutting-edge, high-tech curriculum to align with the latest industry trends.

15 Goal #6:

The CE Graduate Program is the preferred educational choice for professionalsto expand their knowledge and the value they bring to industries world-wide.

16 Goal #7:

CE expands key partnerships for engagement in academicand professional development and practice.

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FOCUS AREA: PROGRAM QUALITY

Goal #1: CE is a nationally ranked program where engineering students develop skills that demonstrate professional excellence in our discipline.

STRATEGIES	Year Priority 1	2	3	4	5
1.1 Provide leading edge professional development certifications.					
1.2 Create micro-certifications to provide periodic successes along the degree path.					
1.3 Develop opportunities for CE alumni and industry to network and mentor students					

FOCUS AREA: COMMITMENT TO CONTINUED CULTURE IMPROVEMENT

Goal #2: CE is a welcoming and supportive environment for students, faculty, and staff.

STRATEGIES	Year Priority 1	2	3	4	5
2.1 Provide conflict resolution training to encourage greater learning and productivity.	tbd				
2.2 Host a variety of social activities to build strong, trusted relationships with each other, students, and alumni.	tbd				
2.3 Create staff, faculty, and student appreciation events.	tbd				
2.4 Use social media presence to provide support to department members (resources, meet-ups, connections).	tbd				
2.5 Create and practice guidelines for respectful conversation for all members of the department (students, faculty, staff)	tbd				
2.6 Provide students with diversity and inclusion training to foster the value of diversity in the engineering discipline.	tbd				

Goal #3: CE continues to implement effective systems and fosters opportunities for faculty and staff to work efficiently and grow professionally.

STRATEGIES	Year Priority 1	2	3	4	5
3.1 Sustain excellence by increasing department support staff to serve our growing student population and faculty.					
3.2 Research comparable staffing levels within the CSU system.					

FOCUS AREA: EMPOWERING THE TEACHER-SCHOLAR MODEL

Goal #4: CE engages in research and innovation as the means to support the teacher-scholar model.

STRATEGIES	Year Priority 1	2	3	4	5
4.1 Engage more students in under-graduate research and industry internships. ○ Draft Action 1: Increase support for hourly under-graduate research assistants. ○ Draft Action 2: Hold departmental graduation luncheon to					

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Goal #4: CE engages in research and innovation as the means to support the teacher-scholar model.	Year Priority				
STRATEGIES	1	2	3	4	5
acknowledge seniors active in research. ○ Draft Action 3: Solicit non-industry scale research projects to bring to campus.					
4.2 Create initiatives to team teach relevant case studies to solve societal challenges.					
4.3 Expand professional development opportunities for faculty-conferences, training, networking, research, and grant writing.					

FOCUS AREA: CURRICULUM ENHANCEMENT AND IMPROVEMENT

Goal #5: CE delivers a cutting-edge, high-tech curriculum to align with the latest industry trends.	Year Priority				
STRATEGIES	1	2	3	4	5
5.1 Incorporate coding, data analytics, and advanced technology courses into our comprehensive curriculum.					
5.2 Engage students in a plethora of extracurricular activities, clubs, and competitions that enhance student experience.					
5.3 Create and foster a student-centered, educational paradigm that integrates technical, global, and professional competencies in our graduates. (Rigor) ○ Draft Action 1: Promote under-grad innovation and entrepreneurship. ○ Draft Action 2: Engage Advisory Board committee as a component of a comprehensive curriculum review to better align needs of employers.					
5.4 CE demonstrates high-quality, 1:1 student advising that supports students' evolving needs and goals. ○ Draft Action 1: Use department meetings to train faculty on student advising, e.g. best practices for 1:1 advising and when to refer to professionals. ○ Draft Action 2: Promote pedagogy training for faculty as part of professional development workshops and seminar series.	x				
5.5 Explore opportunities to increase accessibility to fieldwork to ensure people of varying physical abilities as well as people from varying economic or social backgrounds are welcome and encouraged to the major.					
5.6 All CE professors maintain a commitment to technology proficiency to support ease in student communication and learning.					

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FOCUS AREA: GRADUATE PROGRAM

Goal #6: The CE Graduate Program is the preferred educational choice for professionals to expand their knowledge and the value they bring to industries world-wide.	**Year Priority**				
STRATEGIES	1	2	3	4	5
6.1 Strengthen the pipeline of high-quality CE recruits for our graduate program.	x				
6.2 Implement a continuous improvement program that assesses the needs of our prospective graduate students and industry, and implements changes from this research.					
6.3 Identify best graduate classes to advise undergraduates to take that will introduce students to the benefits of furthering their education through an advanced degree.					
6.4 Create a graduate degree information session (frequency?) to expose students to the difference between undergraduate and graduate programs.					

FOCUS AREA: INDUSTRY ENGAGEMENT

Goal #7: CE expands key partnerships for engagement in academic and professional development and practice.	**Year Priority**				
STRATEGIES	1	2	3	4	5
7.1 Identify all customer groups and their value propositions.					
7.2 Offer Summer fellowships for faculty to gain professional development in conjunction with Industry.					
7.3 Enhance professional development opportunities for faculty to ensure the needs of industry and students are integrated within the CE model.					
7.4 Engage industry in offering training to students to improve professional workplace skills. ○ Draft Action 1: Ask CE Advisory Board or Dean's Leadership Board toassist with specific skills students need for the workplace, such as selling, communicating, good meeting skills, etc.					

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Strategic Plan Alignment with the College Plan

CE Strategic Plan	COE Strategic Plan Focus Areas
FOCUS AREA: PROGRAM QUALITY **Goal #1** CE is a nationally ranked program where engineering students develop skills that demonstrate professional excellence in our discipline.	**FOCUS AREA:** STUDENT SUCCESS
FOCUS AREA: COMMITMENT TO CONTINUED CULTURE IMPROVEMENT **Goal #2:** CE is a welcoming and supportive environment for students, faculty, and staff. **Goal #3:** CE continues to implement effective systems and fosters opportunities for staff to work efficiently and grow professionally.	**FOCUS AREA:** CULTURE
FOCUS AREA: EMPOWERING THE TEACHER-SCHOLAR MODEL **Goal #4:** CE engages in research and innovation as the means to support the teacher-scholar model.	**FOCUS AREA:** FACULTY AND STAFF EXCELLENCE
FOCUS AREA: CURRICULUM ENHANCEMENT AND IMPROVEMENT **Goal #5:** CE delivers a cutting-edge, high-tech curriculum to align with the latest industry trends.	**FOCUS AREA:** EXPERIENTIAL LEARNING
***FOCUS* AREA*:* GRADUATE PROGRAM** **Goal #6:** The CE Graduate Program is the preferred educational choice for professionals to expand their knowledge and the value they bring to industries world-wide.	**FOCUS AREA:** RESOURCE DEVELOPMENT AND EXCELLENCE
FOCUS AREA: INDUSTRY ENGAGEMENT **Goal #7:** CE expands key partnerships for engagement in academic and professional development and practice.	**FOCUS AREA:** STRATEGIC PARTNERSHIPS AND INDUSTRY ENGAGEMENT

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Strategic Planning Process

On February 23, 2021 the Civil Engineering Department strategic planning team began its work to conduct an inclusive and collaborative process that will ultimately guide the department direction in the coming years and ensure alignment with the strategic initiatives of the college and the university. The core team followed a Strategic Directioning framework and the Organizations of Character Model™ [1] to ensure a comprehensive work product that addressed planning needs as well as successful plan implementation.

The following list describes the processes and decisions the team worked through during development of this plan.

1. Agree to project scope and timeline recognizing work will be online with shorter duration meetings due to the COVID-19 pandemic.
2. Initialize understanding of the "current situation".
   - Identify key stakeholders: CE Faculty, Staff, Students, Alumni, and Industry Representatives.
   - Gather a variety of stakeholder input through one-to-one virtual interviews and focus groups.
     i. Each group was asked the same questions to understand what key indicators represent CE future success, behaviors that are working and behaviors that are not working, what groups need most from CE.
3. Define Cornerstone behaviors to create a conscious understanding around each COE core value.
   - Identify ways to demonstrate and connect the core values with each key stakeholder.
     i. Faculty, Students, Staff and University/COE peers
4. Claim the future by discussing important goals, feedback and what success looks like.
   - Analyze and identify themes from all information received.
   - In context of the COE vision and mission, identify the CE strategic objective.
     i. The strategic objective is the long-term desired condition or change resulting from departmental work and programs. It is what makes the department different and why it matters to the COE.
   - Identify goals and strategies to further the department strategic objective and the COE vision and mission.
   - Prioritize Year 1 strategies.
5. Provide opportunity for stakeholder feedback to the draft plan.
6. Finalize strategic plan.

[1] The Organizations of Character Model© can be found on the K2OHSolution website https://www.k2ohsolutions.com/organizational-development/

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Acknowledgments

We owe enormous thanks to the many individuals who volunteered their opinions, shared theirknowledge, participated in surveys or interviews, donated their time and helped develop this plan. Thank you to our students for their honest and constructive feedback. Finally, thank you Dean Baski for her generous support of the CE Strategic Planning Team.

17 Strategic Planning Team

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