California State Polytechnic University, Pomona

Abbreviated Academic Program Review Self-Study
College of Engineering
Department of Civil Engineering
BS Civil Engineering
BS Construction Engineering and Management

(ABET accredited)

AY 2023-2024

Spring 2025

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1 PROGRAM EVALUATION – BS CIVIL ENGINEERING

1.1 Curriculum and Pedagogy – BS Civil Engineering

Tables 1 and 2 provide data associated with high non-passing rates for Civil Engineering – general option and Civil Engineering – environmental option. Note the enrollment numbers for the geospatial option are not high enough to be presented. It is important to note that the numbers reported below are based on filtering the data by major, so only students enrolled as the Civil Engineering degree program are included in the counts.

Table 1 – Civil Engineering Program High – DFW's by Non-Pass Rates for 2018-2023[1]

Non-Passing					
Year Term	Course Code	Course Title	Enrollment	Non-passing Rate	Impact
All Academic Years - Semester	CE4540	Bridge Design	11	27%	3
All Academic Years - Semester	CE3501	Structural Analysis I	1188	19%	224
All Academic Years - Semester	CE4201	Water and Wastewater Egr	101	19%	19
All Academic Years - Semester	CE2041	Engineering Statics	1135	16%	184
All Academic Years - Semester	CE4560	Structural Design - Steel	601	15%	88
All Academic Years - Semester	CE4510	Strctrl Dsgn Reinfrcd Concrete	838	14%	117
All Academic Years - Semester	CE4530	Structural Design - Timber	228	13%	30
All Academic Years - Semester	CE4241	Environmental Remediation	39	13%	5
All Academic Years - Semester	CE2051	Mechanics of Materials	1246	12%	145
All Academic Years - Semester	CE3510	Structural Analysis II	354	12%	41
All Academic Years - Semester	CE1101L	Construction Drafting Lab	49	12%	6
All Academic Years - Semester	CE1101	Construction Drafting	49	12%	6
All Academic Years - Semester	CE4321L	Subdiv Eng Lnd Srvy Desc Lab	129	9%	12
All Academic Years - Semester	CE4321	Subdvsn Egr Land Survey Desc	129	9%	12
All Academic Years - Semester	CE4301L	Digital Mapping Laboratory	108	9%	10
All Academic Years - Semester	CE4301	Digital Mapping	108	9%	10
All Academic Years - Semester	CE1001	Civil Engineering	1284	8%	101
All Academic Years - Semester	CE1001L	Civil Engineering Laboratory	1284	8%	100
All Academic Years - Semester	CE4530L	Structural Design Timber Lab	228	8%	19
All Academic Years - Semester	CE3301	Engineering Geomatics	414	7%	29
All Academic Years - Semester	CE3201	Environmental Engineering	288	7%	21
All Academic Years - Semester	CE2071	Engineering Mechanics Dynamic	28	7%	2
All Academic Years - Semester	CE3601	Transportation Engineering	1067	6%	62
All Academic Years - Semester	CE3211	Water Resources Engineering	783	6%	50
All Academic Years - Semester	CE4690	Traffic Engineering	123	6%	7
All Academic Years - Semester	CE4631	Trans Systems Design and Op	49	6%	3

[1] CSU Dashboard "In Which Courses Do They Struggle" Report https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle

Table 2 – Civil Engineering Program– Environmental Option High – DFW's by Non-Pass Rates for 2018-2023[2]

Non-Passing					
Year Term	**Course Code**	**Course Title**	**Enrollment**	**Non-passing Rate**	**Impact**
All Academic Years - Semester	CE3501	Structural Analysis I	90	22%	20
All Academic Years - Semester	CE2051	Mechanics of Materials	226	17%	38
All Academic Years - Semester	CE2041	Engineering Statics	200	17%	34
All Academic Years - Semester	CE4301	Digital Mapping	13	15%	2
All Academic Years - Semester	CE4301L	Digital Mapping Laboratory	13	15%	2
All Academic Years - Semester	CE3501L	Structural Design Laboratory	78	12%	9
All Academic Years - Semester	CE4331L	Gis Apps In Eng Rmte Snsng Lab	18	11%	2
All Academic Years - Semester	CE3301	Engineering Geomatics	88	10%	9
All Academic Years - Semester	CE3601	Transportation Engineering	67	10%	7
All Academic Years - Semester	CE4321	Subdvsn Egr Land Survey Desc	22	9%	2
All Academic Years - Semester	CE4321L	Subdiv Eng Lnd Srvy Desc Lab	22	9%	2
All Academic Years - Semester	CE3150	Construction Eqpmnt and Safety	11	9%	1
All Academic Years - Semester	CE4201	Water and Wastewater Egr	193	8%	16
All Academic Years - Semester	CE4241	Environmental Remediation	171	8%	13
All Academic Years - Semester	CE4341L	Satellite Surveying In Eng Lab	12	8%	1
All Academic Years - Semester	CE1001L	Civil Engineering Laboratory	256	7%	17
All Academic Years - Semester	CE1001	Civil Engineering	256	7%	17
All Academic Years - Semester	CE2061	Fluid Mechanics	211	7%	15
All Academic Years - Semester	CE2070	Comp Programming and Num Metho	169	7%	11
All Academic Years - Semester	CE4231	Water Reclamtn and Desalintn	27	7%	2

[2] CSU Dashboard "In Which Courses Do They Struggle" Report
https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle

Figure 1 depicts the civil engineering department courses with the largest equity gaps for URM and non-URM students for all terms from 2018-2023. Figure 2 depicts the civil engineering department courses with the largest equity gaps for Pell recipients and non-Pell recipients. The scale uses grades (*1 = D; 2 = C; 3 = B; 4 = A*). This data encompasses all the civil engineering department programs (Civil Engineering and the Construction Engineering and Management programs).

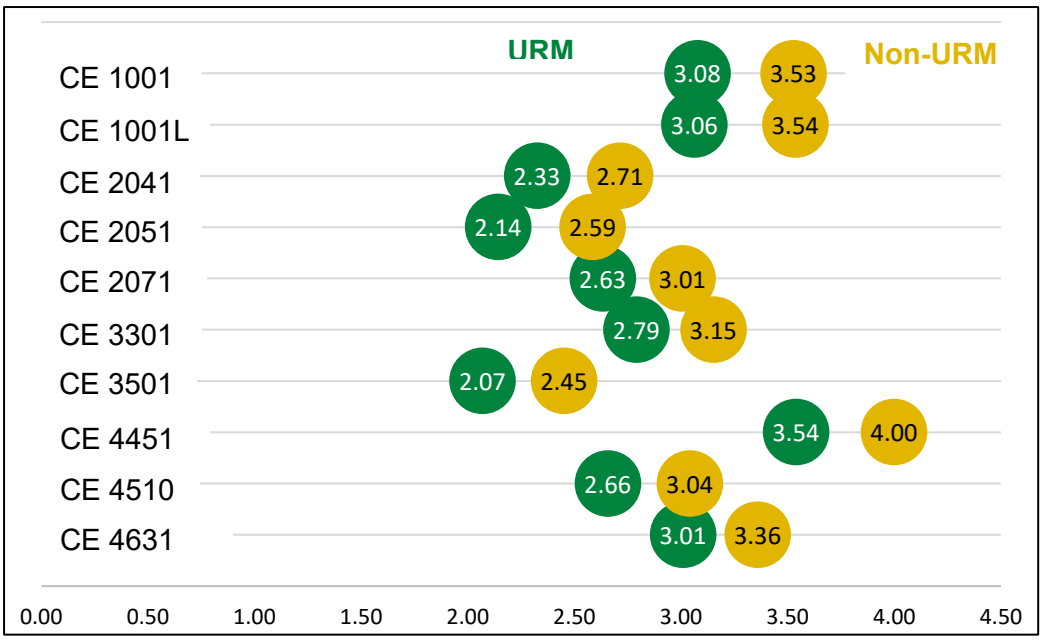

Figure 1– Courses with the Largest Equity Gaps by URM Status for Civil[3]

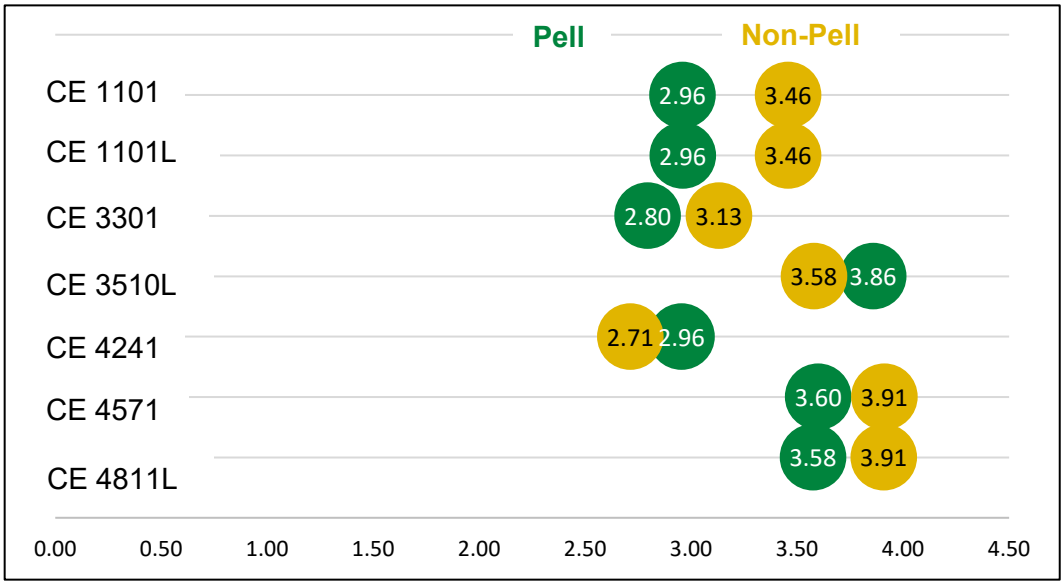

Figure 2– Courses with the Largest Equity Gaps by Pell Status for Civil[4]

[3] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1
[4] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1

Bottleneck
Over the year the Civil Engineering Department has taken an active role in addressing bottleneck courses. The following are strategies that have been successfully implemented:

- All lower division courses are offered by the department each semester.
- Based on demand many of the upper-division courses are offered by the department each semester.
- Lower division courses and pre-requisite courses for senior projects (EGR 4810,4820 and 4830) are offered during the summer based on student need and demand.
- Opening additional course sections when demand exists.

Potential opportunities to reduce impacts caused by the potential of bottlenecks:

- Developing a matrix of course offerings for all the programs offered within the civil engineering department.
- Develop list of course sequencing that would help students when meeting with their professional and academic advisors.

DFW
Student success is key to the operation of all programs within the Civil Engineering Program. The following are strategies that have been implemented to date:

- Supplemental instruction courses are being offered for classes with high DFW, such as Statics and Strength of Materials.
- Several Faculty (with Dr. Sunai Kim as PI) within the department have worked collaboratively to secure a $1 million NSF grant to address achievement gaps in undergraduate civil engineering courses, including Engineering Statics and Mechanics of Materials.
- The addition of a 1-unit lab was added to Engineering Statics (one of our bottleneck classes) to offer students more opportunities to learn and apply the material. Preliminary data has been shown to improve passing rate of students compared to previous years where the lab was not offered. Additional analysis is needed to determine if this can be replicated for other courses without changing the units to degree.

Potential opportunities to reduce the impact of DFW:

- Based on Tables 1 and 2, the department will need to work together to develop strategies to reduce the equity gaps in courses such as CE 1001/L and CE 2051
- Discussion will be starting regarding the DFW rates for CE 3501 and CE 4201.
- FACULTY TO ADD

2 STUDENTS – BS CIVIL ENGINEERING

2.1 Student Retention and Graduation Rates – Graduation Initiative 2025

Figure 3 provides graduation data for students entering the Civil Engineering Department as First-Time Freshmen. Any on-campus transfers who started in another department as a freshman are not accounted for in the First-Time Freshmen Graduation Rates for the Civil Engineering programs. The figure below shows:

- Prior to fall 2019, on average 32% of first-time freshman completed their degree in 4 years. However, in fall of 2019 almost 50% of student complete their degree in 4-year. This can be attributed to semester conversion and the impacts of the pandemic. Many students were able to accelerate the date to graduation.
- The 5-year graduation rate has hovered around 66%, with fall 2016 having 73.3%. Overall, the 5-year rates are constant.
- The 6-year graduation rates have been relatively stable at an average of 77%.

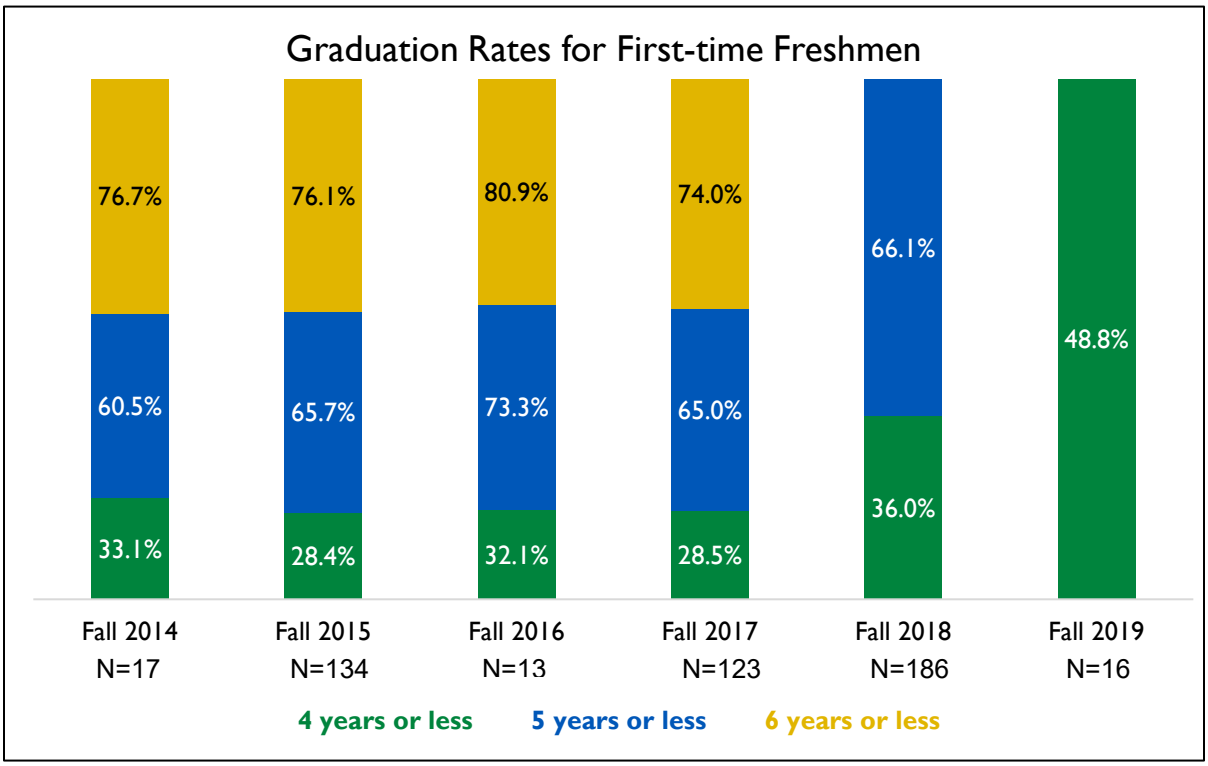

Figure 3 – First-time Freshmen Graduation Rates for Civil[5]

[5] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

Figure 4 provides graduation data for students entering as a civil engineering major as off-campus fall term transfers. Any transfers entering in a term other than fall or are on-campus transfers are not accounted for in the Fall Entering Transfer Graduation Rates for the civil engineering program. The figure below shows:

- 2-yr graduation rates have improved since fall 2016 and 2017. These growths can be attributed to the semester conversion curriculum and the impacts of the pandemic.
- 3-yr graduation rates have been between relatively constant ranging from 73% to 86%.
- 4-yr graduation rates have improved each year with the most recent data showing close to 95% graduation. This data is quite promising suggesting the most students that transfer into the program graduate from CPP.

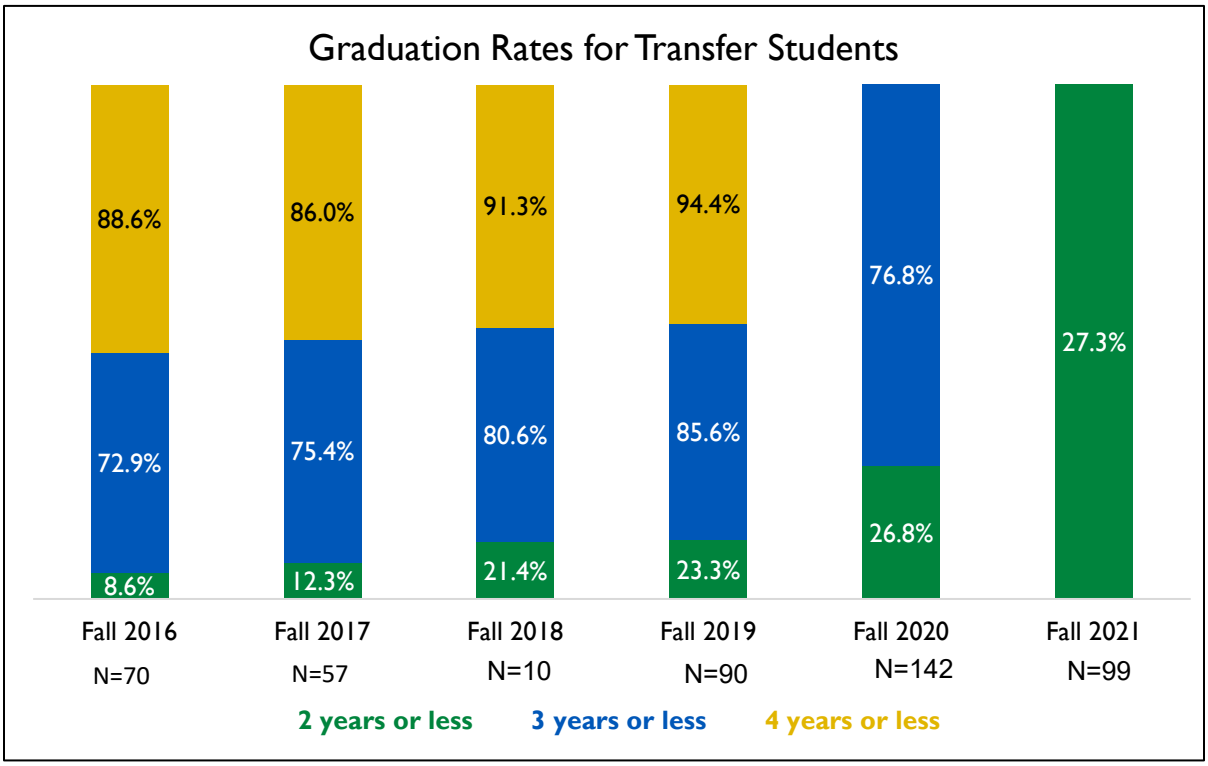

Figure 4 – Transfer Student Graduation Rates for Civil[6]

Figures 5 and 6 show the six-year graduation rates for underrepresented minorities (URM) and Pell-eligible First-time freshmen majoring in civil engineering.

- Based on the results shown in Figure 5, 6-year graduation on average is about 79% for non-URMs, while 70.2% for URMs.
- Based on the results shown in Figure 6, 6-year graduation on average is about 75% for both non-Pell and Pell eligible students.

[6] Source: Tableau
https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

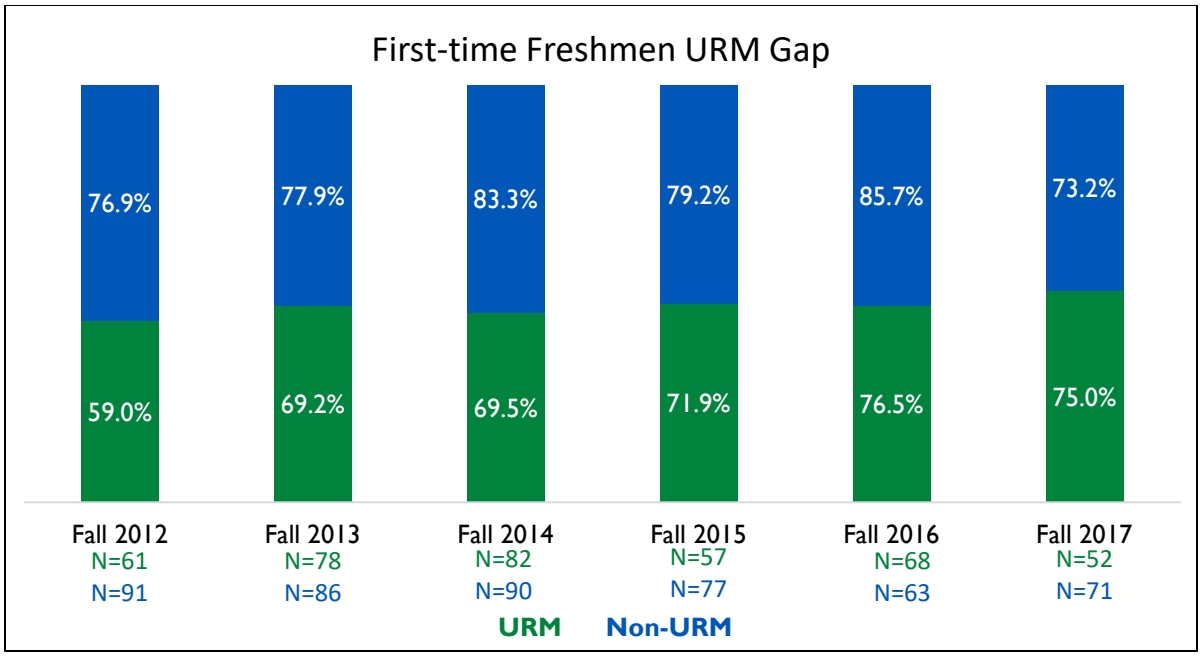

Figure 5 – First-time Freshmen URM Gap for Civil[7]

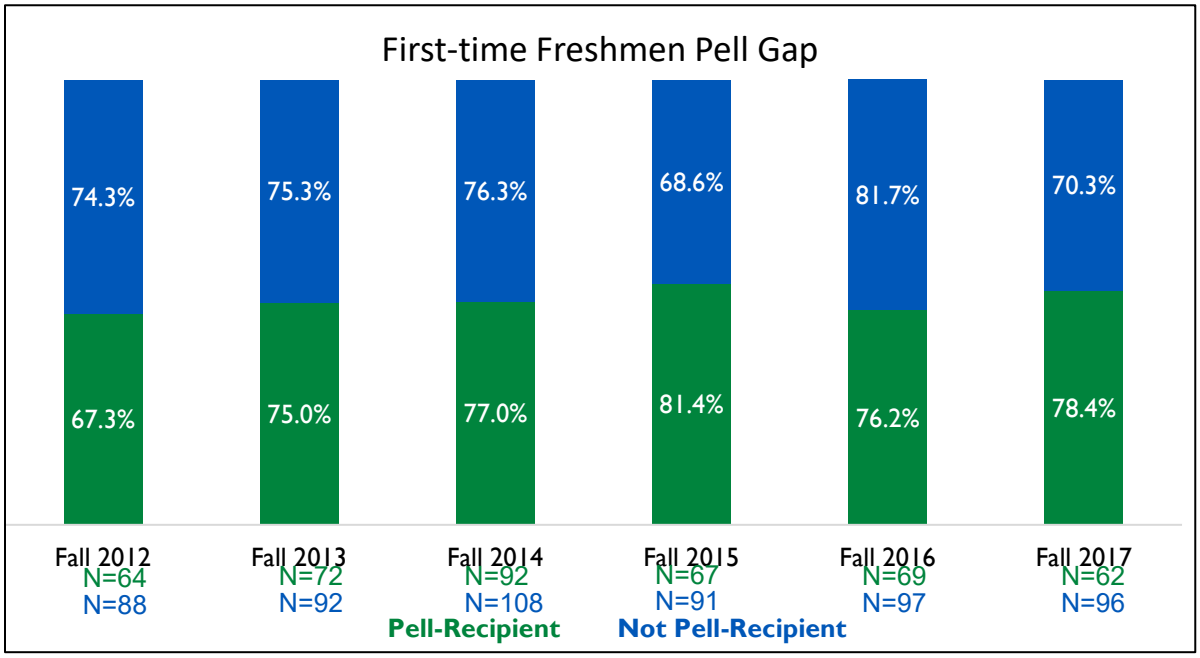

Figure 6 – First-time Freshmen Pell Gap for Civil[8]

[7] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

[8] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRates_0/FTFPellGap?:iid=2

Persistence and Graduation

The department over the course of several years have looked at ways to improve persistence and graduation rates among civil engineering students. This has been accomplished by:

- Offering more courses each semester, to meet the demands of the large student population, as well as increasing class cap sizes.
- Develop a partnership with the College of Engineering (CoE) Staff Advising Center, to educate both groups on the curriculum and policies. At times faculty are not clear on all the policies.
- The university's care center programs are providing our students with numerous resources that are supporting their persistence within the program.
- Strong extracurricular program within the department which includes 16 clubs and 24 competitions teams, which support student belonging.
- Faculty working directly with students on undergraduate research, which supports student belonging.
- Robust industry relationships which provide students with internships during the summer and academic year.

Opportunities to continue to improve persistence and graduation

- During the ABET visit it was clear to the reviewers that there is a need for **additional staff advisors** to meet the number of students. These staff advisors need to remain in the CoE to ensure the best communication between all stakeholders (students, faculty, and staff).
- Provide more opportunities for faculty to utilize existing university resources and high-impact proven practices, such as internship classes, undergraduate research offices, and industry partnerships to support student persistence and graduation.
- Additional tenure track faculty are needed, to offer smaller classes which have been and proven to increase retention.
- Research opportunities for undergraduates and project-based learning experiences has shown to improve retention and graduation rates. Due to heavy teaching loads faculty are limited in their ability to offer these opportunities. The department/college/university needs to develop a sustainable method to support faculty engaged in these initiatives.
- Faculty need to be provided information and training on how to leverage AI to support retention and graduation.

Eliminating URM and Pell Gap

- The department does not have target methods to address graduating rate associated with eliminating URM and Pell graduation gap. Based on the data on average there is minimal to no Pell gap.

Opportunity to improve equity gaps

- Resources and a collective effort is needed from the university to make projects aiming to increase retention rates that are part of many of the current NSF grant more sustainable.
- Develop an internal program within the department that connects faculty to various resources which can assist students: LRC, MEP, supplemental instruction, Innovation Incubator, and deans' advisory council

3 PROGRAM EVALUATION – BS CONSTRUCTION ENGINEERING AND MANAGEMENT

3.1 Curriculum and Pedagogy – BS Construction Engineering and Management

Table 3 provides data associated with high non-passing rates for the construction engineering and management program. It is important to note that the numbers reported below are based on filtering the data by major, so only students enrolled as a Construction Engineering and Management degree program are included in the counts.

Table 3 – Construction Engineering High – DFW's by Non-Pass Rates for 2018-2023[9]

Non-Passing					
Year Term	**Course Code**	**Course Title**	**Enrollment**	**Non-passing Rate**	**Impact**
All Academic Years - Semester	CE3501	Structural Analysis I	273	40%	108
All Academic Years - Semester	CE4530	Structural Design - Timber	116	32%	37
All Academic Years - Semester	CE4560	Structural Design - Steel	122	31%	38
All Academic Years - Semester	CE3301	Engineering Geomatics	10	30%	3
All Academic Years - Semester	CE2051	Mechanics of Materials	298	29%	85
All Academic Years - Semester	CE2041	Engineering Statics	285	29%	84
All Academic Years - Semester	CE2070	Comp Programming and Num Metho	16	25%	4
All Academic Years - Semester	CE4510	Strctrl Dsgn Reinfrcd Concrete	228	24%	55
All Academic Years - Semester	CE1001L	Civil Engineering Laboratory	86	19%	16
All Academic Years - Semester	CE1001	Civil Engineering	86	17%	15
All Academic Years - Semester	CE3501L	Structural Design Laboratory	192	16%	30
All Academic Years - Semester	CE3401	Geotechnical Engineering	278	13%	37
All Academic Years - Semester	CE3601	Transportation Engineering	16	13%	2
All Academic Years - Semester	CE1101L	Construction Drafting Lab	316	10%	33
All Academic Years - Semester	CE1101	Construction Drafting	316	10%	33
All Academic Years - Semester	CE2061	Fluid Mechanics	299	10%	30
All Academic Years - Semester	CE4530L	Structural Design Timber Lab	116	9%	11
All Academic Years - Semester	CE3211	Water Resources Engineering	11	9%	1
All Academic Years - Semester	CE1011	Surveying Engineering	331	8%	26

Figure 7 depicts the civil engineering department courses with the largest equity gaps for URM and non-URM students for all terms from 2018-2023. Figure 8 depicts the civil engineering department courses with the largest equity gaps for Pell recipients and non-Pell recipients for CEM students. The scale uses grades (*1 = D; 2 = C; 3 = B; 4 = A*). This data encompasses all the civil engineering department programs (civil engineering and construction engineering programs).

[9] CSU Dashboard "In Which Courses Do They Struggle" Report
https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle

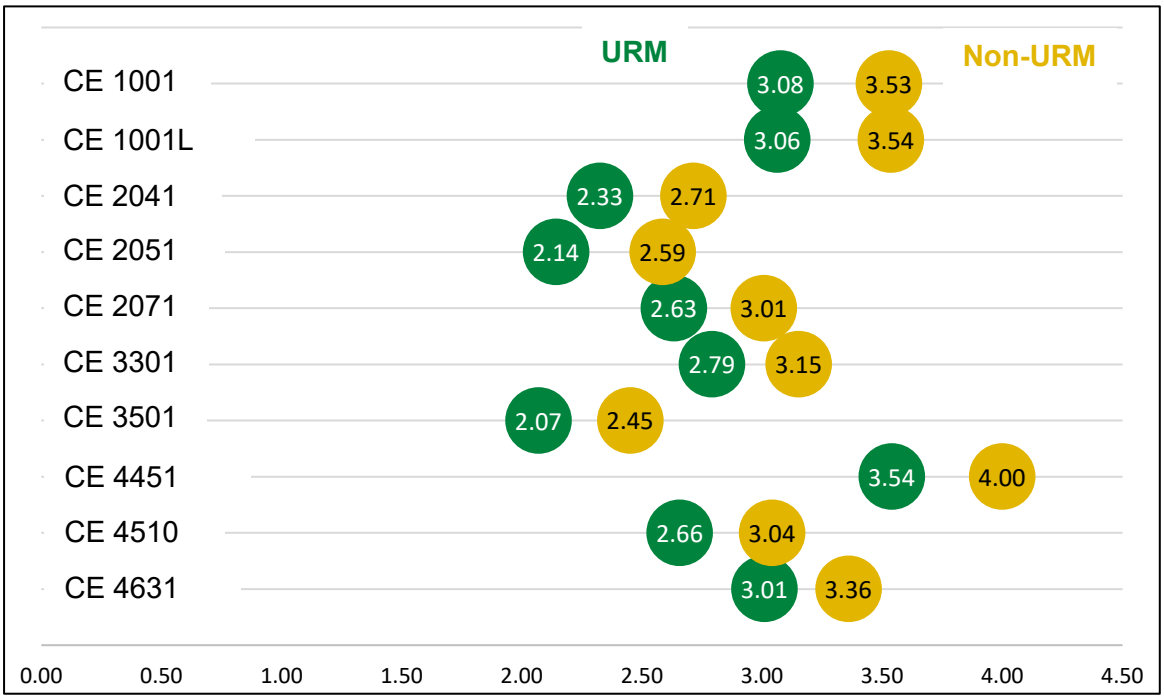

Figure 7– Courses with the Largest Equity Gaps by URM Status for Civil[10]

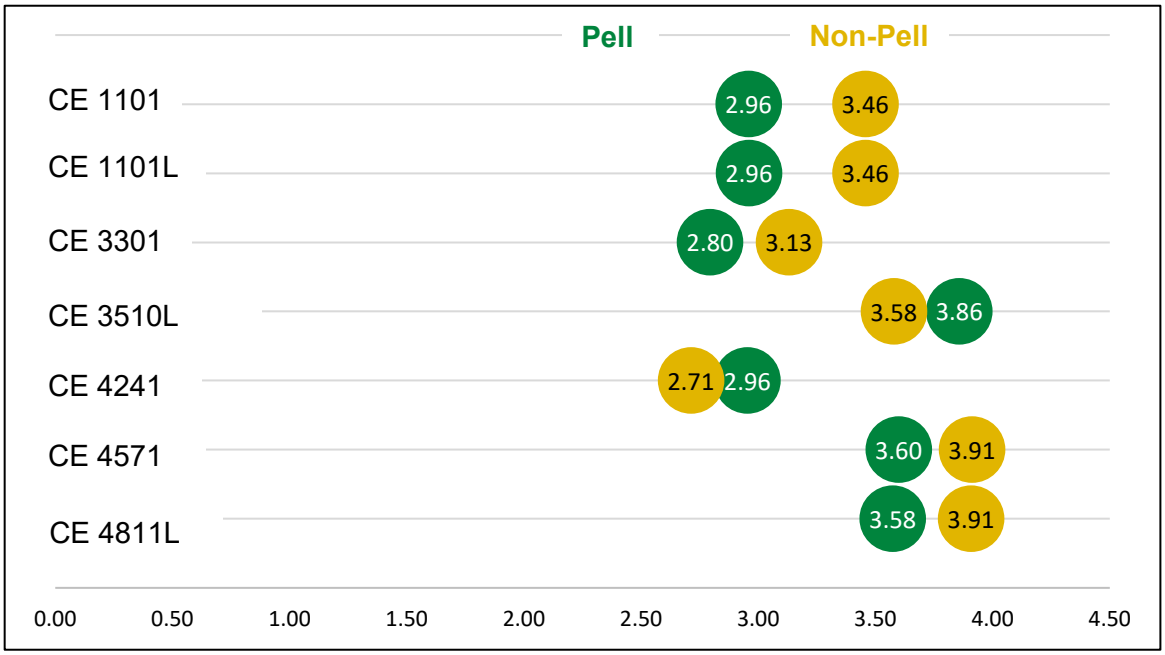

Figure 8– Courses with the Largest Equity Gaps by Pell Status for Civil[11]

[10] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1
[11] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1

Note the BS in Civil Engineering and BS in Construction Engineering and Management are both housed in the Civil Engineering Department. As such initiatives that support one group also impact the other.

Bottleneck

Over the year the Civil Engineering Department has taken an active role in addressing bottleneck courses. The following are strategies that have been successfully implemented:

- All lower division courses are offered by the department each semester.
- Based on demand, many of the upper division courses are offered by the department each semester.
- Lower division courses and pre-requisite courses for senior project (EGR 4810, 4820 and 4830) are offered during the summer based on student need and demand.
- Opening additional course sections when demand exists

Potential opportunities to reduce impacts caused by the potential of bottlenecks:

- Developing a matrix of course offering for all the programs offered within the civil engineering department.
- Develop list of course sequencing that would help students when they are meeting with their professional and academic advisors.

DFW

Student success is key to the operation of all programs within the Civil Engineering Programs. The following are strategies that have been implemented to date:

- Supplemental instruction courses are being offered for classes with high DFW, such as Statics and Strength of Materials.
- Several Faculty (NAMES) within the department have worked collaboratively to secure a $1 million NSF grant to address achievement gaps in undergraduate civil engineering courses, including Engineering Statics.
- The addition of a 1-unit lab was added to the Engineering Statics (one of our bottleneck classes) to offer students more opportunity to learn and apply the material. Preliminary data has been shown to improve passing rate of students compared to previous years where the lab was not offered. Additional analysis is needed to determine if this can be replicated for other courses without change the units to degree.

Potential opportunities to reduce the impact of DFW:

- Based on Tables 1 and 2, the department will need to work together to develop strategies to reduce the equity gaps in courses such as CE 1001/L and CE 2051
- Discussion will be starting regarding the DFW rates for CE 3501.

4 STUDENTS – BS CONSTRUCTION ENGINEERING AND MANAGEMENT

4.1 Student Retention and Graduation Rates – Graduation Initiative 2025

Figure 9 provides graduation data for students entering the Construction Engineering and Management major as First-Time Freshmen only. Any on-campus transfers who started in another major as a freshman are not accounted for in the First-Time Freshmen Graduation Rates for Construction Engineering and Management. Prior to Fall 2018, the program was a BS in Construction Technology. The figure below shows:

- The 4-year graduation rate remains between 15% to 18%.
- The 5-year graduation rate has improved from Fall 2018 from almost 30% to 43% in Fall 2019
- The 6-year graduation rate is around 46%.

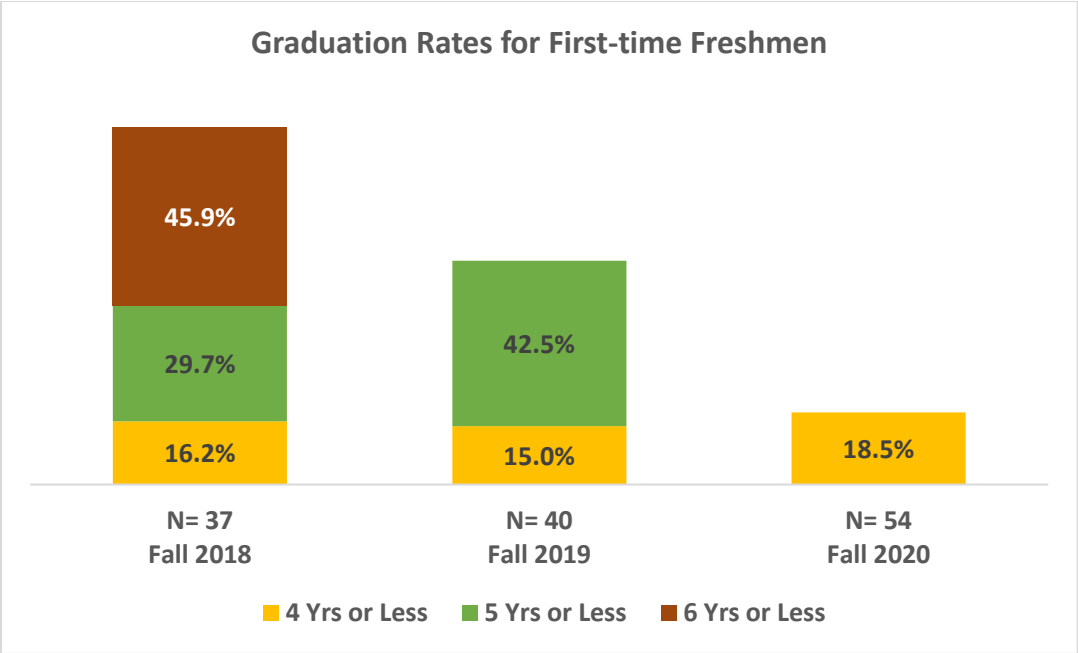

Figure 9 – First-time Freshmen Graduation Rates for Construction Engineering and Management[12]

Figure 10 provides graduation data for students entering as a Construction Engineering and Management major as off-campus fall term Transfers. Any transfers entering in a term other than fall or are on-campus transfers are not accounted for in the Fall Entering Transfer Graduation Rates for the Construction Engineering and Management program. The figure below shows:

- 2-yr graduation rates have improved since fall 2021 to 14%.
- 3-yr graduation rates have been improving each year from 16.7% to 57.1%.
- 4-yr graduation rates have improved each year with the most recent data showing close to 58% graduation. This data is quite promising suggesting the students that transfer into the program are showing progress towards graduation.

[12] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

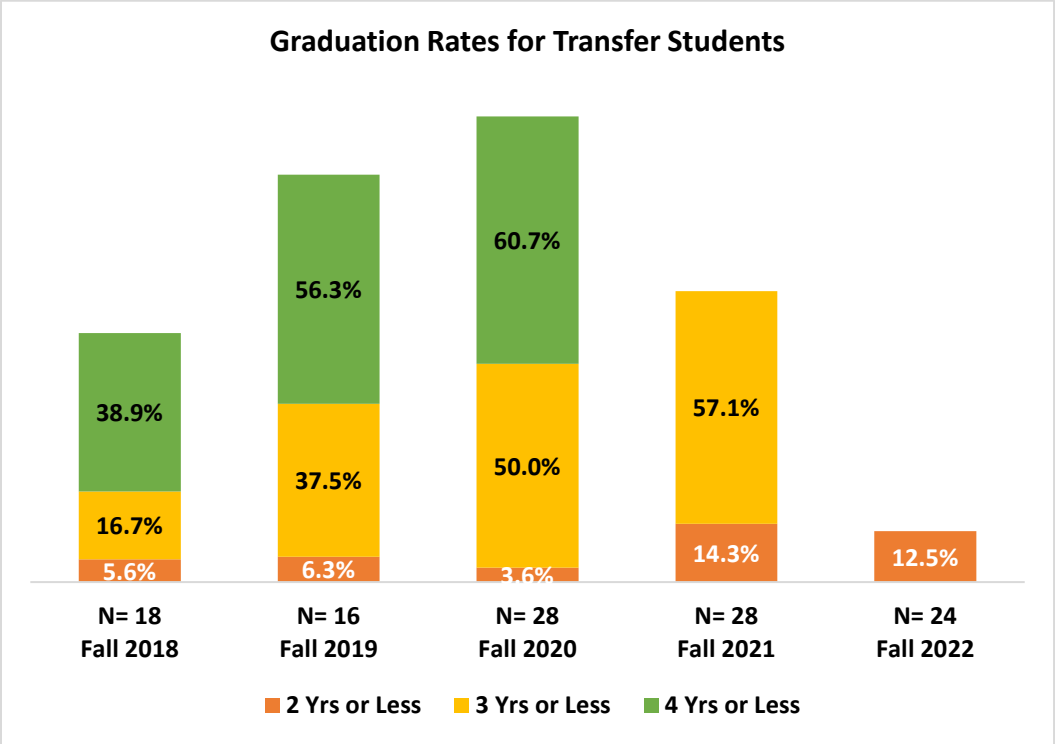

Figure 10 – Transfer Student Graduation Rates for Construction Engineering and Management[13]

Figures 11 and 12 show the six-year graduation rates for underrepresented minorities (URM) and Pell-eligible First-time freshmen majoring in construction engineering and management.

- Based on the results shown in Figure 11, there is a gap between URM and non-URM students in terms of their 4, 5, and 6-year graduation
- Based on the results shown in Figure 12, there is a gap between non-Pell and Pell eligible students in terms of their 4, 5, and 6-year graduation

[13] Source: Tableau
https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

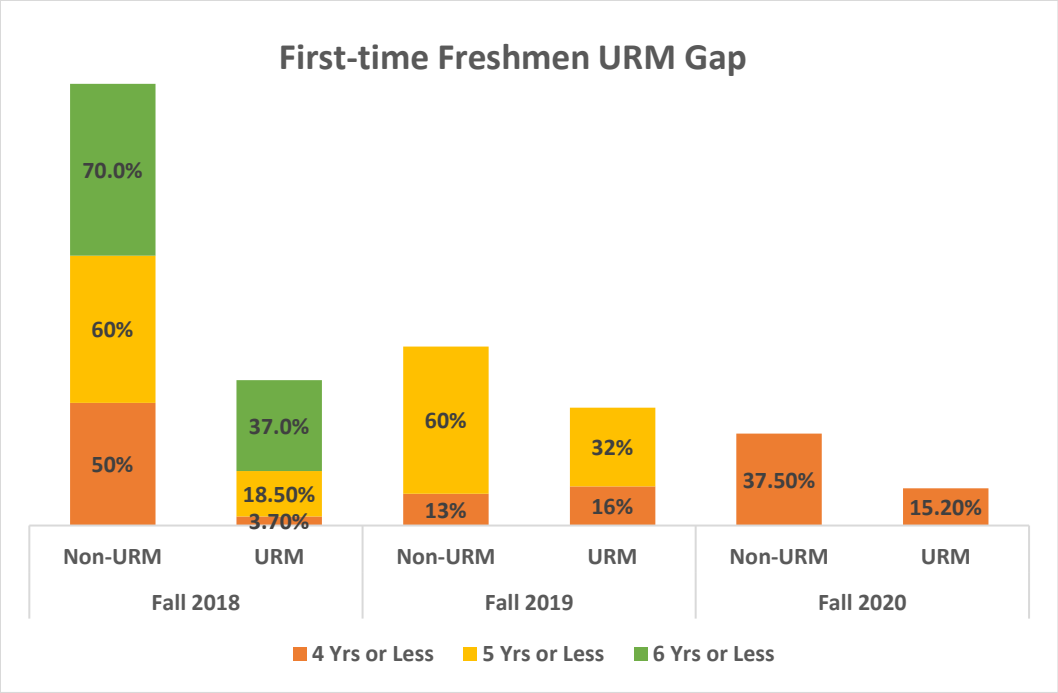

Figure 11 – First-time Freshmen URM Graduation Gap for Construction Engineering and Management [14]

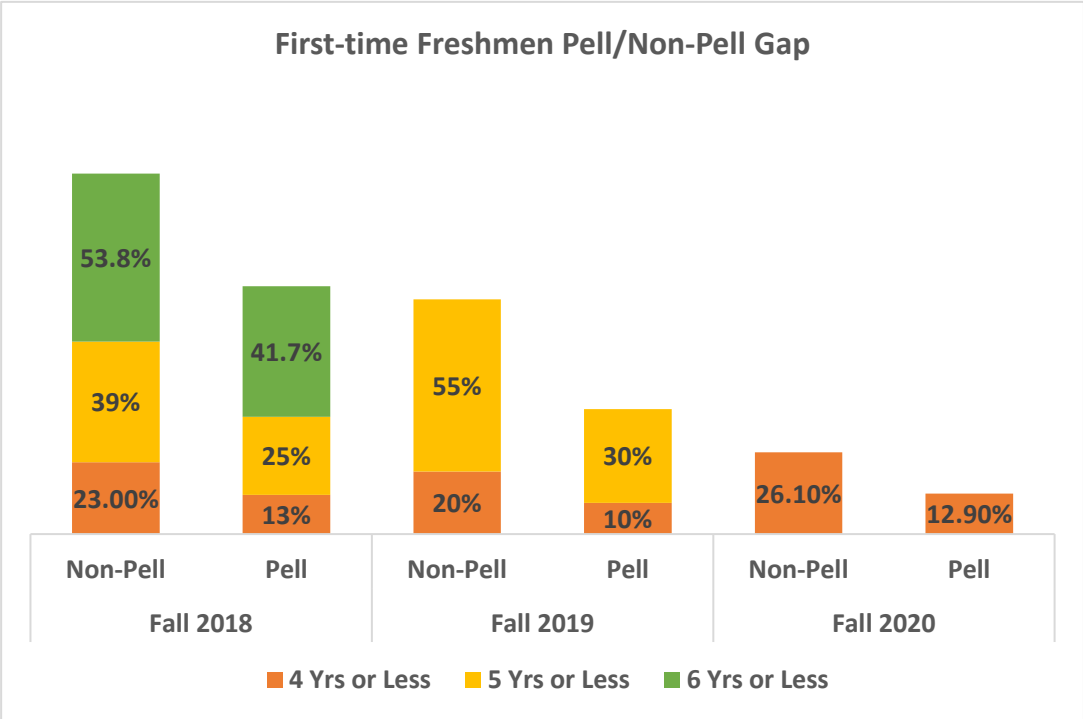

Figure 12 – First-time Freshmen Pell Graduation Gap for Construction Engineering and Management [15]

[14] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2
[15] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRates_0/FTFPellGap?:iid=2

Note the BS in Civil Engineering and BS in Construction Engineering and Management are both housed in the Civil Engineering Department. As such initiatives that support one group also impact the other.

Persistence and Graduation

The department over the course of several years have looked at ways to improve persistence and graduation rates among civil engineering students. This has been accomplished by:

- Offering more courses each semester, to meet the demands of the large student population, as well as increasing class cap sizes.
- Develop a partnership with the College of Engineering (CoE) Staff Advising Center, to educate both groups on the curriculum and policies. At times faculty are not clear on all the policies.
- The university's care center programs are providing our students with numerous resources that are supporting their persistence within the program.
- Strong extracurricular program within the department which includes 16 clubs and 24 competitions teams, which support student belonging.
- Faculty working directly with students on undergraduate research, which supports student belonging.
- Robust industry relationships which provide students with internships during the summer and academic year.

Opportunities to continue to improve persistence and graduation

- During the ABET visit it was clear to the reviewers that there is a need for **additional staff advisors** to meet the number of students. These staff advisors need to remain in the CoE to ensure the best communication between all stakeholders (student, faculty and staff).
- Provide more opportunities for faculty to utilize existing university resources and high impact proven practices, such as internship classes, undergraduate research offices, and industry partnerships to support student persistence and graduation.
- Additional tenure track faculty are needed, to offer smaller classes which have been proven to increase retention.
- Research opportunities for undergraduates and project-based learning experiences has shown to improve retention and graduation rates. Due to heavy teaching loads faculty are limited in their ability to offer these opportunities. The department/college/university needs to develop a sustainable method to support faculty engaged in these initiatives.
- Faculty need to be provided information and training on how to leverage AI to support retention and graduation.

Eliminating URM and Pell Gap

- The department does not have target methods to address graduating rate associated with eliminating URM and Pell graduation gap. Based on the data on average, there seems to be a critical need to address such gaps.
- Individual faculty, have successful been awarded grants, such as "Career development

in Construction Engineering Through Academy and Industry Network (CERTAIN)". This NSF project aims to increase the number of graduates from the college's construction engineering and management program (CEM) for high-achieving underrepresented minorities (URM) students

Opportunity to improve equity gaps

- Resources and a collective effort is needed from the university to make projects aiming to increase retention rates that are part of many of the current NSF grant more sustainable.
- Develop an internal program within the department that connects faculty to various resources which can assist students: LRC, MEP, supplemental instruction, Innovation Incubator, and deans' advisory council

5 INCLUSIVE POLYTECHNIC EDUCATION

Table 4 provides a summary of how department activities align to the Inclusive Polytechnic Education.

Table 4 - Alignment of Department Activities to the Inclusive Polytechnic Education

Department Activity (Curricular and Co-Curricular)	***Elements of Inclusive Polytechnic Education[16]***							
	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***
Senior Design Capstone Projects	X	X	X	X	X	X	X	X
Faculty-Led Research Projects	X	X	X	X	X			X
First Year Experience (e.g. EGR 1000/1000L)	X	X	X	X	X	X	X	X
Participation in Engineering Competitions	X	X	X		X	X		X
Student Clubs (e.g., ASCE, DBIA and various other Student Chapter)				X		X	X	X
Laboratory-Based Courses	X	X			X			X

The Civil Engineering Department ensures students receive an Inclusive Polytechnic Education by integrating hands-on and collaborative learning experiences into both curricular and co-curricular activities. These efforts align closely with the definitions and rubrics developed by the Office of Academic Innovation to evaluate a PolyX experience.

Senior Design Capstone Projects - The Senior Design Capstone sequence (EGR 4810, EGR 4820, EGR 4830) is a cornerstone of Inclusive Polytechnic Education, addressing all eight educational areas essential to student development:

- Application of Knowledge- Students apply knowledge gained throughout their academic journey to address real-world engineering design problems, most of which provided by industry.
- Critical Thinking and Problem-Solving- Through the design process, students integrate critical thinking to identify and analyze issues/problems. They evaluate literature, design manuals, and other resources to develop informed positions and create engineered design solutions.
- Creativity, Discovery, and Innovation- The design process connects theory, practice, and research, encouraging students to develop innovative and creative solutions to complex engineering challenges.

[16] https://www.cpp.edu/polyadvantage/index.shtml

- Diverse and Multi-Disciplinary Perspectives- Projects incorporate engineering standards and constraints, requiring teams to engage with multi-disciplinary perspectives to achieve comprehensive solutions.
- Integration of Technology- Students utilize advanced software tools such as AutoCAD 3D, Bluebeam, Building Information Technology, P6, SAP, SimaPro, HEC-HMS, and HEC-RAS to enhance their analysis and design processes.
- Collaborative Learning- Teamwork is integral, with students working in groups and receiving mentorship from faculty advisors and industry partners to guide their projects.
- Community and Global Engagement- Teams present their projects to peers, faculty, and industry professionals, fostering stakeholder engagement. All projects have connections to industry partners, ensuring real-world relevance.
- Professional and Career Readiness- The capstone experience equips students with the skills and confidence necessary to transition seamlessly into their professional careers.

This comprehensive sequence exemplifies the departments commitment to preparing students to achieve a PolyX experience.

Undergraduate Research: Undergraduate research experience exemplifies an Inclusive Polytechnic Education and covers all 8 areas. However, it is important to note that due to available resources and available department support, only some faculty within the department are active with undergraduate research with some students. Below are more details on how each of these areas are reflected in the undergraduate research experience:

- Application of Knowledge – Student use information and tools they have learned through their academic experience to identify, formulate, and provide alternative solutions for a research topic, with intense mentorship from their faculty advisors.
- Critical Thinking and Problem Solving – Students through these research experiences are provided opportunity to critically think and evaluate alternative solutions within provided constraints (code, standards, regulatory framework, or social constraints)
- Creativity, Discovery and Innovation – the undergraduate research experience involves students in a dynamic process of inquiry where they engage with real-world problems, refine their ability to think independently, creatively propose innovative solutions, and contribute to the advancement of knowledge in their chosen fields. With their produced products, many students present their work in locally, national, and international conferences, such as CARS, RSCA, SCCUR, ASCE, and TRB conferences
- Diverse & Multi-Disciplinary Perspectives – Depending on the research topic explored by students, their investigations may span a wide range of fields (structural, geotechnical, environmental, water, transportation, and construction), integrating concepts and methodologies from various disciplines. This approach encourages students to analyze problems from multiple viewpoints, fostering a deeper understanding and innovative solutions that transcend traditional academic boundaries.
- Integration of Technology – Students use technology and software pertinent to their research topics, such as these mentioned above.
- Collaborative Learning – Some projects include multiple students who work on one single topic, or sometimes students build on each other findings in consecutive semesters.
- Community and Global Engagement – Most of the topics studied stem from actual community needs some of which are serve disadvantaged communities. This allows students to engage with community in identifying their problems and proposing solutions.
- Professional & Career Readiness – Depending on the student aspirations for graduate school, such research experiences have been proven as high impact practices that

prepare them for graduate and academic careers. Some of the students involved in these projects end up joining our master's degree program or master programs in other universities.

First Year Experience: College of engineering freshmen and some transfer students enroll in a one semester lecture and laboratory course, EGR 1000/1000L in which they complete a project work that satisfies all the requirements for First Year Experience. The essence of this course is to develop the individual student's engineering perspective in society. The course aims to engage students in the design cycle, understand an engineer's role in society, explore the various disciplines of engineering, and develop skills that will help them in their academic career both in and out of engineering.

- Application of Knowledge - Students apply their knowledge of the design cycle to understand failures and successes and develop engineering solutions to problems. Students apply mathematical skills and critical thinking skills to model data, make statements about trends and performance and make predictions about designs of experiments.
- Critical Thinking and Problem-Solving - Students engage in research in their field to develop an understanding of current advancements and where they might find themselves in the field. Students are presented various multidisciplinary problems and asked to develop solutions to these problems in teams and judge the success of the solution.
- Creativity, Discovery, and Innovation - Students work in multidisciplinary groups to solve community issues in new and unique ways drawing from the holistic composition of the group. Students also work in the lab to develop a foundational understanding of underpinning physics concepts to be able to apply in later classes.
- Diverse and Multi-Disciplinary Perspectives - Every activity in the course is done in a multi-disciplinary group. Students are taught how to gather input for various stakeholders to define the scope of a project and how to best serve all stakeholders with equitable solutions that draw from each discipline.
- Integration of Technology - Students use technology to model data and various desktop applications to present various technical projects (posters, presentations, and reports).
- Collaborative Learning - Students work in multidisciplinary groups on each project in the lab and discuss solutions to issue in the lecture in a cross-discipline perspective. Students are taught how to work in an effective team focusing on valuing learning styles, communication styles, and psychological safety.
- Community and Global Engagement - When possible, students work on real world problems to engage communities (see PolyX).
- Professional and Career Readiness- Students learn about each discipline of engineering and how they contribute to society, where the field is leading, and how they can contribute to the field. During this exploration, students learn about the other disciplines and how their discipline with interact with the others. Students work on professional skills such as a resume, and LinkedIn page as well as speaking to potential employers.

Student Club Activities and Competitions:

The department actively supports and encourages participation in student-led engineering organizations (16) and competitions (24). Example clubs include ASCE, DBIA, AGC, CAL GEO, CEMA, CHI Epsilon, CLSA, CWEA-AWWA, among others. Example competitions include the American Schools of Construction (ASC), DeCathlon, AISC Steel Bridge, ASCE Concrete Canoe, ASCE GeoWall, and EERI Seismic Design competitions, among others.

These extracurricular student activities enrich the college experience for the students. They also provide opportunities for students to engage in hands-on learning, collaborate with peers, and compete in national and international competitions. These activities foster professional readiness, critical thinking, and creativity, hallmarks of the PolyX experience.

- Application of Knowledge - Theory is taught through a variety of methods and then reinforce those concepts through active hands-on activities that relate to today's opportunities and challenges.
- Critical-Thinking and Problem-Solving - Competitions provide opportunities for students showcase their skills, talents, and knowledge. They encourage creativity and teamwork. They strengthen understanding of the subject's matter. Students get opportunities to solve complex engineering problems.
- Creativity, Discovery, and Innovation - Student competitions provide students a platform to apply their knowledge in a practical way, encourage them to think outside the box, collaborate with peers, solve real-world and complex problems, do literature review, acquire new knowledge and skills that are not taught in classrooms, and develop solutions that might not be explored in traditional classroom settings. Competitions also help develop entrepreneurial mindset and drive them to discover new ideas and approaches.
- Diverse & Multi-Disciplinary Perspectives - Most clubs are open to all engineering majors allowing students from various disciplines—mechanical, electrical, civil, computer, and aerospace engineering—to work together. This inclusivity promotes diverse viewpoints in problem-solving and design, enabling teams to approach challenges from multi-disciplinary angles. Example: In DBIA student competition, architectural, and construction and civil engineering students work collaboratively to develop a conceptual design, develop structural details, and construction details.
- Integration of Technology - Students get opportunities to extensively use engineering technologies to participate in competitions such as using advanced finite element method (FEM), SAP modeling, 5-D modeling, and estimating and scheduling software.
- Collaborative Learning - Club projects are team-oriented, requiring students to share skills and collaborate to achieve a unified goal, such as building a competition-ready vehicle or a functioning prototype. Members are encouraged to innovate, combining theory and practice to create cutting-edge designs. These experiences foster mutual respect, creativity, and the ability to navigate group dynamics, ultimately preparing students for real-world collaboration.
- Community and Global Engagement - Clubs often engage in outreach activities, inspiring the next generation of engineers by hosting workshops or mentoring K-12 students in junior chapters. Community Nights provide opportunities to connect with the local public, demonstrate projects, and discuss the engineering process. Members present their work at national and international competitions and conferences, fostering global awareness and networking with professionals and peers worldwide.
- Professional & Career Readiness - Through participation in student clubs and competitions, students apply theoretical knowledge to real-world problems relevant to society and the engineering industry, gaining hands-on experience in design, testing, and building—preparing them to tackle challenges in their future careers in industry or government agencies. We invite guest speakers, organize industry tours, and collaborate with campus clubs to expose students to various engineering fields and industries. Our technical and professional development workshops provide students with essential technical and soft skills for career success. Social events and

networking sessions connect students with fellow engineers and professionals, offering insights into potential career paths.

Laboratory-Based Courses:

- Application of Knowledge - The vast majority of the courses in Civil Engineering department have a laboratory corequisite. This provides the students with the opportunity to apply the theories from the lecture materials to a real-world hands-on experience to help them understand and relate the concepts as used in practice. Being able to apply the theories from lecture while specifically varying the inputs and then observing the results provides students with direct understanding of the theory and the relationships. Throughout the hand-on laboratory experiments, students are required to anticipate the results using theories and perform analysis that validates their findings.
- Critical Thinking & Problem Solving - Several laboratory sessions require students to develop designs using analysis that requires critical thinking skills as they synthesize solutions for the given problem(s) assigned.
- Integration of Technology - As students develop, implement and test their design and systems, students use relevant software.
- Professional & Career Readiness - The projects developed, and analysis performed throughout the engineering labs align with the tools and methods that they will encounter in industry throughout their career.

6 FACULTY

6.1 Overview of Faculty

Figure 13 to Figure 16 provide data over 5 years on the historical Full Time Equivalent-Faculty (FTE-F), Full Time Equivalent-Student (FTE-S), Student to Faculty Ratio (SFR), and Major to Faculty Ratio (MFR). The following definitions are from the Office of Academic Resources. Full Time Equivalent-Faculty is an aggregate measure of faculty workload based on payroll appointment fractions. Student to Faculty Ratio is an aggregate measure of students served based on units in course sections and student level. For FTE-S reporting, graduate student (master or doctoral) is considered full-time with 12 units; all others are considered full-time with 15 units. Student Faculty Ratio is FTE-S divided by FTE-F. Lastly, Major Faculty Ration is the number of stateside degree-seeking students enrolled at census by the FTE-F for tenure-line faculty in the department.

Please note that the data for the following contains information for both undergraduate and graduate programs.

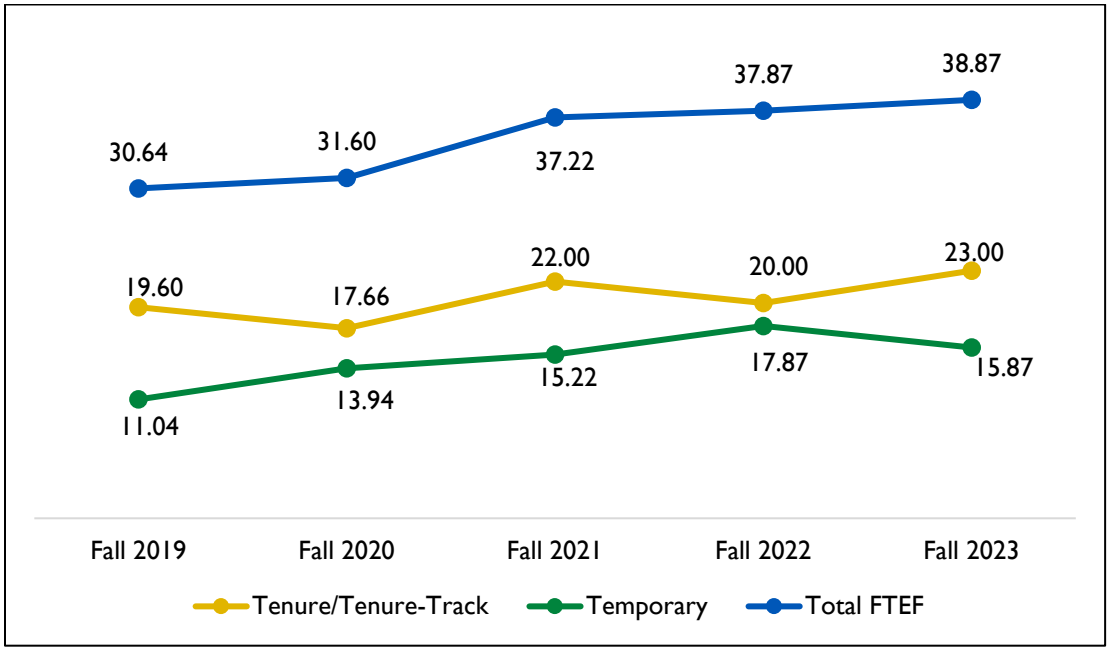

Figure 13 – Full Time Equivalent-Faculty (FTE-F)[17]

The Office of Academic Resources no longer provides a break down the FTE-S data for Tenure/Tenure-track and Temporary faculty at the time our office conducted the data pull.

[17] AR "FTE-Faculty with Status Detail Tenure-Track and Temporary Faculty" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

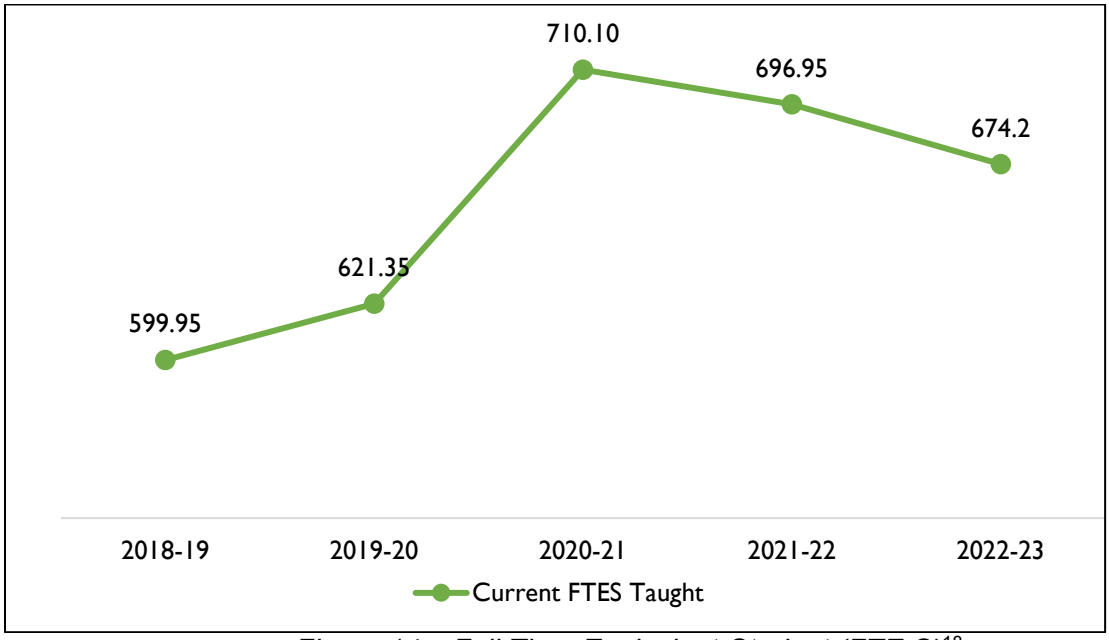

Figure 14 – Full Time Equivalent-Student (FTE-S)[18]

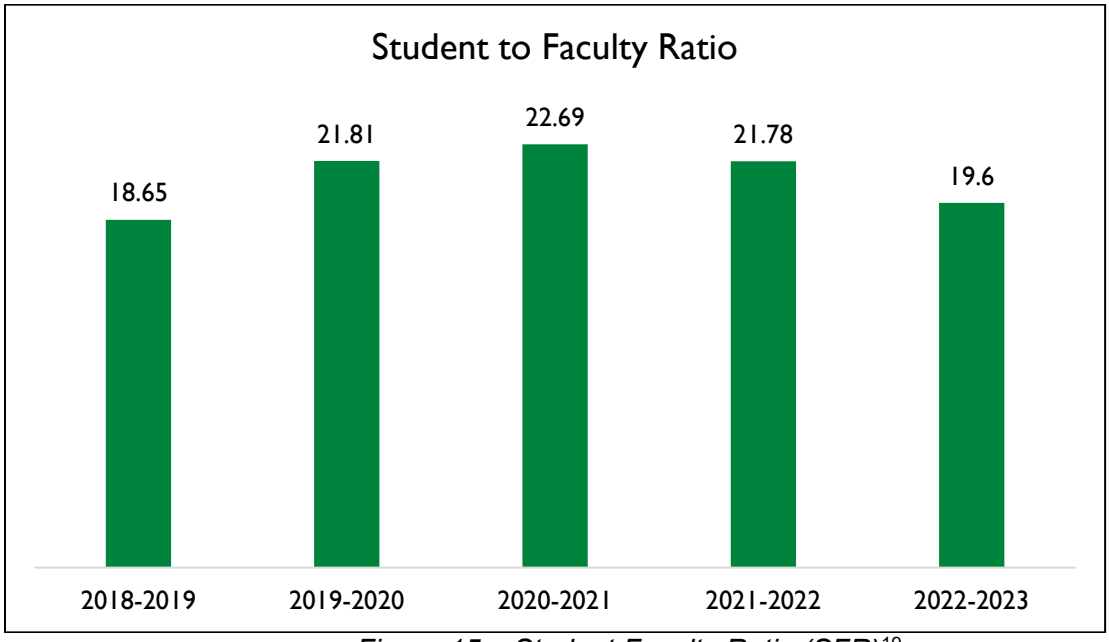

Figure 15 – Student Faculty Ratio (SFR)[19]

[18] AR "Student to Faculty Ration Reports" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml
[19] AR "Student to Faculty Ration Reports" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

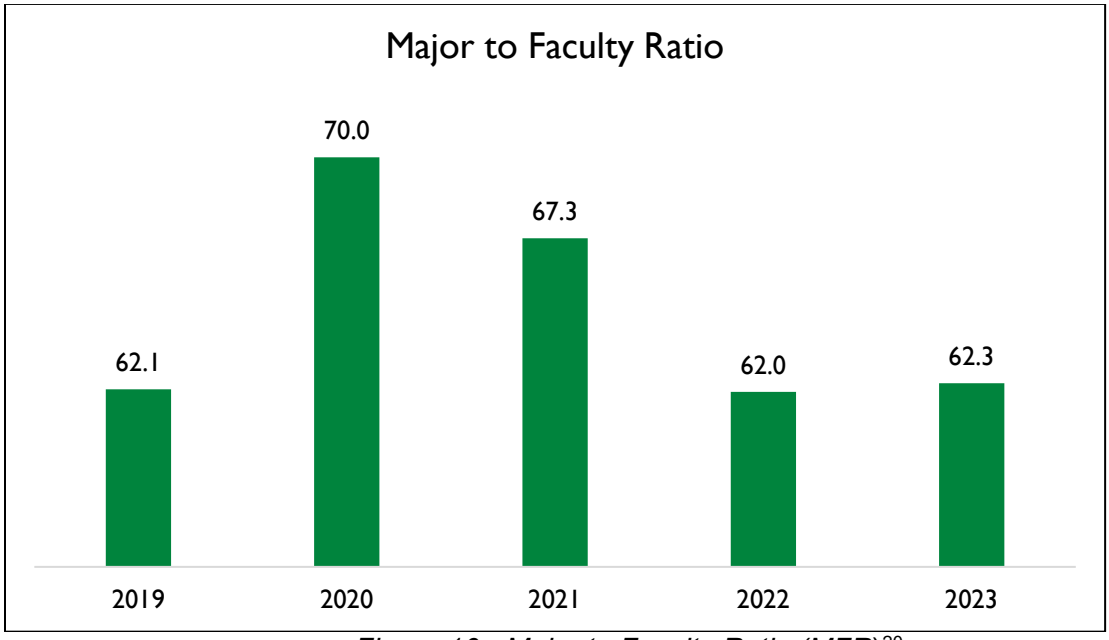

Figure 16 - Major to Faculty Ratio (MFR)[20]

Adjunct Faculty (portion taught by)

- The Civil Engineering department relies heavily relies (40%) on adjunct lecturers to deliver a significant portion of its coursework. These part-time instructors, many of whom are alumni and practitioners, bring industry expertise to upper division lecture and laboratory courses, enriching the educational experience by bridging the gap between academia and real-world applications.

Student Grader/Teaching Assistant

- When lecture courses have enrollments over 45 students, the college and/or department is providing support for student graders.
- Graduate students within the department are offered opportunities to be teaching assistant for laboratory courses.

Demand for Major

- Enrollment has grown consistently over the past five years, reflecting strong student interest. From 2019 to 2023, there has been a 30% growth in the programs. However, this growth has not been met with a corresponding increase in tenure-line positions (15% growth). While the FTEF (which includes temporary faculty) has increased, the major-to-faculty ratio continues to rise, placing a heavier teaching, service, and advising burden on tenure-line faculty.

[20] ARAR "Major to Faculty Ratio",https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

Capacity of Growth

- Our capacity for growth has reached its limits due to the lack of additional tenure-line faculty and other university resources. Without increased support, the department is constrained in its ability to expand enrollment further or implement quality control measures to ensure the highest academic standards.
- Strategies for accommodating more students without additional resources would include expanding online or hybrid course offerings and increasing reliance on adjunct faculty. However, these approaches need to be developed in a structured robust process to ensure program outcomes are met and the quality of education is not compromised.
- Campus spaces such as SSB need to be reallocated to open up office spaces for faculty and conference rooms to accommodate large classes.
- With additional resources, the department could hire more tenure-line faculty to improve the major-to-faculty ratio, support new program development, improve graduation and retention rates, and accommodate growing demand while maintaining educational quality. We appreciate the tenure-line faculty positions allocated to us in recent years and urge the university to continue and expand this support. Additional tenure-line hires would allow us to grow enrollment, improve student-faculty interactions, and help the university better meet its enrollment targets.
- Classroom modernization is essential to prepare students for the future

7 CONCLUSION

In conclusion, the Civil Engineering Department exhibits several **key strengths**.

Students

1. **Hands-on Learning**: The programs emphasize a hands-on approach to learning. Students engage in laboratory work, design projects, and experiential learning opportunities. This practical experience enables them to apply theoretical concepts to real-world engineering problems, enhancing their problem-solving and critical-thinking skills.
2. **Student Competition Teams/Clubs:** Clubs participate in design competitions, host guest speakers, assist with job placement, provide professional development, provide tutoring, offer services to the department, host career fairs, and K-12 outreach, which provides a sense of belonging.
3. **Teamwork and Communication Skills**: The program emphasizes teamwork and effective communication, preparing students to collaborate successfully in multidisciplinary and diverse engineering environments. Through group projects and presentations, students develop strong interpersonal and communication skills, which are vital in the professional world.
4. **Professionalism Career Readiness:** The program strives to prepare students to be workforce-ready. This is accomplished by developing a curriculum that goes beyond theory. Courses incorporated theory and applied learning. Most students graduate from the program with the EIT or LSIT.

Curriculum and Faculty

1. **Comprehensive and Rigorous Curriculum**: The programs offer a comprehensive and rigorous curriculum that covers a wide range of fundamental and advanced topics in civil engineering. Students gain a strong foundation in the field. This is reflected in CPP CE students consistently performing better than the national average in the FE Exam.
2. **Senior Project:** All students conclude their engineering curriculum by taking a year-long senior design course. The design process connects theory, practice, and research, encouraging students to develop innovative and creative solutions to complex engineering challenges. All projects incorporate engineering standards and constraints, requiring teams to engage with multi-disciplinary perspectives to achieve comprehensive solutions.
3. **Dedicated and Experienced Faculty**: The programs are supported by highly qualified and experienced faculty who are dedicated to student success. The faculty members are actively involved in research, industry collaborations, and professional organizations, providing students with valuable insights and mentoring. Faculty within the department have their engineering licensure.

The following are <u>Opportunities for Improvement and Planned Actions</u>

1. **Lecture Classroom Modernization and Space:**

- *Opportunity*: Currently, most engineering lecture classrooms have significant issues that impact the quality of education. For example, in many classrooms, the instructor cannot use both the whiteboard and projector at the same time, some classrooms only have a single non-dimmable light switch, and the desks are not useful for group interaction. The

department is also challenged with the limited classroom space as well as adequately equipped classrooms that encourage student learning and project team-based learning.

- *Action*:
    - The CoE and University develop a working relationship with University IT and Facilities to prioritize and create classroom spaces that promote student success and provide a polytechnic experience.
    - New classrooms should have a tiered approach to allow students to see the board and instructor. This will also enable the instructor to see their students.

2. **Laboratory Space and Equipment**:

- *Opportunity*: The university offers several facilities and laboratories. However, these facilities require a lot of improvements. In addition, there is not sufficient space to accommodate the students. Students need more access to equipment and software tools, enabling them to conduct experiments, simulations, and projects using industry-standard technology
- *Action*:
    - The department in partnership with the college should develop industry partnerships to fund the design and construction of a new laboratory faculty.
    - The department should support faculty collaboration on internal and external grants to improve laboratory equipment, purchase new laboratory equipment, and improve existing laboratory spaces.

3. **Faculty Resources and Quality Control:**

- *Opportunity*: Even though enrollment has grown consistently over the past five years, this growth has not been met with a corresponding increase in tenure-line positions. The increasing reliance on adjunct faculty poses challenges in maintaining consistency and quality across all courses, especially with growing enrollment.
- *Action*:
    - Advocate for additional tenure-line faculty positions to better balance the major-to-faculty ratio and strengthen mentorship and quality control in both lecture and laboratory courses.
    - Implement standardized course materials and periodic reviews of adjunct-taught courses to ensure alignment with program objectives.
    - Provide support to course coordinators to assure course quality.

4. **Advising support**:

- *Opportunity*: There are two academic support staff within the College of Engineering to support students in the Civil Engineering and Construction Engineering and Management degree programs. Each support staff has approximately 700 plus students to support.
- *Action*:
    - University and COE need to hire more staff advisors to support the increasing number of students.
    - CoE needs to preserve the College level advising due to the unique nature of the engineering curriculum.

5. **Office Space:**

- *Opportunity*: As the department continues to strive to grow in our faculty hiring to meet the student demands, the departments lack office space for new faculty.
- *Action*:

    - Campus spaces such as SSB need to be reallocated to open office spaces for faculty and conference rooms to accommodate large classes.
    - More industry support to build the new engineering building would be optimum on the long term.

6. **Senior Project and Undergraduate Research:**

- *Opportunity*: Though we have a robust program for senior project design and undergraduate research, there is not enough WTU support to provide faculty with the needed time to work with students effectively. Thus, if it was not for the dedicated **faculty** students would not have such a robust undergraduate academic experience.
- *Action*: Leadership to provide a structured process for equitable support of faculty that are active in undergraduate research and senior projects.

7. **Supporting Student Success and Reducing Equity Gaps:**

- *Opportunity*: Despite strong overall performance, underrepresented minority (URM) students and Pell-eligible students face equity gaps in retention and graduation rates.
- *Action*:
    - College to look to expanding support services such as tutoring, mentoring, and outreach through programs like *Maximizing Engineering Potential (MEP)*.
    - Strengthen faculty participation in inclusive teaching workshops and develop targeted interventions for at-risk students, such as early alert systems and proactive advising.
    - Develop college level professional development program to support faculty to better understand teaching strategies that can reduce equity gaps.

8. **Capacity for Growth:**

- *Opportunity*: With increasing demand for the Civil Engineering program, the department is at its capacity to accommodate more students without compromising quality.
- *Action*: Collaborate with the university to secure additional resources, such as tenure-line faculty positions, upgraded facilities, and expanded classroom and laboratory space. In the interim, explore innovative strategies to manage enrollment growth efficiently.

9. **Student Engagement and Career Readiness:**

- *Opportunity*: Although students benefit from hands-on learning, greater emphasis on industry engagement and interdisciplinary experiences can further enhance their career readiness.
- *Action*: Strengthen partnerships with industry to increase internship and co-op opportunities and integrate real-world projects into the curriculum. Expand student involvement in interdisciplinary competitions and collaborative projects across engineering disciplines. Student achievements can be monitored to track the effectiveness of the action (i.e. club competitions, papers published/presented, internships attended, etc.)

10. **Laboratory Technician and Administrative Support**:

- *Opportunity***:** Lack of sufficient staff support for laboratory equipment maintenance, department operations, and supporting student success.
- *Action:* Develop grants where technician and administrative support can be embedded on soft money. This will support faculty that are active in research to have a robust program.