



PLO No. 19 Report

Assessment Measures and Results

At Cal Poly's Construction Management Department, PLO 19 (Understand the basic principles of structural behavior) is assessed using two different instruments, listed below.

Assessment Measure 1: Final Exams

Direct Measure

The final exam for ARCE 212 – Structures II evaluates students' understanding of structural behavior and calculations. The complete final exam is used as the assessment instrument.

Our goal is that at least 80% of all students get at least 70% or better on the exam. Since the assessment measure was introduced in Fall 2018, student performance has varied. Overall, only 71% of students have received an 80% or better on the exam.

Assessment Measure 2: AIC Exam Results

Direct Measure

Starting in academic year 2018-2019, as part of CM 461, all students must complete the AIC exam in order to graduate. Although a few students completed the AIC prior to Fall 2018, most of the results are from Fall 2018 onward.

Our goal is that our students perform either at or above the national average at each exam date. Students have teetered within a few percentage points of the national average. In Spring 2018 and Winter 2019, students scored 1 and 2 percentage points below national average. In Winter 2016, Winter 2017, and Spring 2019 students scored higher or at national average.

Assessment Measure 3: Survey – Industry Employer

Indirect Measure

At the end of each academic year, surveys are sent out to industry members who recruit and employ Cal Poly Construction Management graduates assessing graduates' abilities to understand the basic principles of structural behavior. Surveys have been sent out in the spring of 2016 and each spring from 2108 through 2020.

Our goal is that at least 50% of employers assess students' ability as good or above. In all years, students scored greater than 50%, with 87% (2016), 80% (2018), 92% (2019) and 83% (2020) of employers answering good and above.

Assessment Measure 4: Survey – Graduating Senior/Recent Alumni

Indirect Measure

At the end of each academic year, surveys are sent out to graduating seniors assessing personal abilities to understand the basic principles of structural behavior. Surveys have been sent out in the spring of 2016 and each spring from 2108 through 2020.

Our goal is that at least 65% of students indicate their ability as good or above. In 2016 and 2018, only 46% and 56% of students, respectively, answered good and above. These results have been consistently above 89% each year, with 92% (2016), 94% (2018), 89% (2019), and 94% (2020) of students answering good and above.



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Evaluation of Assessment Data



This PLO is of medium concern to the department. Students are performing above expectations for two of the four measures, but below expectations on the AIC exam and the embedded assessment. Student and employer perceptions have been consistent over the last few years.

The direct assessment is considered valid for this assessment, but is not housed within the construction management department. The curriculum map shows additional areas where this content is introduced and reinforced, but not mastered.

Although this assessment is not housed within the department, it is still an effective measure. With the addition of the AIC exam as a direct measure, students are being measured appropriately.

Results from the ARCE 212 course show a large range of results. The measure indicates that students struggle somewhat with this measure, but there is no way to identify areas of concern within the instrument.

Student results by are further explained later in this report.

Quality Improvement Plan

Data for this PLO is collected quarterly by the PLO Champion and provided to the Outcomes Assessment Committee at the end of each academic year.

Industry and graduating senior surveys are collected each spring. Results from the AIC exam are collected after each exam is conducted (November and April). Results from surveys and the AIC exam are housed by the Outcomes Assessment Committee.

Every three years, the annually collected data will be analyzed by the faculty, with identification of strengths, weaknesses, and recommendations for curricular change, program change, or assessment instrument modifications. This analysis will happen in the following years:

2020/2021

2023/2024

2026/2027

2029/2030

Actions Taken

As a result of the assessment data collected, the department has taken the following actions:

- During the Fall 2019 retreat, the assessment instrument and preliminary results were analyzed.
- During Fall 2019 retreat, it was determined that the assessment is embedded in the correct class, and no changes need to be made at this time.
- During the Fall 2020 retreat, the assessment results were reviewed by faculty representatives. Discussion centered around moving the assessment instrument into a course that is managed by the construction management department rather than the architectural engineering department. Although they have provided results consistently, there is little way of knowing



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where our students struggle, making it hard to improve. An identification of possible course embedment will be discussed and finalized during the 2020/2021 academic year.

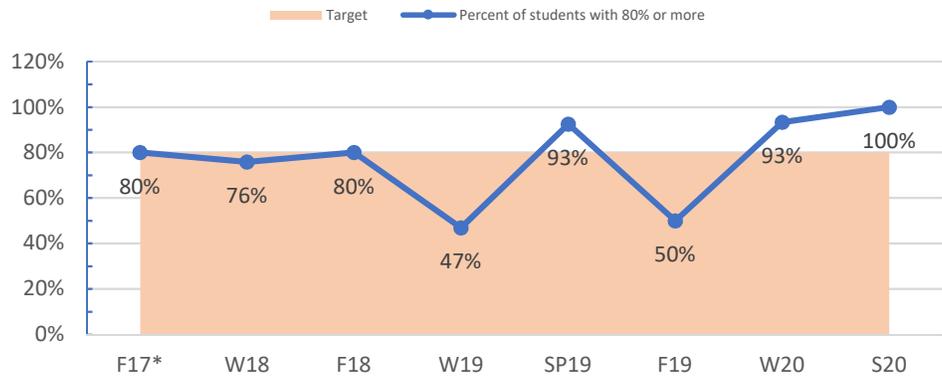
Assessment Summary

PLO No. 19 – Understand Structures

Assessment Measure 1

Assessment Method: Final Exam in course
Type of Measure: Direct
Goal: 80% of students will achieve an overall score of 70% or better.

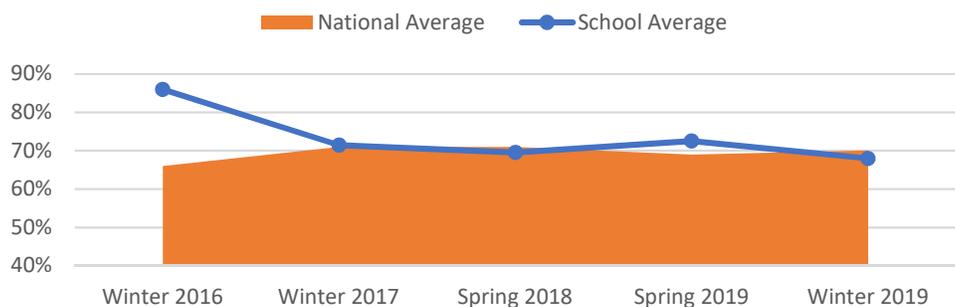
PLO 19 - Assessment Scores Measurement



Assessment Measure 2

Assessment Method: AIC exam
Type of Measure: Direct
Goal: School average is higher than national average

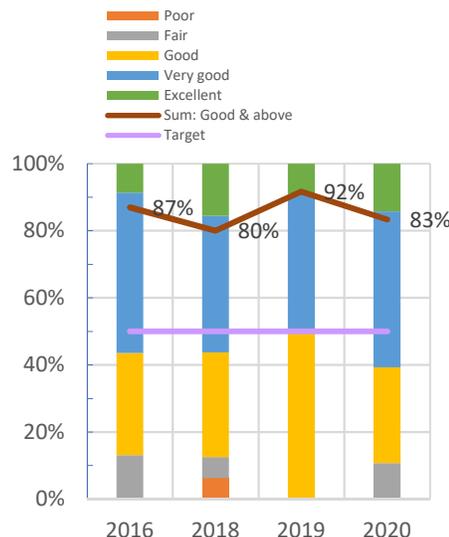
AIC Exam Results - PLO No.19



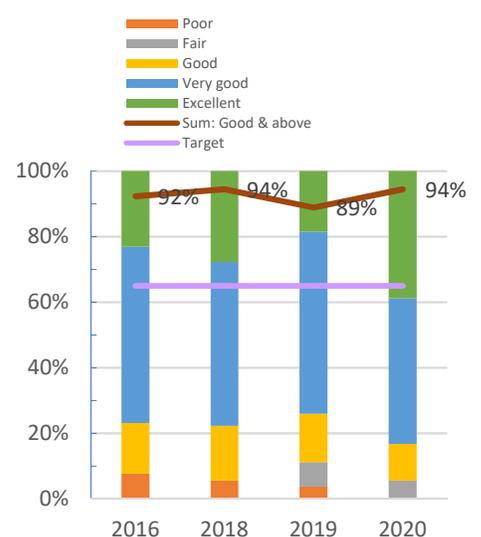
Assessment Measures 3 & 4

Assessment Method: Surveys
Type of Measure: Indirect
Goal: 50% of employers answer good or above
 65% of graduating students and recent alumni answer good and above

Employer Survey Summary - PLO No.19



Graduating Seniors & Recent Alumni Results - PLO No.19



Resulting Actions and Follow-Up

PLO No. 19 – Understand Structures

Original Assessment Measure

Fall 2017 First assessment measure implemented

Modifications to Original Assessment Measure

No changes have been made to the assessment instrument.

Assessment Measure 1: Background

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PLO Number and Description

PLO 19 - Understand the basic principles of structural behavior.

Method of Assessment

After consultation with the Architectural Engineering Department, it has been determined to conduct this assessment in ARCE 212 – Structures II. This is a course that teaches the basic principles of structural behavior by ARCE faculty who are very qualified to assist us in making this assessment. We will be using the students' scores on the final exam in this course for the assessment measure.

Assessment Reasoning

It was determined that assessing just one or two embedded questions in the ARCE 212 final exam would not be adequate for this assessment. Given the complexity of the problems included on the final exam, typically there are only five questions on the exam each worth 20 points for a total maximum score of 100 points. Looking at a very limited list of questions for this assessment would measure too narrow a cross-section of the required knowledge base and would lead to scores that are likely to be too variable for tracking improvements over time. Using the score on the entire exam would assess a broader knowledge base with less variance from quarter to quarter.

ARCE 212 has six learning outcomes stated in the syllabus:

1. Apply equations of equilibrium to solve for internal and external forces for two and three-dimensional structures.
2. Evaluate simple pinned framed structures, including pinned arches
3. Develop shear and moment diagrams
4. Calculate shear and bending stresses in beam elements
5. Compute combined axial and flexural stresses in beam or column elements
6. Compute the flow of gravity loads through a structure

These six outcomes are a good measure of a student's ability to "understand the basic principles of structural behavior." This is the second course of the four-course Structures sequence taken by all CM majors. The course is also taken by all Architectural Engineering majors and Architecture majors which provides us the ability to compare the performance of CM majors against their peers in other departments. This course is the last time all three of these majors are studying Structures together, so assessing this PLO later in the sequence would preclude the opportunity for this comparison. Also, later courses cover more advanced topics in structural analysis and design which, arguably, do not represent the "basic principles" called for in this PLO. All of this supports the argument of using student scores on the final exam in ARCE 212 as the ideal assessment measure in this case.

Data Collection and Distribution

At the end of each quarter, results for the final exam for all sections of ARCE 212 will be provided to the CM department for analysis. This will enable the assessment team to separate the scores on the exam by major and to determine the performance of CM majors completing the course. Any students not completing the course (i.e., receiving a score of "0" on the final exam) will be excluded from the analysis.

Assessment Measure 1: Background

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The average score for CM students will be compared with the overall class average and the percentage of CM students attaining the expected level of achievement will be reported. These results will be tracked from quarter to quarter to determine if CM student performance on this exam is getting better or worse.

Result Expectations

These expectations are based on CM student performance in ARCE 212 on the final exam for the fall of 2017. Only one section of the course was offered that quarter and 20 of the 33 students in the class were CM majors. Neglecting two students (only one CM) who did not finish the course and received a "0" on the exam, the class average was 81.74 and the CM student average was 78.85. Sixteen of the 20 CM students in the class (80%) scored 70% or better on the exam providing a good baseline measure. Using this data, it was decided to measure future students against this performance. Therefore, the goal for this PLO will be for 80% of the enrolled CM students to score 70% or higher on the final exam in ARCE 212 each quarter. This standard was achieved for the fall quarter of 2017.

Assessment Measure 1: Questions and Results

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Questions

A representative exam is provided in the assessment folder.

Assessment Results by Quarter:

	Total number of CM students	Total number of students with 80% or more	Percent of students with 80% or more	Target
F17*	20	16	80%	80%
W18	54	41	76%	80%
F18	20	16	80%	80%
W19	49	23	47%	80%
SP19	27	25	93%	80%
F19	24	12	50%	80%
W20	45	42	93%	80%
S20	3	3	100%	80%
Overall	170	121	71%	80%

Assessment Measure 2: Details

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Method of Assessment

Students will take the American Institute of Constructors (AIC) Level 1 Certification Exam during their junior or senior year.

Assessment Reasoning

The AIC exam has mapped ACCE student learning outcomes to questions in their exam; these results can be used to assess ACCE's 20 student learning outcomes.

Data Collection and Distribution

Upon completion of the exam (held twice a year), results are sent from the AIC to a designated faculty member. These results include individual student performance by each ACCE SLO as well as national averages. The faculty member distributes the results to the data team for recording and results are shared at departmental meetings.

Result Expectations

The goal is that the school average is higher than the national average for each test period.

AIC Exam Results by Date

AIC Exam Results - PLO No.19						
	Winter 2016	Winter 2017	Spring 2018	Spring 2019	Winter 2019	Spring 2020**
School Average	86%	71%	70%	73%	68%	#N/A
National Average	66%	71%	71%	69%	70%	#N/A
Number of students who took the exam	1	9	10	4	97	0
Number of Students who Passed Exam	1	6	6*	0	79	0

*one student left the exam early and this student's results are not included in the results

**Exams cancelled due to COVID-19

Assessment Measures 3 & 4: Details

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Method of Assessment

Surveys are sent out each year to industry employers, graduating seniors, and recent alumni. Surveys ask respondents to rank each of the 25 PLOs against student performance with the scale of (1) unable to assess; (2) poor; (3) fair; (4) good; (5) very good; (6) excellent.

Industry employers are asked to rate their perception of Cal Poly student performance for each of the 25 PLOs.

Graduating seniors and recent alumni are asked to rank their individual performance in each PLO area based on their individual perception.

Assessment Reasoning

The surveys are used to identify overall how the program is perceived by industry and how students perceive their attainment of each individual PLO.

Data Collection and Distribution

Annually, each spring, a member of the outcomes assessment committee sends out a survey to (1) industry employers; (2) graduating seniors; and (3) recent alumni using Survey Monkey. Results are collected from each group, shared with the outcomes assessment committee, and shared with the department at the fall retreat.

Result Expectations

The goal is that 50% of employers answer good or above and 65% of graduating students and recent alumni answer good and above.

Employer Survey Results by Year

	2016	2018	2019	2020
Number of Responses	23	35	24	30
Unable to assess	0%	9%	8%	7%
Poor	0%	6%	0%	0%
Fair	13%	6%	0%	10%
Good	30%	29%	46%	27%
Very good	48%	37%	38%	43%
Excellent	9%	14%	8%	13%
Sum: Very good & Excellent	57%	51%	46%	57%
Sum: Good & above	87%	80%	92%	83%
Target	50%	50%	50%	50%

Assessment Measures 3 & 4: Details

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Graduating Seniors and Recent Alumni Results by Year

	2016	2018	2019	2020
Number of Responses	13	18	27	19
Unable to assess	0%	0%	0%	0%
Poor	8%	6%	4%	0%
Fair	0%	0%	7%	6%
Good	15%	17%	15%	11%
Very good	54%	50%	56%	44%
Excellent	23%	28%	19%	39%
Sum: Very good & Excellent	77%	78%	74%	83%
Sum: Good & above	92%	94%	89%	94%
Target	65%	65%	65%	65%