CM Program 2017 SLO/PLO Assessment Meeting Report

Date: February 15, 2017

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Introduction:

Per the CM Program Assessment Implementation Plan, the CM faculty met to review collected assessment data for the following PLO/SLOs: 4, 6, 9, 12-15, & 17 (Exhibit A). Per the SLO/Course Responsibility Matrix (Exhibit B), these SLOs are assessed in the following courses:

CM 2001 Construction Documents, Law & Project Delivery Systems

SLOs 9, 12, 13, 15, & 17 were assessed in this course. Two sections of this course were taught in Spring 2016 and Fall 2016. Data from the CM students in the two sections in the Spring was combined and analyzed together, as was data from the two sections taught in the Fall. A total of 11 CM students completed the course in Spring 2016, and a total of 41 CM students completed the course in Fall 2016.

CM 3034 Construction Estimating & Costing

SLOs 4, 6, & 14 were assessed in this course. Data from forty-two CM students who completed the course in Spring 2016 was used in the assessment of these SLOs.

CM 5010 Construction Management Capstone Project

SLO 6 was also assessed in this course. Data from thirty-six students in the course in Spring 2016 was used in the assessment of this SLO.

Performance Criteria for Direct Assessments:

The performance criteria for all of the PLO/SLOs assessed at this meeting are that 70% of CM students should pass the direct assessment (whether it be a test, quiz, presentation, etc.) with a score of 70% or better.

PLO/SLO #4: Create construction project cost estimates

In CM 3034, students learn the process of developing cost estimate of a project during various stages of a project including Programming, Schematic Design, Design Development, and Construction Documents. The students' performance in achieving this objective was assessed via

an estimating project. Students were provided design documents (2D Drawings and BIM models) and RSMeans cost data and asked to create an estimate for the project. The work involved included:

1. Performing Quantity Takeoff for:
    a. Division 03 – Concrete
    b. Division 04 – Masonry
    c. Division 05- Metals
    d. Division 08 – Openings
2. Estimating Cost (using RSMeans Building Construction Cost Data) for:
    a. Division 01- General Conditions
    b. Division 03 – Concrete
    c. Division 04 – Masonry
    d. Division 05- Metals
    e. Division 08 – Openings
    f. Home Office Overheads
3. Creating the Estimate Summary by combining the estimates developed by the students, subcontractor quotes, overhead and profits.
4. Compiling all the relevant documentation in a professional manner.

Results: *Spring 2016: 93% of CM students passed with a 70% or higher.*
Objective = Met

The faculty are in favor of maintaining the current method of assessment. This can be further supplemented by including a section on estimating in CM 4001: MEP for Constructors, which will be taught in Fall 2018 by Prof. Jason Mack.

PLO/SLO #6: Analyze professional decisions based on ethical principles

Note: It is generally the opinion of the UC CM faculty that although ACCE requires only one direct assessment on the topic of construction ethics, ethics is such a broad and important topic that it should be taught or touched upon in a variety of courses and in a variety of contexts throughout the curriculum. Thus, we assessed ethics in two separate courses.

Direct Assessment #1:
Ethics was discussed in the context of estimating in CM 3034. In this course, the instructor discussed the importance of ethical behavior for the well-being of the construction industry. The code of ethics of the American Society of Professional Estimators (ASPE) was discussed in the class. Students were assigned a homework assignment in the form of a case study that dealt with bid shopping. In the assignment, students were asked to: define Ethics; analyze the case study for unethical behavior; reflect on their experiences in the construction industry; discuss the potential impact of bid shopping on subcontractors' business; discuss the potential impact of bid shopping on project outcomes.

Results: *Spring 2016: 95% of CM students passed with a 70% or higher.*
Objective = Met

Of the 42 students in the class, only 2 students argued in favor of bid shopping. The rest of the class overwhelmingly identified the ethical issues associated with the practice and they argued for fair play. After reading student's reflection on their co-op (internship) experiences and their analysis of the case presented to them, it was very clear that students had taken time to analyze the case based on ethical principles. Ethics is currently also discussed (but not assessed) in other courses such as CM 2003: Construction Safety. The ethical implications of contractors' decisions regarding worker safety are currently discussed in CM 2003.

Direct Assessment #2:
CM 5010 consists of a seminar-style format with lectures on a variety of topics, including ethics. For the ethics module, students hear a lecture from a member of industry and are given reading assignments on the topic. Assessment of PLO/SLO #6 was covered via a short-answer quiz where students were given scenarios that presented an ethical conflict, and asked to choose and justify their next course of action.

Results: *Spring 2016: 94% of CM students passed with a 70% or higher.*
Objective = Met

The target for this objective has been met. The students' answers to essay prompts showed a careful consideration of their options and their implications, with regard to ethics and otherwise.

PLO/SLO #9: Apply construction management skills as a member of a multi-disciplinary team

CM 2001 requires students to understand the various roles and responsibilities of stakeholders in the design and construction process. Understanding the roles and responsibilities of members of a multi-disciplinary team is foundational knowledge that is necessary to understand later aspects of the course (such as how those team members organize themselves into various project delivery methods, and what impact that has on how the team functions). Assessment of PLO/SLO #9 was covered via a subset of questions on the 2nd of three tests in the course.

Results: *Spring 2016: 91% of CM students passed with a 70% or higher.*
Fall 2016: 95% of CM students passed with a 70% or higher.
Overall: 94% of CM students passed with a 70% or higher.
Objective = Met

The target for this objective is being easily met. However, the faculty feel that this introductory-level class is not the best place to perform this assessment. Upper level courses,

and in particular the Capstone courses, require the students to work in multidisciplinary teams on a regular basis. However, ACCE's direct assessment guidelines prohibit the use of the group work for assessment. Better guidance is needed from ACCE so that we can determine how to directly assess more advanced work in multi-disciplinary teams in a more suitable course.

PLO/SLO #12: Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.

CM2001 requires students to understand common forms of project delivery, such as Design-Bid-Build, Design-Build, CM-Agent, and CM-At-Risk, as well as emerging concepts such as Integrated Project Delivery and Public Private Partnerships. The students also learn to anticipate the effects that a chosen project delivery method has on the project team and its' processes. Assessment was covered via a subset of questions on the 1st and 2nd of three tests in the course.

Results: *Spring 2016:* *73% of CM students passed with a 70% or higher.*
Fall 2016: *71% of CM students passed with a 70% or higher.*
Overall: *71% of CM students passed with a 70% or higher.*
Objective = Met

The target for this objective is being met, but there is there is room for improvement of student performance on this outcome. The instructor believes that performance may be improved by decreasing student apathy towards the topic, which to these students (most of whom haven't had their first co-op yet), seems to be a largely academic exercise. Guest Speakers from industry who can talk about the PDMs used on their real-life projects could help reinforce the message and aid in student retention of the concepts.

PLO/SLO #13: Understand construction risk management.

CM2001 introduces students to a number of concepts related to construction risks of all types--financial risk, legal risk, schedule risk, site risks, and safety risks—as well as general concepts of project control to mitigate those risks. The course also introduces the concepts of insurance (Builder's Risk, CGL, and Worker's Comp) and surety bonds and their purpose. These concepts of risk are assessed via subsets of questions on all three of the exams in this course.

Results: *Spring 2016:* *82% of CM students passed with a 70% or higher.*
Fall 2016: *76% of CM students passed with a 70% or higher.*
Overall: *77% of CM students passed with a 70% or higher.*
Objective = Met

The target for this objective is being met. The Instructor notes that students have an easier time understanding project-specific risks (site, schedule, etc.) and a harder time with legal and

financial concepts of risks. The project specific risks are typically covered in the middle part of the class, while the legal and financial considerations are covered nearer the end. It is possible that better integration of the topics throughout the course of the semester could improve student performance.

PLO/SLO #14: Understand construction accounting and cost control.

In CM 3034, the various types of construction costs such as direct costs (labor costs, material costs, equipment costs, and subcontractor costs), indirect costs, home office overheads etc. were discussed in detail. The instructor discussed these costs from an estimating perspective earlier in the semester and subsequently revisited them later in the semester to discuss how a contractor can monitor, control, and forecast these costs at a work package level and at the project level. The fundamental components of a typical project cost report were also discussed. Finally, students were introduced to the fundamental concepts on earned value analysis: Planned Value, Earned Value and Actual Costs. Students learned how to analyze data to calculate cost variance, schedule variance, cost performance index, and schedule performance index and make inferences from these metrics.

Results: *Spring 2016: 83% of CM students passed with a 70% or higher.*
Objective = Met

The primary assessment tool used for this SLO was a quantitative homework assignment. In the Spring semester of 2017, this can be supplemented with qualitative questions in the form of a quiz so that students' learning of all aspects of cost control systems is assessed even more comprehensively.

PLO/SLO #15: Understand construction quality assurance and control.

The course introduces the general concept of control processes (including cost, quality, safety, schedule, etc.) through the Plan-Do-Check-Act cycle and related derivatives. We also cover aspects of quality control from the drafting of specifications, to the shop drawing and submittal process, mock-ups, and testing and inspection. Various aspects of quality assurance and control processes in general are assessed via a subset of questions on the 2nd and 3rd of three exams in this course.

Results: *Spring 2016: 73% of CM students passed with a 70% or higher.*
Fall 2016: 73% of CM students passed with a 70% or higher.
Overall: 73% of CM students passed with a 70% or higher.
Objective = Met

The target for this objective is being met. The faculty notes that a new course, CM 4001 Quality & Safety Management, has been added to the curriculum and will begin being offered in Fall

2018. While the current CM 2001 course is sufficient to assess students at the "understand" level, the new course may provide an even more thorough opportunity for assessment in the future.

PLO/SLO #17: Understand the legal implications of contract, common, and regulatory law to manage a construction project.

The importance of project documentation of all types, and the legal implications of those documents, are covered in this course. This applies not only to traditional legal documents (such as contracts, change orders, and mechanics liens) but also to the legal relevance of day-to-day project documentation (such as RFIs, daily logs, emails, etc.). Students are also exposed to regulations affecting the construction industry from the local/regional level (zoning, building codes), and the state and national level (OSHA, EPA, lien laws, etc.). Students also receive a brief civics refresher on the three branches of government and how a project's location may impact the applicable common law.

Results:	*Spring 2016:*	*64% of CM students passed with a 70% or higher.*
	Fall 2016:	*73% of CM students passed with a 70% or higher.*
	Overall:	*71% of CM students passed with a 70% or higher.*
	Objective = Met	

The target for this objective was met in FS 2016, but not quite in SS 2016. Taken together over both semesters, the objective was met. Both semesters of the course were taught by the same instructor and covered the material in approximately the same way. Possible explanations for the variation in performance are:

- The small sample size of only 11 CM students in the SS 2016 courses.
- The fact that CM students taking this course in the spring semester tend to be off-track from their peers for one reason or another.

The faculty recognizes that legal issues are not at the forefront of concerns for the typical CM student or even early-career CM graduate, and apathy can be an issue. The instructor for this course has a litigation background and strives to bring in real-world examples of the legal issues that arise on construction projects whenever possible.

Completion of Prior Year's Action Items:

This section is not applicable because this is the first year of the first assessment cycle under the new ACCE Assessment Plan.

Indirect Assessments:

CM Senior SLO Surveys

Starting in spring 2016, the senior CM class was asked to complete a survey to self-assess whether they feel they meet ACCE's 20 SLO's. Students were asked to preface each SLO with an "I" or "I can" and indicate the extent to which they agree or disagree with the resulting statement on the following scale:

- 1 – Strongly Disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly Agree

Twenty-seven students responded to the survey. Results for the PLO/SLO's under review in this cycle are summarized in the table below. All PLO/SLO's ranked in the "Agree" to "Strongly Agree" range. PLO/SLO #17 was the lowest scoring, but still averaging near the "Agree" mark. The results of this indirect assessment appear to be consistent with the results of the direct assessment of these PLO/SLOs as discussed above.

PLO/SLO #	Average Score (1-5)
4	4.26
6	4.85
9	4.59
12	4.30
13	4.26
14	4.04
15	4.26
17	3.96

Action Items:

1. This report shall be circulated to all CM Program Faculty and the CAECM Department Head.
2. Obtain better guidance from ACCE on acceptable methods for assessing PLO/SLO #9 using group projects. The CM faculty believes that CM 5010 (CM Capstone Project) is much more in the spirit of this PLO/SLO, but we are currently unable to use that course as a "direct assessment" for PLO/SLO #9 without better guidelines on ACCE's allowable assessment methods for group work.
3. Combat student apathy about project delivery systems by incorporating guest speakers in CM2001 to discuss the effect of the choice of project delivery systems on their real-life projects (PLO/SLO#12).
4. Move the assessment of PLO/SLO#15 to CM 4001 Quality & Safety Management when the course is offered in Fall 2018.
5. Continue indirect assessment of CM seniors through a PLO/SLO survey in Spring 2017.

EXHIBIT A

SLOs/PLOs Examined in 2017 (Highlighted)

PLO #	ACCE SLO #	Description
1	1	*Create written communications appropriate to the construction discipline.*
2	2	*Create oral presentations appropriate to the construction discipline.*
3	3	*Create a construction project safety plan.*
4	4	*Create construction project cost estimates.*
5	5	*Create construction project schedules.*
6	6	*Analyze professional decisions based on ethical principles.*
7	7	*Analyze construction documents for planning and management of construction processes.*
8	8	*Analyze methods, materials, and equipment used to construct projects.*
9	9	*Apply construction management skills as a member of a multi-disciplinary team.*
10	10	*Apply electronic-based technology to manage the construction process.*
11	11	*Apply basic surveying techniques for construction layout and control.*
12	12	*Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.*
13	13	*Understand construction risk management.*
14	14	*Understand construction accounting and cost control.*
15	15	*Understand construction quality assurance and control.*
16	16	*Understand construction project control processes.*
17	17	*Understand the legal implications of contract, common, and regulatory law to manage a construction project.*
18	18	*Understand the basic principles of sustainable construction.*
19	19	*Understand the basic principles of structural behavior.*
20	20	*Understand the basic principles of mechanical, electrical, and piping systems.*
21	-	*Experience the application of various construction management concepts through successful completion of real-world co-operative education opportunities.*

EXHIBIT B
SLO/Course Responsibility Matrix

SLO #	SLO Description / Course Number	Construction Drawings 1	Construction Drawings 2	Constr. Docs, Law, & Project Delivery Systems	Construction Safety & Equipment	Construction Methods & Productivity	Construction Estimating & Costing	Project Planning, Scheduling, & Control	Construction Finance & Strategic Management	CM Capstone	Civil Engineering Measurements	Structural Design	Construction Materials	Fluid Mechanics & Thermodynamics	Statics	Basic Strengths of Materials	Soils & Lab	Value Engineering	Leadership & Decision Making	Building Systems 1 - Mechanical	Building Systems 2 - Plumbing & Fire Protection	Building Systems 3 - Electrical & Lighting	Senior Survey	Employer Survey
		CM 1001	CM 1002	CM2001	CM2002	CM3003	CM3034	CM3035	CM4037	CM5010	CVE2001C	CVE2002	CVE2003C	CVE2005	CVE2031	CVE2032	CVE3002C	CVE5136	CVE5138	AE3041	AE3042	AE4043		
1	*Create written communications appropriate to the construction discipline.*				DA																		IA	IA
2	*Create oral presentations appropriate to the construction discipline.*				DA																		IA	IA
3	*Create a construction project safety plan.*				DA																		IA	IA
4	*Create construction project cost estimates.*						DA																IA	IA
5	*Create construction project schedules.*							DA															IA	IA
6	*Analyze professional decisions based on ethical principles.*						DA			DA													IA	IA
7	*Analyze construction documents for planning and management of construction processes.*						DA1	DA2															IA	IA
8	*Analyze methods, materials, and equipment used to construct projects.*				DA																		IA	IA
9	*Apply construction management skills as a member of a multi-disciplinary team.*			DA																			IA	IA
10	*Apply electronic-based technology to manage the construction process.*		DA2					DA1															IA	IA
11	*Apply basic surveying techniques for construction layout and control.*										DA												IA	IA
12	*Understand different methods of project delivery and the roles and responsibilities of all constituencies invovled in the design and construction process.*			DA																			IA	IA
13	*Understand construction risk management.*			DA																			IA	IA
14	*Understand construction accounting and cost control.*						DA																IA	IA
15	*Understand construction quality assurance and control.*			DA																			IA	IA
16	*Understand construction project control processes.*							DA															IA	IA
17	*Understand the legal implications of contract, common, and regulatory law to manage a construction project.*			DA																			IA	IA
18	*Understand the basic principles of sustainable construction.*									DA													IA	IA
19	*Understand the basic principles of structural behavior.*											DA											IA	IA
20	*Understand the basic principles of mechanical, electrical, and piping systems.*																			DA	DA	DA	IA	IA

DA = Direct Assessment, IA = Indirect Assessement