CM Program Quality Improvement Plan

1.0 Strategic Plan for Educational Unit

The strategic plan is updated every five years. In the past each program has developed its own 5-year plan, and the last plan for the CM program was created in 2012.

A new 5-year plan is currently being drafted for 2017, but this time it is being done at the CAECM department (educational unit) level. The 5-year plan for the CM program from 2012 is attached at the end of this QIP document as Exhibit 1.

2.0 Assessment Plan for CM Program

CM Program Mission

The mission of the CM Program is to prepare students to become managers who have a strong understanding of the technical and management principles applied to today's complex construction projects.

CM Program Objectives

The degree program objective is to produce graduates that are able to complete the Program Learning Outcomes, which are outlined in the next section.

Program Learning Outcomes

The CM Program Learning Outcomes correspond directly with ACCE's twenty SLOs, with one addition (PLO#21), as detailed in the following table:

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.*

Assessment Tools

Direct Assessments:

Program Learning Outcomes #1-20, which correspond with ACCE SLOs #1-20, are directly assessed by tests, homeworks, and projects assigned in courses per the following matrix attached at the end of this document as Exhibit 2.

Program Learning Outcome #21 is directly assessed by completion of several items at the conclusion of each student's co-op semester:

- A formal performance review by the co-op employer for their particular student.
- The student's completion of a review of their employer.
- The student's completion of an assignment as required by the Experience-Based Learning & Career Education department (typically an essay).

Students who enter the CM program directly must successfully complete five semesters of co-op experience in order to be certified for graduation. Allowances are made to require fewer co-op experiences for students who transfer into the CM program after the freshman year, but in no case can a transfer student graduate from the CM program with less than three semesters of co-op experience.

Indirect Assessments:

Program Learning Outcomes #1-21 (and corresponding ACCE SLOs #1-20) are Indirectly Assessed as follows:

Assessment Method	When/How Often?	How is Data Collected?	Applicable to PLO/SLO#
Course Evaluations	Every Semester	Electronic survey by University	Varies depending on course.
Coop Employer Survey	Every Semester	Electronic survey by Department of Experienced Based Learning & Career Education	Always PLO#21, others depending upon work experience.
Coop Student Survey Assessment	Every Semester	Electronic survey by Department of Experienced Based Learning & Career Education	Always PLO#21, others depending upon work experience.
CM Graduate Employment Information Survey	Every Spring Semester	Electronic survey by Department of Experienced Based Learning & Career Education, and a paper survey completed during CM Capstone Class	CM Program Objective #1
CM Senior SLO Survey	Every Spring Semester	Paper survey completed during CM Capstone Class	PLO/SLO#s 1-20
Industrial Advisory Board Feedback	Semi-annually during Advisory Board Meetings	Captured in meeting minutes & circulated to faculty (and other attendees).	Varies
Student Competitions	Annually (numerous competitions, fall and spring semesters)	A list of competition team placement is kept and published on the CAECM website.	Varies depending on particular competition. Typically covers PLO/SLO#s 1-13 & 15-18.

Performance Criteria

The performance criteria for Program Learning Outcomes #1-20 (which correspond with ACCE SLOs #1-20) 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. This baseline goal was set for all of the first 20 PLO/SLOs as we began collecting data under the new ACCE standards.

The performance criteria for Program Learning Outcome #21 is that students who start in the CM program as freshmen must complete a total of five co-op semesters in accordance with the Department of Experience Based Learning & Career Education's requirements. Allowances are made for students who

transfer into the CM program after their freshman year, but in no case shall a student complete fewer than three co-op semesters.

Evaluation Methodology

Data for Indirect Assessment is collected as noted in the table under "Assessment Tools."

Data for Direct Assessments is collected by individual faculty who are teaching the specific course in which that PLO/SLO is directly assessed.

SLOs will be evaluated on a rotating basis every three years, such that (once a full assessment cycle has passed), three years of assessment data will be available for review.

3.0 Assessment Implementation Plan for the CM Program

Assessment of the CM Degree Program

The CM program faculty and CAECM department head shall meet annually to assess progress on the achievement of Program Objectives. Progress shall be measured by comparing collected data to stated performance criteria to determine if outcomes and objectives were achieved, and if there is a need for improvement in any areas.

Individual Program Learning Outcomes (including ACCE's SLOs) will be assessed on a rotating three-year cycle per the following schedule:

Cycle Year	PLOs/SLOs To Be Examined
Year 1	SLO #4, 6, 9, 12, 13, 14, 15, 17
Year 2	SLO #1, 2, 3, 7, 8, & PLO #21
Year 3	SLO #5, 10, 11, 16, 18, 19, 20

Results of Assessment Cycle & Action Items for Goals

The results of each assessment cycle shall be recorded in a written report circulated to all CM faculty and the CAECM department head. The report shall include a list of action items to address any goals that have not been achieved. Successful completion of the prior year's action items shall then be reviewed and documented as part of the next year's assessment, in addition to the scheduled PLOs/SLOs per the chart above.

Improvement of the Assessment Plan

This Assessment Plan shall be reviewed at each annual degree program review and revised as necessary to ensure continuous improvement in the program.

EXHIBIT 1
5-Year Plan from 2012
Construction Management Program 5-Year Plan

I- Introduction

- Construction accounts for approximately eight to 10 percent of the U.S. gross domestic product.
- UC has served the construction industry through 2 main programs:
  - CM Program: A BSc program that started at UC in 1973 as a five year coop program. The program has established a strong reputation both regionally and nationally. Many of the CM students have successfully competed in and won regional and national CM competitions.[1] CM Alumni have excelled in industry and many hold executive positions in leading local, regional, and national construction companies.
  - Civil Engineering (CVE) Program: a large percentage of CVE students select Construction Engineering and Management (CEM) as their area of concentration. CVE alumni working in construction have also excelled in the industry.
- **Extensive discussions with industry have indicated the need for <u>both</u> programs**.
- **<u>Both</u>** programs require students to take courses in construction engineering and construction management.
  - The Construction Engineering and Management (CEM) Faculty teaches both construction engineering and construction management courses
  - Before the merger, there were **<u>CEM faculty in both COE and CAS</u>** teaching duplicated classes. One of the objectives of the merger is increasing efficiency by eliminating duplicated CEM classes.
    - In addition to teaching, the responsibilities of the COE CEM faculty included supervising graduate students & conducting funded research.
    - Since CAS did not have a graduate program, the responsibilities of CAS CEM faculty included teaching and unfunded research.

II- Summary of Current Status (Actual), Current Status (Needed) and 5-Year Goals

The table below summarizes: 1) the current actual status, 2) immediate goals, and 3) 5-year goals.

	Current (Actual)	**Current (Needed)**	**5-year Goals**
CM Enrollment	160	160	160
CM Yearly admission	30	30	30
CM Co-op model	Single section	Double section	Double section
Number of CEM Faculty members	**3**	**3** (1 TT & 2 PE)	**5** (**3** TT & **2** PE)
CEM Total Endowment	$1,347,676	$1,792,689	$6,000,000
CEM Research expenditures	$100,000/year	$200,000	$500,000
CEM faculty teaching in Summer	No	Yes	Yes
Use of Professorship money to support CEM research	No	Yes	Yes

[1] We use these competitions to benchmark the success of UC program against other CM programs. During the last three years, our students have won the majority of these competitions.

The Construction Engineering and Management (CEM) Faculty is currently understaffed, and will become more so after the retirement of Dr. Suckarieh at the end of this academic year. In addition to advising CVE graduate students, t**he CEM Faculty teaches CEM courses to CM majors, CVE, and AE majors within CEAS, as well as to DAAP students who choose to take CEM electives or complete the CM minor**.

The **CVE** Program has designated CEM to be one of four ABET "**areas of proficiency**". Therefore, in addition to **160 CM** students, the **CEM faculty** is teaching **300 CVE students three required** CEM courses. About **40% of CVE students** choose to take additional courses in CEM. Furthermore the **CEM faculty** is teaching **110 AET/AE** students a minimum of 3 CEM courses.

III- Immediate Goals

CEM Course Load and Number of CEM Faculty

Currently the CEM faculty is responsible for providing 26 sections of CEM courses per year. However, we currently only have 3 full-time CEM faculty, who teach an average of 4 semester sections per year. Thus, only about 12 sections per year are covered by full-time CEM faculty. The remaining 14 sections of CEM courses—**over 50% of all CEM courses**—are taught by adjunct instructors. Although ACCE cited our reliance on adjuncts as a weakness during our last accreditation visit, and we promised to fix the problem, the percentage of courses taught by adjuncts has actually *increased* since the ACCE accreditation visit (when it was 47%).

The CEM faculty worked diligently during the semester conversion process to control this percentage by combining courses and agreeing to a single section co-op.[2] However, demand for CEM courses by other programs continues to drive the need for additional course sections and thus additional adjuncts. This situation will worsen with the expected retirement of Dr. Suckarieh at the end of this academic year.

To reduce the percentage of CEM classes taught by adjuncts, we recommend the following immediate actions:

1. Hire a new CEM faculty member (professor educator) to replace Dr. Suckarieh **starting Fall 2013**. **It is essential that the hiring process start immediately to have a CEM faculty in Fall 2013. Our ACCE third year report is due in Spring 2014 and we need to demonstrate that we have reduced our dependence on adjuncts.**
2. Allow all 3 CEM full-time faculty to teach in the summer. This will increase the average number of courses taught by full-time CEM faculty to 6 per year, reducing the amount of CEM courses taught by adjuncts to 31%.

Recommendations to change Co-op program into a double section co-op

When designing the CM curriculum for semester conversion, it was assumed that the single-section program under which the CM Program currently operates will significantly reduce the CEM teaching load. However, because the CEM faculty provides courses for CVE which operate under double-section co-ops, the majority of CM courses must still be offered twice or three times a year. With minor changes to when the CEM courses are taught, the CM co-op program can be changed into a double section co-op while only increasing the number of required CEM sections to 28 (instead of 26). Industry and students prefer double section co-op models. It makes it easier to find co-op jobs for students.

IV- 5-Year Goals for the CM Program

Graduate Program

[2] The single-section co-op is unpopular with industry stakeholders and students, but is necessary due to limited faculty resources because it reduces the number of times certain courses must be offered each year.

- While **the immediate goals focus on meeting teaching needs**, **the 5 year goals focus on strengthening the CVE graduate program in CEM**.
  - **Currently**, the CEM faculty advises a small number of graduate students **(2 MENG students and 1 MSC student)**. Because the CEM faculty is short staffed, it has not been offering any of the 7000 graduate-level CEM courses.
- **Traditionally**, the CVE graduate program in CEM at UC has been strong. The loss of CEM faculty has negatively impacted the graduate program in CEM.
- Short term, the CVE graduate program in CEM should be strengthened by using the funds generated by the "Lichter Professorship of Engineering Construction". This professorship was held by a former COE CEM faculty, Dr. Minkarah. The money generated by this fund is not currently used for CEM education/research activities.
- Long term, the CVE graduate program in CEM should be strengthened by the **hiring of 2 additional tenure track** CEM faculty
  - One in Heavy Highway construction which will be partly funded by the Heavy Construction Professorship (after it completes its targeted value)
  - Another in Industrial construction which will be partly funded by new fundraising activities as described below.
- The **hiring of 2 additional tenure track** CEM faculty will:
  - Increased funded research
  - Enable the growth of the MENG with concentration in CEM to support SAS collaboration efforts with China
  - Strengthen the CVE graduate program

Research Quantity and Focus

Currently, the CEM faculty's research expenditure is $100,000 per year with a focus on economic selection and implementation of green construction strategies and the feasibility of renewable energy technologies. Of the current 3 full-time faculty in the program, one is a "professor-educator" and does not have any research obligations to the University, but has research interests in construction law. With the hiring of two additional tenure track CEM faculty, we expect a growth in research expenditures to $500,000 per year. We expect future research to include research relevant to the heavy highway construction and industrial construction industries.

Endowment

The CM program has a strong endowment that reflects the support of the industry, yet the endowment is small compared to some of our competitors such as Arizona State or Virginia Tech. These schools were able to receive stronger support from industry by offering individualized construction education that is based on interdisciplinary collaboration.

Our goal is to work with industry and the UC foundation to increase our endowment to $6,000,000. In the short term, we need to increase the Heavy Construction Endowed Professorship to $1,000,000 in order to begin building a focus area in the heavy highway industry. In the long term, we believe that the Virginia Tech model is a good model to replicate at UC. Virginia Tech created an endowed ($10M) construction group that consists of a joint venture between various departments and colleges that offer construction related education and research, including the College of Engineering and the College of Architecture.

The endowed funds will be used to:

- Establish a Construction Education Center that bring faculty from multiple departments to provide students with additional opportunities to pursue concentrations, minors, or support courses related to construction
- Student scholarships
- Establish the new tenure-track position in Industrial construction as described above

EXHIBIT 2
SLO/Course Responsibility Matrix

SLO #	Course Number / SLO Description	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