## College of Engineering

Department of Civil Engineering & Construction Engineering Management

## CONSTRUCTION MANAGEMENT PROGRAM

## **Assessment Tools**

Table 1 below summarizes the assessment tools, the frequency for using the tools and the procedures for data collection to support the program assessment.

Table 1. Summary of the Program Strategic Plan

Level	Assessment Tool	Target to be Assessed	Frequency
Level I	-Advisory & Development Council Meetings -Job offers and Internship placement -Academic and professional Awards -Activities in student organizations	Program Educational Objectives (1-4) and Program Strategic Goals (G1-G5)	- Annually
Level II	-Graduating senior surveys - Employer surveys - CEM alumni surveys	Program Learning Outcomes (1-20)	<ul><li>Bi-annually</li><li>Every 3 yrs</li><li>Every 3 yrs</li></ul>
Level III	-Course evaluations (Survey Questionnaires) -Student works (Assignments, Tests, Quizzes, Lab Reports, Projects)	Course Learning Outcomes and ACCE - SLOs	- Bi-annually

For the Student Learning Outcomes # 1 and # 2, the following rubrics (see Tables 2a and 2b) will be used as the assessment tools for measuring the ability to create written communications appropriate to the construction discipline and ability to create oral presentations appropriate to the construction discipline.

# Table 2a. Rubric for Assessment of Student Learning Outcome # 1 WRITTEN COMMUNICATION SKILL - RUBRIC

(ACCE-SLO # 1. Create written communications appropriate to the construction discipline.)

Sub-Outcome	SCORE (1-4)	NOVICE (1)	APPRENTICE (2)	PROFICIENT (3)	EXEMPLARY (4)
(Report Quality & Writing Skills)					
SLO1.1. Spelling and grammar		Make frequent spelling and/or grammatical mistakes (> 1 mistake/page)	Make noticeable spelling and/or grammatical mistakes (< 1 mistake/page)	Rare spelling and/or grammatical mistakes (<0.5 mistake/page)	Almost no spelling and/or grammatical mistakes (<0.2 mistake/page)
S.O1.2. Punctuation		No use of punctuation at all Sentences seems to go on and on forever  No Apparent usage of paragraphs	Some improper use of punctuation. Sentences are usually too long, many repetitive words, some improper use of paragraphs	Proper use of punctuation. Sentences are sometimes too long, some repetition of words, proper use of paragraphs	Proper use of punctuation. Sentences are not too long, no repetition of words, proper use of paragraphs
SLO1.3. Structure and organization (choice of fonts, titles, sub-titles, chapters, sub-chapters, sections, sub-sections to enhance the readability and understanding of the report) having a table of contents, list of figures and tables		The structure and organization of the report seem to be random; does not follow the template at all, missing table of content, list of figures or tables	The structure and organization are not good, noticeable departure from template, poor table of content, list of figures and tables	Good structure and organization with some departure from the ideal template, good table of content, list of figures and tables	Super structure of the report, everything makes sense (understand templates and can follow them exactly), perfect table of content, list of figures and tables
SLO1.4. Use of visual illustrations, other than plain text (graphs, charts, flow diagrams, tables,) to enhance the understanding of the report		Information is rarely illustrated graphically with improper choice of illustration methods	Most information that can be graphically illustrated is presented as plain text. Some information is illustrated graphically with some wrong illustration methods	Most information that can be graphically illustrated is presented as such with good choice of the illustration method that suits the information being presented the most.	All information that can be represented graphically is presented as such with proper choice of the illustration method that suits the information being presented the most.

# Table 2b. Rubric for Assessment of Student Learning Outcome # 2 ORAL COMMUNICATION SKILL - RUBRIC

(ACCE-SLO # 2 - Create oral presentations appropriate to the construction discipline.)

Sub-Outcome	SCORE (1-4)	NOVICE (1)	APPRENTICE (2)	PROFICIENT (3)	EXEMPLARY (4)		
SLO2.1. Audience awareness: interact with audience, looking at them, making eye contact		Does not interact with audience at all. Does not look at the audience. Look at PC, screen, or elsewhere	Little interaction with audience	Some interaction with audience	Interact with audience throughout the presentation		
SLO2.2. Focus: goal, evidence, conclusion		Does not give audience an adequate road map of goal, evidence and conclusion	Gives audience some road map of goal, evidence and conclusion	Gives audience an adequate road map of goal, evidence and conclusion	Gives audience very clear road map of goal, evidence and conclusion		
SLO2.3. Transitions: phrases smoothly link one part to next		Abruptly transitions from one phrase to the next	Some transitions are provided though not smooth	Transitions are generally smooth	Very smooth transitions		
<b>SLO2.4.</b> Questions: asks audience questions		Does not ask for questions	Rarely ask for questions	Asks for questions	Effectively opens ("I'd be happy to answer questions")		
SLO2.5. Answers questions effectively and smoothly		Does not answer questions adequately	Rarely answers questions adequately	Answers questions adequately	Answers questions effectively and smoothly		

In addition, the assessment tools for the Program Strategic Goals (G1-G5) are presented in Table 3. below.

Table 3. Summary of Assessment Tools for Program Strategic Goals

Strategic Goal	Assessment Tool	Collected Data
G1	Advisory & Development Council Employer/Alumni Surveys	Industry trends
G2	Program QIP assessment results	Items to be improved
G3	Annual faculty reports	Scholarly activities of faculty
G4	Annual CECEM-ADC reports.	Industry partnerships
G5	Annual faculty reports	Global activities of faculty/students

The collected data obtained from the annual assessment of the Program Strategic Goals will be used as Planned Activities for improvement in the following academic year by ensuring their achievements and taking appropriate actions, if needed. Table 4 illustrates the template/tool prepared for summarizing the assessment results of the Program Strategic Goals.

Table 4. Assessment Results for Program Strategic Goals

Strategic Goals	Academic Year:											
Goals	Planned Activities	Achievement	Actions									
G1												
G2												
G3												
G4												
G <sub>5</sub>												

## **Performance Criteria**

For assessment purposes, the 20 Program Learning Outcomes (i.e. ACCE-SLOs) are broken into sub-outcomes as Performance Criteria which are linked to the course learning outcomes from CEM courses. Table 5 below describes the Performance Criteria of the 20 Student Learning Outcomes.

**Table 5. Performance Criteria of Program Learning Outcomes (ACCE-SLOs)** 

Program Learning Outcomes (ACCE SLOs)	Performance Criteria (P.C.)					
Create written communications appropriate to the construction discipline.	P.C.1 Ability to create written construction documents/reports with an appropriate format					
2. Create oral presentations appropriate to the construction discipline.	P.C.1 Ability to create written construction documents/reports with an appropriate format					
3. Create a construction project	P.C.1 Ability to apply safe practices					
safety plan	P.C. 2 Ability to explain mandatory procedures, training, records, and maintenance					
4. Create construction project cost estimates.	P.C.1 Ability to use different types of estimates					
	P.C.2 Ability to create quantity takeoff					
	P.C.3 Ability to explain Labor and equipment productivity factors					
	P.C.4 Ability to do Pricing and create price data bases					
	P.C.5 Ability to create Job direct and indirect costs					
	P.C. 6 Ability to create Bid preparations and bid submission					
5. Create construction project schedules.	P.C.1 Ability to create Schedule information presentation					
	P.C.2 Ability to create Network diagramming and calculations with CPM					
	P.C.3 Ability to create Resource allocation and management					
	P.C.4 Ability to explain Impact of changes					

6. Analyze professional decisions based on ethical principles.	P.C.1 Ability to compare and contrast different ethical issues in construction projects to explore the optimum professional decisions					
	P.C.1 Ability to analyze Cost control data and procedures					
	P.C.2 Ability to analyze Documentation at job site and office					
7. Analyze construction documents for planning and management of construction processes.	P.C.3 Ability to compare/contrast different Quality control philosophies and techniques					
8. Analyze methods, materials, and equipment used to construct	- P.C.1 Ability to analyze materials of construction					
projects.	-P.C.2 Ability to analyze construction methods and equipment					
9. Understand construction management skills as a member of a multi-disciplinary team.	P.C. 1 Ability to describe the concepts, roles, and responsibilities P.C. 2 Ability to explain construction management skills as a member of a multi-disciplinary team					
10. Apply electronic-based technology to manage the construction process.	– P.C.1 Ability to apply an electronic-based technology in construction management					
11. Apply basic surveying	- P.C.1 Ability to apply basic surveying techniques for construction layout					
techniques for construction layout and control	<ul> <li>P.C.2 Ability to apply basic surveying techniques for alignment control</li> </ul>					
12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process	P.C.1 Ability to explain roles and responsibilities of all constituencies involved in the design and construction process P.C.2 Ability to explain different methods of project delivery					
13. Understand construction risk	P.C.1 Ability to explain and classify					

management.	different risk factors in construction projects P.C.2 Ability to describe plans for construction risk management
14. Understand construction accounting and cost control.	P.C.1 Ability to explain cost accounting and industry formats P.C.2 Ability to explain Fixed and variable costs: insurance, bonding, marketing, general and administrative expenses P.C.3 Ability to explain different construction practices in cost control P.C.4 Ability to describe time value of money, depreciation, cash flow requirements, forecasting costs.
15. Understand construction quality assurance and control.	<ul> <li>- P.C.1 Ability to explain construction quality assurance</li> <li>- P.C.2 Ability to explain construction quality control</li> </ul>
16. Understand construction project control processes.	P.C.1 Ability to explain construction project control processes
17. Understand the legal implications of contract, common, and regulatory law to manage a construction project	P.C.1 Ability to explain construction contracts, roles & responsibilities of parties to manage a construction project
18. Understand the basic principles of sustainable construction.	P.C.1 Ability to explain the basic principles of sustainable construction
19. Understand the basic principles of structural behavior.	P.C.1 Ability to describe structural systems P.C.2 Ability to explain structural behaviors of structural systems
20. Understand the basic principles of mechanical, electrical and piping systems.	P.C.1 Ability to explain the basic principles of electrical systems P.C.2 Ability to explain the basic principles of mechanical/plumbing systems

These Performance Criteria are then linked to the CEM Course Learning Outcomes which are measured by using both the direct and indirect assessment tools (see Table 6 below as an example).

The assessment results will be used to continuously improve the quality of the BSCM curriculum by updating and/or revising course syllabi/contents as well as instructional methods.

Before the program assessment plan can be implemented, the Program Learning Outcomes (i.e. 20 SLOs) must be linked to the CEM courses. Figure 2 below presents the curriculum map of the BSCM Program in which the 20 SLOs are linked to the CEM Courses.

Note: There are more than one CEM course covering the same SLO including introductory, reinforced, and mastery levels.

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	-	CE 130/L- Surveying and Mapping	2											×									
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				Create written communications appropriate to the construction discipline	Create oral presentations appropriate to the construction discipline	Create a construction project safety plan	Create construction project cost estimates	Create construction project schedules	Analyze professional decisions based on ethical principles	Analyze constructions documents for planning and management of construction processes	Analyze methods, materials, and equipment used to construction projects	Understand construction management skills as a member of a multi-disciplinary team.	Apply electronic-based technology to manage the construction process	Apply basic surveying techniques for construction avout and control	in the constitution of the constitution of the constitution of the constitution of the constitution process.	Understand construction risk management	Understand construction accounting and cost control	Understand construction quality assurance and control	Understand construction project control processes	Understand the legal implications of contract, common, and regulatory law to manage a construction project	Understand the basic principles of sustainable construction	Understand the basic principles of structural behavior	Understand the basic principles of mechanical
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Figure 2. Curriculum Map of the BSCM Program

### **Assessment Methodology**

As described above, the continuous Quality Improvement Plan is implemented at three levels: (I) Program Educational Objectives/Goals; (II) Program Learning Outcomes -ACCE-SLOs; and (III) Course Learning Outcomes. The assessment results of these three levels should be compiled to obtain the overall results of the program assessment. It is noted that there are more than one CEM course covering the same program learning outcome (i.e. ACCE-SLO). For this particular period of assessment, only several courses will be evaluated for the program learning outcome. Also, both direct and indirect assessment tools (Direct tools: Student works and Indirect tools: Surveys) are used for the program assessment. In order to facilitate the data collection process, a spreadsheet template was created for each CEM course assessment report. Below is a typical spreadsheet template for data collection of CEM 121 (Construction Drawings) - see Table 6 below.

**Table 6. Typical Template for CEM Course Data Collection (CEM 121)** 

Tool	Rating (%)	Average (%)	Weight	Overall (%)	Relevant ACCE- SLO	ACCE-SLO Overall (%)	
Assignments	84%						
Labs	90%				ACCE-SLO 4		
Midterm 1	80%	97%	60%		P.C. 1	ACCE-SLO	
Midterm 2	90%	0770	0078	88%		4	
Midterm 3	90%					4	
Final	86%				88%		
Survey	90%	90%	40%				
Assignments	78%				ACCE-SLO 4		
Midterm 1	80%						
Midterm 2	90%	83%	60%	95%	F.C. 2	87%	
Midterm 3	88%			83%		07/0	
Final	78%				85%		
Survey	88%	88%	40%				
Assignments	90%				ACCE-SLO		
Midterm 1	86%	0.09/	60%		18 P.C. 1	ACCE-SLO	
Midterm 2	80%	90%	00%	88%		18	
Midterm 3	96%					10	
Final	98%				88%		
Survey	84%	84%	40%				
Assignments	78%				ACCE-SLO		
Midterm 1	90%				18		
Midterm 2	98%	87%	60%	86%	P.C. 1	87%	
Midterm 3	88%			00/0		07/0	
Final	80%				86%		
Survey 84%		84%	40%				
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In Table 6, the assessment of the 4 course learning outcomes (CLOs) of CEM 121 was conducted by using the averaged grades of student works (i.e. Assignments, Labs, Midterm 1, Midterm 2,

Midterm 3, and Final exam) as direct assessment tools and the ratings of survey questionnaires as indirect assessment tools. The percentages are calculated as follows:

- Rating (%): Quizzes, midterm, final exam, and term project for this class were prepared with the questions/problems addressing the CLOs, whose averaged grades were used as rating (%) of student works as shown in the table above. In addition, a survey was conducted to obtain the rating of student satisfaction in regard to the three CLOs using a scale of 5, where 5 is highest and 1 is lowest. The 1-5 rating was then converted into percentages (%).
- Average (%): represents the average rating % of the student works and the survey.
- Weight: In order to determine the overall achievement % for each CLO, a weight of 0.6 was assigned to the average rating of student works and a lower weight of 0.4 was for the survey due to its subjective evaluation obtained from students.
- Overall (%): was calculated as the sum of the weighted average % of student works and the weighted average % of the survey. As an example, overall % of CLO # 1 = (Average% of Student Works)\*0.6 + (Average % of Survey)\*0.4
- Relevant ACCE-SLO #: For this course, the relevant ACCE-SLOs are # 4 and 18. As an example, the achievement of ACCE-SLO#4 was calculated as the average % of those for CLOs # 1 and 2 and the achievement of ACCE-SLO#18 was calculated as the average % of CLOs # 3 and 4.

The data collected from the above spreadsheet of CEM 121 and other CEM courses are then compiled to identify the overall achievements of the Program Learning Outcomes or actions needed for improvements. Another spreadsheet template was created for such a compilation of collected data (see Table 7).

Table 7. Template for Overall Program Assessment Data and Results

-			nent Res				Results		
Program Learning Outcomes	Relevant CEM Course	F2020	S2021		Feedback	Importance Ranking	Actions		
	CE 101	F2020	32021	F2021					
1. Create written communications	CEM 225								
appropriate to the construction discipline	CEM 429								
uiscipiiie	Average								
2. Create oral presentations	CE 101 CEM 225								
appropriate to the construction	CEM 429								
discipline	Average								
	CEM 315								
3. Create a construction project	CEM 424								
safety plan	CEM 490								
	Average CEM 121								
4. Create construction project cost	CEM 225								
estimates	CEM 429								
	Average								
5. Create construction project	CEM 421								
schedules	CEM 490								
	Average CE 101								
6. Analyze professional decisions	CE 101 CEM 225								
based on ethical principles	CEM 429								
	Average								
7. Analyze construction documents	CEM 424								
for planning and management of	CEM 429								
construction processes	CEM 490 Average								
	CEM 200/L								
	CEM 335/L								
8. Analyze methods, materials, and equipment used to construct projects	CEM 324								
equipment used to construct projects	CEM 424								
	Average								
0 Understand construction	CE 101 CE 125								
9. Understand construction management skills as a member of									
a multi-disciplinary team	CEM 490								
	Average								
	CEM 206								
10. Apply electronic-based technology									
to manage the construction process	CEM 490 Average								
	/ trendge								
11. Apply basic surveying techniques	CEM 130/L								
for construction layout and control									
12 11 1 1 1188 1 1 1 6	Average								
12. Understand different methods of project delivery and the roles and	CEM 206 CEM 373								
responsibilities of all constituencies	CEM 490								
involved in the design and									
construction process	Average								
	CEM 315								
13. Understand construction risk	CEM 373								
management	CEM 421 Average								
14 Hadametandan d	CE 406								
14. Understand construction accounting and cost control	CEM 429								
and cost control	Average								
15. Understand construction quality	CEM 426								
assurance and control	CEM 490 Average								
	CEM 421								
16. Understand construction project	CEM 490								
control processes	Average								
17. Understand the legal implications	CEM 426								
of contract, common, and regulatory	CEM 490								
law to manage a construction project	Average								
	CEM 121								
18. Understand the basic principles of									
sustainable construction	CEM 375								
	Average CEM 204								
19. Understand the basic	CEM 204 CEM 225								
principles of structural behavior	CEM 437								
F -F	Average								
20. Understand the basic principles of									
		1							
mechanical, electrical and piping systems	CEM 375 Average								