

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) | - Bi-annually - Every 3 yrs - Every 3 yrs |
| 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 (Report Quality & Writing Skills) | SCORE (1-4) | NOVICE (1) | APPRENTICE (2) | PROFICIENT (3) | EXEMPLARY (4) |
|---|-------------|--|---|--|---|
| 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) |
| SLO1.2. 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 |
| SLO2.4. 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 CECM-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: _____ | | |
|------------------------|-----------------------------|--------------------|----------------|
| | Planned Activities | Achievement | Actions |
| G1 | | | |
| G2 | | | |
| G3 | | | |
| G4 | | | |
| G5 | | | |

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.) |
|--|---|
| 1. 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 safety plan | P.C.1 Ability to apply safe practices |
| | 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 |
| 7. Analyze construction documents for planning and management of construction processes. | P.C.1 Ability to analyze Cost control data and procedures |
| | P.C.2 Ability to analyze Documentation at job site and office |
| | P.C.3 Ability to compare/contrast different Quality control philosophies and techniques |
| 8. Analyze methods, materials, and equipment used to construct projects. | - P.C.1 Ability to analyze materials of construction -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 techniques for construction layout and control | – P.C.1 Ability to apply basic surveying techniques for construction layout – P.C.2 Ability to apply basic surveying techniques for alignment control |
| 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. | - P.C.1 Ability to explain construction quality assurance - P.C.2 Ability to explain construction quality control |
| 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.

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)

| CLO # | Assessment Tool | Rating (%) | Average (%) | Weight | Overall (%) | Relevant ACCE-SLO | ACCE-SLO Overall (%) |
|--------|-----------------|------------|-------------|--------|-------------|----------------------------------|----------------------|
| 1 | Assignments | 84% | 87% | 60% | 88% | ACCE-SLO 4 P.C. 1 88% | ACCE-SLO 4 |
| | Labs | 90% | | | | | |
| | Midterm 1 | 80% | | | | | |
| | Midterm 2 | 90% | | | | | |
| | Midterm 3 | 90% | | | | | |
| | Final | 86% | | | | | |
| Survey | 90% | 90% | 40% | | | | |
| 2 | Assignments | 78% | 83% | 60% | 85% | ACCE-SLO 4 P.C. 2 85% | 87% |
| | Midterm 1 | 80% | | | | | |
| | Midterm 2 | 90% | | | | | |
| | Midterm 3 | 88% | | | | | |
| | Final | 78% | | | | | |
| | Survey | 88% | | | | | |
| 3 | Assignments | 90% | 90% | 60% | 88% | ACCE-SLO 18 P.C. 1 88% | ACCE-SLO 18 |
| | Midterm 1 | 86% | | | | | |
| | Midterm 2 | 80% | | | | | |
| | Midterm 3 | 96% | | | | | |
| | Final | 98% | | | | | |
| | Survey | 84% | | | | | |
| 4 | Assignments | 78% | 87% | 60% | 86% | ACCE-SLO 18 P.C. 1 86% | 87% |
| | Midterm 1 | 90% | | | | | |
| | Midterm 2 | 98% | | | | | |
| | Midterm 3 | 88% | | | | | |
| | Final | 80% | | | | | |
| | Survey | 84% | | | | | |

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

| Program Learning Outcomes | Relevant CEM Course | Assessment Results (%) | | | Feedback | Importance Ranking | Actions |
|---|---------------------|------------------------|-------|-------|----------|--------------------|---------|
| | | F2020 | S2021 | F2021 | | | |
| 1. Create written communications appropriate to the construction discipline | CE 101 | | | | | | |
| | CEM 225 | | | | | | |
| | CEM 429 | | | | | | |
| | Average | | | | | | |
| 2. Create oral presentations appropriate to the construction discipline | CE 101 | | | | | | |
| | CEM 225 | | | | | | |
| | CEM 429 | | | | | | |
| | Average | | | | | | |
| 3. Create a construction project safety plan | CEM 315 | | | | | | |
| | CEM 424 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 4. Create construction project cost estimates | CEM 121 | | | | | | |
| | CEM 225 | | | | | | |
| | CEM 429 | | | | | | |
| | Average | | | | | | |
| 5. Create construction project schedules | CEM 421 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 6. Analyze professional decisions based on ethical principles | CE 101 | | | | | | |
| | CEM 225 | | | | | | |
| | Average | | | | | | |
| 7. Analyze construction documents for planning and management of construction processes | CEM 424 | | | | | | |
| | CEM 429 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 8. Analyze methods, materials, and equipment used to construct projects | CEM 200/L | | | | | | |
| | CEM 335/L | | | | | | |
| | CEM 324 | | | | | | |
| | Average | | | | | | |
| 9. Understand construction management skills as a member of a multi-disciplinary team | CE 101 | | | | | | |
| | CE 125 | | | | | | |
| | CEM 373 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 10. Apply electronic-based technology to manage the construction process | CEM 206 | | | | | | |
| | CEM 421 | | | | | | |
| | Average | | | | | | |
| 11. Apply basic surveying techniques for construction layout and control | CEM 130/L | | | | | | |
| | Average | | | | | | |
| 12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process | CEM 206 | | | | | | |
| | CEM 373 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 13. Understand construction risk management | CEM 315 | | | | | | |
| | CEM 373 | | | | | | |
| | CEM 421 | | | | | | |
| | Average | | | | | | |
| 14. Understand construction accounting and cost control | CE 406 | | | | | | |
| | CEM 429 | | | | | | |
| | Average | | | | | | |
| 15. Understand construction quality assurance and control | CEM 426 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 16. Understand construction project control processes | CEM 421 | | | | | | |
| | Average | | | | | | |
| 17. Understand the legal implications of contract, common, and regulatory law to manage a construction project | CEM 426 | | | | | | |
| | CEM 490 | | | | | | |
| | Average | | | | | | |
| 18. Understand the basic principles of sustainable construction | CEM 121 | | | | | | |
| | CEM 365 | | | | | | |
| | CEM 375 | | | | | | |
| | Average | | | | | | |
| 19. Understand the basic principles of structural behavior | CEM 204 | | | | | | |
| | CEM 225 | | | | | | |
| | Average | | | | | | |
| 20. Understand the basic principles of mechanical, electrical and piping systems | CEM 437 | | | | | | |
| | CEM 365 | | | | | | |
| | Average | | | | | | |

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