

Construction Engineering and Management Assessment Plan

For Master's degree program (See Program Requirements & Options on page 10)

Note: Although the process is initiated each year, it consists of a two-year cycle to close the loop on any proposed program modifications.

Program Educational Objectives (PEO)

Graduates leave the program with the capacity to contribute to the (1) managerial, (2) technical, and (3) organizational aspects of the construction project as viewed from the perspective of the owner, design professional, and constructor. The attainment of course outcomes in CEM 608, CEM 610, CEM 619, CEM 620, CEM 615, and CEM 710 is assessed using the rubrics shown below, and results are recorded on the Student Work Evaluation Sheet. (See pages 3 – 6 below.)

Industrial Advisory Council:

The original group of industry professionals organized as part of the Carrington-Millard donation and instrumental in initiating the program ceased to exist. In 2015, as a short-term solution we requested the CEE Professional Advisory Board (PAB) to fill that role. The PAB meets twice yearly, once in conjunction with the Fall Career Fair, and once in May. CEM items are presented to the PAB at the fall meeting. The PAB reviews and comments on the relevancy of the Program Educational Objectives and makes a review of the yearly assessment data and Faculty Recommendations and provides written comments to the department, the Provost, and the President. The PAB also is provided with an update on progress made from the previous year's recommendations and comments from the PAB.

Yearly Data Collection:

Results from three Core courses, one from each PEO as selected by the coordinator at the beginning of the academic year (core courses represent various points in program from start to finish)

- (1) Student Grade Averages, Highs, and Lows – This provides general PEO data that will be reflective of the instructor's observations of student learning.
- (2) Review of ungraded Special Journal Question, Quiz Question, or Assignment by a faculty member other than instructor. Review is made of items from 3 randomly selected students. Specific item is to be reflective of the mapped course PEO – This provides specific PEO data that will be reflective of the department's observations of student learning.
- (3) Student Exit Survey – This provides PEO data that will be reflective of the students' observations and experiences

Review:

Data is collected by instructors each semester and the by the department after graduation. Compilation of the data is undertaken at the beginning of Fall semester by the Program Coordinator. (See "Program Objectives Faculty Assessment Summary" sheet on page 8 below.)

Data is reviewed and analyzed by three CEM Faculty and/or Adjuncts, excluding the course instructor. The data analysis is reviewed by all CEM Faculty and Adjuncts and a final determination of the level of Objectives is made along with adjustments, if needed. Final recommendations are presented for review to the Fall meeting of the IAC.

Review is made by IAC with recommendations back to Faculty and Administration in a letter to the Provost and Department Head. Implementation is made by faculty and report to IAB following year. (See Program Objectives Professional Advisory Board Assessment from below on page 9.)

Schedule (2 Year – new cycle starts each fall)

- August 30th - Coordinator Select Fall Courses for Data Collection
- September 15th - Instructors select data source (HW assignment, test or quiz question(s), etc.) to demonstrate attainment of linked Program Objective
- December 15th - Instructors Teach course and Provide Course Data to Program Coordinator
- January 1st - Coordinator Select Spring Courses for Data Collection
- January 20th - Instructors select data source (HW assignment, test or quiz question(s), etc.) to demonstrate attainment of linked Program Objective
- April 30 - Instructors Teach course and Provide Course Data to Program Coordinator
- May 15th - Instructors Provide Course Data to Program Coordinator
- May 15th - Coordinator Email Exit Survey to Graduating Students
- August 30th - Coordinator randomly selects data from 3 of the students for each course.
- August 30th - Program Coordinator establishes course review committees (3 faculty and/or adjuncts other than instructor) to review each of the course data available
- September 7th - Committee members review each course and establish a level of attainment for each outcome mapped to objectives.
- September 15th - Program coordinator averages results from each valuator and provides a summary to the entire CEM faculty.
- September 15th - Faculty meets to discuss findings, create a summary, and to establish recommendations if needed.
- September 20th - Results are forwarded to PAB for discussion and response in their fall meeting.
- September – May Implement Recommendations

Program Objectives Attainment Rubric – Course Outcomes

For use in evaluating CEM 608, CEM 610, CEM 619, CEM 620, CEM 615, and CEM 710

Outcomes	Fails to Meet Objective 1 - 2	Progressing Toward Objective 2 - 3	Meeting Objective 3 - 4	Exceeds Objective 4 - 5
1. Problem Identification: Identifies and summarizes the problem, question, or issue.	<ul style="list-style-type: none"> ▪ Does not identify or inaccurately identifies the problem, question, or issue ▪ Does not summarize or inaccurately summarizes the problem, question, or issue 	<ul style="list-style-type: none"> ▪ Identifies and summarizes the problem, question, or issue but some aspects may be incorrect or unclear 	<ul style="list-style-type: none"> ▪ Identifies and summarizes the problem, question, or issue clearly and correctly ▪ Nuances and critical details are absent or glossed over 	<ul style="list-style-type: none"> ▪ Identifies secondary or implicit issues. ▪ If applicable, notes relationships among factors in the situation and how they relate to each other.
2. Considers Alternative Perspectives: Integrates issue using other perspectives and positions.	<ul style="list-style-type: none"> ▪ Investigates only a single perspective ▪ Fails to discuss various perspectives, especially those held by others. ▪ Adopts a single idea or limited ideas with little question. 	<ul style="list-style-type: none"> ▪ Investigates more than one perspective but some perspectives only in a limited way. ▪ May dismiss alternative views too hastily. 	<ul style="list-style-type: none"> ▪ Addresses alternative perspectives to qualify analysis but may not investigate all perspectives equally. ▪ Roughly integrates multiple viewpoints and comparison of ideas or perspectives ▪ Utilized critical thinking concepts to analyze and solve problems 	<ul style="list-style-type: none"> ▪ Fully addresses diverse perspectives drawn from outside information to qualify analysis. ▪ Fully integrates ideas and perspectives from variety of sources. ▪ Integrates own and others' ideas through a complex process of judgment and justification. ▪ Clearly presents and justifies own view while respecting other views.
3. Develops own perspective, hypothesis, or position.	<ul style="list-style-type: none"> ▪ Presents position or hypothesis that is clearly inherited or adopted with little original consideration. ▪ Fails to present and justify own opinion or forward hypothesis. ▪ Presents position or hypothesis that is unclear or simplistic. 	<ul style="list-style-type: none"> ▪ Presents position that includes some original thinking or acknowledges, refutes, synthesizes or extends other assertions, although some aspects may have been adopted. ▪ Presents own position or hypothesis, though inconsistently. ▪ Presents and justifies own position without addressing other views, or does so superficially. ▪ Addresses a single source or view of the argument, failing to clarify the established position relative to one's own. 	<ul style="list-style-type: none"> ▪ Presents position that includes significant original thinking or that acknowledges, refutes, synthesizes or extends other assertions. ▪ Presents own position or hypothesis, consistently and clearly. ▪ Clearly presents and justifies own view or hypothesis while qualifying or integrating contrary views or interpretations. 	<ul style="list-style-type: none"> ▪ Presents position that demonstrates ownership by constructing knowledge or framing original questions, integrating objective analysis and intuition. ▪ Clearly identifies own position on the issue, drawing support from experience, and/or clear application of information not available from assigned sources. ▪ Position or hypothesis demonstrates sophisticated, integrative thought and is developed clearly throughout.

Program Objectives Attainment Rubric – Course Grades

For use in evaluating CEM 608, CEM 610, CEM 619, CEM 620, CEM 615, and CEM 710

<p>4. Evaluates Quality of Evidence: Identifies, assesses, and analyzes the quality of supporting data/evidence.</p>	<ul style="list-style-type: none"> ▪ Repeats information provided without question or ignores or dismisses evidence without adequate justification. ▪ Does not distinguish among fact, opinion, and value judgments. ▪ Uses data or sources that are inappropriate or not on topic. ▪ Demonstrates little or no skill in searching, selecting, and evaluating sources to meet the information need. 	<ul style="list-style-type: none"> ▪ Use of evidence is qualified and selective, though unintentional. ▪ Discerns some fact from opinion; may recognize bias in evidence though spotty, inappropriate, or exaggerated. ▪ Uses data or sources that adequately meet the information need, though little evidence of more than routine exploration. ▪ Demonstrates a developing skill in searching, selecting, and evaluating sources to meet the information need. 	<ul style="list-style-type: none"> ▪ Examines evidence and its source; evaluates accuracy, precision, relevance, completeness. ▪ Information need is clearly defined and related to assignment ▪ Discerns fact from opinion; looks for bias in evidence though not be thorough. ▪ Uses data and sources that clearly meet the information need ▪ Demonstrates adequate skill in searching, selecting, and evaluating sources to meet the information need 	<ul style="list-style-type: none"> ▪ Clearly distinguishes fact from opinion and recognizes bias in evidence ▪ Uses data and sources that clearly meet the information need and provides independent verification ▪ Demonstrates strong skill in searching, selecting, and evaluating sources to meet the information need; notable identification of uniquely salient resources.
<p>5. Analysis: Undertakes appropriate quantitative or qualitative analysis.</p>	<ul style="list-style-type: none"> ▪ Fails to analyze all or much relevant evidence ▪ Conducts quantitative or qualitative analysis that is inappropriate, inaccurate, or superficial ▪ Analysis does not help clarify the issues or facilitate decision-making. 	<ul style="list-style-type: none"> ▪ Analyzes much but not all relevant evidence ▪ Conducts quantitative or qualitative analysis that is appropriate and accurate, but rather superficial. ▪ Analysis provides limited help in clarifying the issues and facilitating decision-making 	<ul style="list-style-type: none"> ▪ Analyzes all relevant evidence ▪ Conducts quantitative or qualitative analysis that is appropriate, accurate, and thorough. ▪ Analysis effectively clarifies the issues and facilitates decision-making. 	<ul style="list-style-type: none"> ▪ Demonstrates and understanding of factors in the analysis that would result in inaccurate analysis. ▪ Demonstrates an understanding of the decision making needs and the implications of variations in analysis on the decision making process.
<p>6. Reasoned and Logical Conclusion or Design: Identifies and assesses conclusions, implications, and consequences.</p>	<ul style="list-style-type: none"> ▪ Fails to identify conclusions, implications, and consequences of the issue or identifies conclusions without consideration of evidence ▪ Fails to discuss key relationships between other elements of the problem. ▪ Does not propose solution ▪ Mistakes correlations with cause. ▪ Considers knowledge as absolute when confirmed by one authority. 	<ul style="list-style-type: none"> ▪ Identifies some conclusions, implications, and consequences ▪ Conclusions reflect influence of some other perspectives, assumptions, and evidence. ▪ Proposes solution to problem(s) that is somewhat related to previous dimensions noted in rubric. ▪ Confuses correlations with cause. ▪ Considers knowledge as relative collection of opinions and perspectives, and makes little attempt to compare. 	<ul style="list-style-type: none"> ▪ Identifies and discusses conclusions, implications, and consequences considering assumptions, data, and evidence. ▪ Proposes solution to problem(s) based on previous dimensions noted in rubric. ▪ Objectively qualifies own assertions. ▪ Recognizes limitations of correlations or association 	<ul style="list-style-type: none"> ▪ Identifies and discusses changing factors that may dispute conclusions or areas needing further development to maintain current conclusions ▪ Recognizes limitations of correlations or association and qualifies implications of assertions accordingly. ▪ Views knowledge as the best available evidence within the given context, even in the face of uncertainty and ambiguity

	Fails to Meet Objective 1 - 2	Progressing Toward Objective 2 - 3	Meeting Objective 3 - 4	Exceeds Objective 4 - 5
1. Course Average Grade	▪ Below 76	▪ 76 – 84 (C)	▪ 85 – 92 (B)	▪ 93 (A) or Higher
2. Highest Student Grade	▪ Below 85	▪ 85 – 89 (Low B)	▪ 90 – 92 (High B)	▪ 93 (A) or Higher
3. Lowest Student Grade	▪ Below 69	▪ 69 – 75 (D)	▪ 76 – 84 (C)	▪ 85 – 92 (B)

Student Work Evaluation Sheet

Instructions: Evaluators should review the **UNGRADED** Special Journal Question, Quiz Question, or Assignment from each of the three randomly selected students and provide a separate evaluation worksheet for each.

Year: _____

Semester: Fall Spring Summer

Course Number and Name: CEM _____ - _____

Mapping to Program Objective(s): Technical Management Organizational

Reviewer: _____

Instructor: _____

Student: _____

Part 1 – Random Student Work Summary Assessment of Outcomes

1. Problem Identification: Identifies and summarizes the problem, question, or issue.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

2. Considers Alternative Perspectives: Integrates issue using other perspectives and positions.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

3. Develops own perspective, hypothesis, or position.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

4. Evaluates Quality of Evidence: Identifies, assesses, and analyzes the quality of supporting data/evidence.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

5. Analysis: Undertakes appropriate quantitative or qualitative analysis.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

6. Reasoned and Logical Conclusion or Design: Identifies and assesses conclusions, implications, and consequences.

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

Part 2 – Program Objectives Assessment

Based on the attainment of student outcomes as indicated above, the reviewer determines that the program

Fails to Meet is Progressing toward Meets Exceeds

the specified Objective

Program Assessment Course Data Summary Sheet

Instructions: Course Instructors should fill out Course Information and Part 1 and return to the Program Coordinator with copies of **UNGRADED** Special Journal Question, Quiz Question, or Assignment from all registered students that demonstrates a student's ability to meet the identified Program Objective

Year: _____

Semester: Fall Spring Summer

Course Number and Name: CEM _____ - _____

Mapping to Program Objective(s): Technical Management Organizational

Enrolment: _____

Instructor: _____

Part 1 – Instructor Grade Summaries

Average of all students final grades:

Highest student final grade:

Lowest Student Final Grade:

Part 2 – Random Student Work Assessment of Attainment of Student Outcomes and Program Objectives

Review of 3 Random Students Special Journal Question, Quiz Question, or Assignment (not grade) by other than instructor.

Reviewer 1:

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

Reviewer 2:

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

Reviewer 3:

Fails to Meet Objective Progressing toward Objective Meets Objective Exceeds Objective

Program Objectives Faculty Assessment Summary

Having reviewed the appropriate data the CEM faculty have analyzed and discussed each of the following program outcomes, making a final determination as to the level of attainment and any recommendations to revise the program in order to improve the level of attainment in future years.

Date of Faculty meeting(s) _____

Review Year: _____

1. Graduates leave the program with the capacity to contribute to the **managerial** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Faculty Recommendations:

2. Graduates leave the program with the capacity to contribute to the **technical** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Faculty Recommendations:

3. Graduates leave the program with the capacity to contribute to the **organizational** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Faculty Recommendations:

Program Objectives Professional Advisory Board Assessment

Having reviewed the appropriate data provided, other supplemental data, and the Faculty review and recommendations the Professional Advisory Board, during its meeting on _____, determined the following.

Review Year: _____

1. Program Educational Objectives are relevant and appropriate for industry needs
 True False

Board Recommendations:

2. Graduates leave the program with the capacity to contribute to the **managerial** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Board Recommendations:

3. Graduates leave the program with the capacity to contribute to the **technical** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Board Recommendations:

4. Graduates leave the program with the capacity to contribute to the **organizational** aspect of construction project as viewed from the perspective of the owner, design professional, and constructor.
 Fails to Meet Progressing toward Meets Exceeds

Board Recommendations:

Board Chair

Date

Construction Engineering & Management Program Requirements & Options

The requirements for the Master of Science in Construction Engineering and Management are as follows:

- A minimum of 33 credits, of which a minimum of 18 credits must be 600-level, or above, courses in Construction Engineering & Management (CEM).
- A thesis or final examination is not required. A project report is optional.
- A maximum of 12 credit hours may be transferred from another accredited institution.
- For SD Mines undergraduate students only: Students admitted to the “accelerated” MS program may apply up to 9 credits of SD Mines 500/600 level coursework taken as an undergraduate to their master’s degree requirements.

Core Courses (mapped to Objectives)

CEM 608: Construction Contracts (Tech)
CEM 610: Construction Project Management (Management)
CEM 615: Engineering & Construction Ethics (Organization)
CEM 619: Construction Company Management or (Management)
CEM 620: Leading & Managing Design Orgs. (Management)
CEM 710: Advanced Construction Management (Organization & Management)

Suggested (Approved) Electives (mapped to Objectives)

CEM 612: Construction Cost Estimating (Tech)
CEM 613: Construction Scheduling (Tech)
CEM 616: Codes and Standards (Tech)
CEM 665: Construction Equipment Management (Management)
CEM 706: Managing Sustainable Projects (Management)
CEM 715: Construction Operations (Management)
CEM 750: Environmental Permitting (Tech)
CEM 788: Professional Practice Research (Organization)

ENGM 620: Quality Management (Technical and Management)
ENGM 625: Innovation and Comm. (Technical and Management)
ENGM 640: Business Strategy (Management)
ENGM 650: Safety Management (Technical and Management)
ENGM 661: Engineering Economics for Managers** (Technical)
ENGM 663: Operations Planning (Organization)
ENGM 742: Engineering Management & Labor Relations (Organization)

MEM 530: Resource Industry Mergers & Acquisitions (Organization)
MEM 535: Resource Industry Finance & Accounting (Tech)

Other CEE courses, 600 level and above, also qualify as Technical Electives for on campus students.