Quality Improvement Plan and 2022-2023 Assessment Results Construction Management

Updated May 2023

Construction Management Program
Michigan Technological University

Introduction

The purpose of this document is to outline the elements of the Construction Management Quality Improvement Plan and to summarize the assessment results.

Student Learning Outcomes

The Quality Improvement Plan has been updated to reflect the changes made to the Student Learning Outcomes by ACCE in Spring 2023. The updated Student Learning Outcomes (SLOs) for the program are as follows.

1. Create written communications appropriate to the construction discipline.
2. Create oral presentations appropriate to the construction discipline.
3. Create a construction project safety plan.
4. Create construction project cost estimates.
5. Create construction project schedules.
6. Analyze professional decisions based on ethical principles.
7. Analyze methods, materials, and equipment used to construct projects.
8. Apply electronic-based technology to manage the construction process.
9. Apply basic surveying techniques for construction layout and control.
10. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.
11. Understand construction accounting and cost control.
12. Understand construction quality assurance and control.
13. Understand construction project control processes.
14. Understand the legal implications of contract, common, and regulatory law to manage a construction project.
15. Understand the basic principles of sustainable construction.
16. Understand the basic principles of structural behavior.
17. Understand the basic principles of HVAC, electrical and plumbing systems.

However, the data presented in the QIP are for the 20 SLOs that existed before the Spring 2023 change.

1. Create written communications appropriate to the construction discipline.
2. Create oral presentations appropriate to the construction discipline.
3. Create a construction project safety plan.
4. Create construction project cost estimates.
5. Create construction project schedules.
6. Analyze professional decisions based on ethical principles.
7. Analyze construction documents for planning and management of construction processes.
8. Analyze methods, materials, and equipment used to construct projects.

9. Understand the role of the construction manager as a member of different multidisciplinary project teams.
10. Apply electronic-based technology to manage the construction process.
11. Apply basic surveying techniques for construction layout and control.
12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.
13. Understand construction risk management.
14. Understand construction accounting and cost control.
15. Understand construction quality assurance and control.
16. Understand construction project control processes.
17. Understand the legal implications of contract, common, and regulatory law to manage a construction project.
18. Understand the basic principles of sustainable construction.
19. Understand the basic principles of structural behavior.
20. Understand the basic principles of mechanical, electrical and piping systems.

SLO Assessment Plan

While both the College of Business and the Civil, Environmental, and Geospatial Engineering department support the degree program, a single assessment plan generates improvements to the CMG program. The CMG assessment plan uses direct and indirect assessment methods to collect program assessment data and make program improvements. Student-based data is a central component of the assessment process. Alumni-based data is an integral part of the assessment process, including direct curriculum review, direct interaction with faculty and students, and survey input.

Direct Assessment Plan

The following assessment map documents the assessment location for each SLO. The program objectives will be explained in the program improvement portion of this document.

Table 1. SLO Assessment Map Beginning Fall 2023 Onward

SLO	Assessment Location & Type of Evidence, Semester (fall=f; spring=s)
1. Create written communications appropriate to the construction discipline (Old SLO 1)	CMG 4120 (s), Final Report CEE 4905 (f/s), Final Report
2. Create oral presentations appropriate to the construction discipline (Old SLO 2)	CMG 2140 (s), Final Presentation CMG 4210 (f), Final Presentation CEE 4905 (f/s), Final Presentations
3. Create a construction project safety plan (Old SLO 3)	CMG 4210 (f), Lab 5B CMG 4400 (f), Assessment

4. Create construction project cost estimates (Old SLO 4)	CEE 3332 (f/s), Homework CMG 3265 (s), Final Presentations
5. Create construction project schedules (Old SLO 5)	CMG 1200 (s), Homework CMG 4120 (s), Final Project
6. Analyze professional decisions based on ethical principles (Old SLO 6)	CMG 3265 (s), Project CMG 4400 (f), Homework
7. Analyze methods, materials, and equipment used to construct projects (Old SLO 8)	CMG 2110 (f), Project 3 CMG 3265 (s), Lab 5
8. Apply electronic-based technology to manage the construction process (Old SLO 10)	CMG 1200 (s), Exam CMG 3265 (s), Spreadsheet
9. Apply basic surveying techniques for construction layout and control (Old SLO 11)	SU 2000 (f/s), Labs 5 and 7 CMG 3200 (s), Homework
10. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process (Old SLO 12)	CMG 3265 (s), Lab 4 CMG 4200 (f), Chapter 11
11. Understand construction accounting and cost control (Old SLO 14)	CMG 4300 (f), Homework Identifying additional assessment point
12. Understand construction quality assurance and control (Old SLO 15)	CEE 3101 (f/s), Lab CMG 4210 (f), Lab 7
13. Understand construction project control processes (Old SLO 16)	CEE 3332 (f/s), Final Exam CMG 4300, Homework
14. Understand the legal implications of contract, common, and regulatory law to manage a construction project (Old SLO 17)	CMG 4200 (f), Homework CMG 4400 (f), Final Exam
15. Understand the basic principles of sustainable construction (Old SLO 18)	CMG 2140 (s), Quiz CMG 4800 (s), Homework
16. Understand the basic principles of structural behavior (Old SLO 19)	CMG 2120 (s), Quiz and Final CMG 3250 (f), Homework
17. Understand the basic principles of HVAC, electrical and plumbing systems (Old SLO 20)	CMG 2110 (s), Exam Identifying additional assessment point

The program uses Bloom's Taxonomy as defined by the ACCE Accreditation Manual (Document 103 Standards And Criteria For The Accreditation Of Construction Education Programs, Updated 02/17/2023).

Create: At the highest level, students are producing new ideas or products that integrate the knowledge they have gained. When students are involved in creating new artifacts, they are actively engaged in the subject matter.

Analyze: Students begin to develop higher order thinking. They may be asked to compare and contrast or take a concept and break it into parts to explore the relationships present.

Apply: At this level, students begin to put the information they are learning into context. Here they are able to integrate ideas across multiple situations or utilize the content in a new way.

Understand: At this level, students demonstrate that they understand the content by explaining, summarizing, classifying, or translating the given information.

Indirect Assessment Plan

Indirect assessment is accomplished via surveys to graduating students, advisory board members and other stakeholders.

Stakeholder Survey

A survey is also sent to the Construction Management Industrial Advisory Board. The Industrial Advisory Board survey captures data on the achievement of the CMG program objectives as well as the 20 SLOs.

Current SLO Student Survey

At the end of each semester, the graduating students are asked to complete an exit survey so the program can gather student feedback about the program.

The survey contained 18 questions and question 16 was subdivided into 20 parts to obtain student feedback on their ability to attain the ACCE Student Learning Outcomes. Survey used through Spring 2023 is as follows.

1. When did you start your job search?
2. How many job applications have you submitted so far?
3. How many offers have you received so far? Please provide the company name, the scope of the business, and the position offered for each offer received.
4. Have you already accepted a job offer?
5. What was your annual salary offer?
6. What knowledge/skills/abilities learned from this program have helped you most in obtaining this job?
7. What knowledge/skills/abilities do you think would help you find a more satisfying job but have not been adequately developed in this program?
8. As a college student, did you ever take a co-op or intern position related to your major, or work in a position related to your major, either full-time or part-time?

9. If you answered yes to the previous question, which companies have you worked for and for how many months?
10. Other than the capstone project course, did you participate in any “Enterprise” or similar programs while in college?
11. If you answered yes to the previous question, please list which other program(s).
12. While you were a student at Michigan Tech, were you a member of any student or professional organizations? If so, please note the organization(s) and your level of participation in each.
13. Do you plan to go to graduate school?
14. Do you expect to take continuing education courses, seminars, etc. throughout your career?
15. What recommendations would you make for ways to improve the student experience in this program?
16. Please rate the quality of education and training you received from the Construction Management program in the following areas from 1 (poor) to 5 (excellent):
    a. Create written communications appropriate to the construction discipline. (SLO 1)
    b. Create oral presentations appropriate to the construction discipline. (SLO 2)
    c. Create a construction safety plan. (SLO 3)
    d. Create construction project cost estimates. (SLO 4)
    e. Create construction project schedules. (SLO 5)
    f. Analyze professional decisions based on ethical principles. (SLO 6)
    g. Analyze construction documents for planning and management construction processes. (SLO 7)
    h. Analyze methods, materials, and equipment used to construct projects. (SLO 8)
    i. Apply construction management skills as an effective member of a multidisciplinary team. (SLO 9)
    j. Apply electronic-based technology to manage the construction process. (SLO 10)
    k. Apply basic surveying techniques for construction layout and control. (SLO 11)
    l. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process. (SLO 12)
    m. Understand construction risk management. (SLO 13)
    n. Understand construction accounting and cost control. (SLO 14)
    o. Understand construction quality assurance and control. (SLO 15)
    p. Understand construction project control processes. (SLO 16)
    q. Understand the legal implications of contract common, and regulatory law to manage a construction project. (SLO 17)
    r. Understand the basic principles of sustainable construction. (SLO 18)
    s. Understand the basic principles of structural behavior. (SLO 19)
    t. Understand the basic principles of mechanical, electrical, and plumbing systems. (SLO 20)
17. Overall, I think the program is:
18. Please use the space below to provide suggestions for improving this survey.

Name:
Email Address:
Mailing Address:

Revised SLO Student Survey

Beginning in Fall 2024, the survey will be modified to reflect the revised Student Learning Outcomes (removal of three outcomes) so that the final survey will look like this.

1. When did you start your job search?
2. How many job applications have you submitted so far?
3. How many offers have you received so far? Please provide the company name, the scope of the business, and the position offered for each offer received.
4. Have you already accepted a job offer?
5. What was your annual salary offer?
6. What knowledge/skills/abilities learned from this program have helped you most in obtaining this job?
7. What knowledge/skills/abilities do you think would help you find a more satisfying job but have not been adequately developed in this program?
8. As a college student, did you ever take a co-op or intern position related to your major, or work in a position related to your major, either full-time or part-time?
9. If you answered yes to the previous question, which companies have you worked for and for how many months?
10. Other than the capstone project course, did you participate in any “Enterprise” or similar programs while in college?
11. If you answered yes to the previous question, please list which other program(s).
12. While you were a student at Michigan Tech, were you a member of any student or professional organizations? If so, please note the organization(s) and your level of participation in each.
13. Do you plan to go to graduate school?
14. Do you expect to take continuing education courses, seminars, etc. throughout your career?
15. What recommendations would you make for ways to improve the student experience in this program?
16. Please rate the quality of education and training you received from the Construction Management program in the following areas from 1 (poor) to 5 (excellent):

    a. Create written communications appropriate to the construction discipline. (SLO 1)
    b. Create oral presentations appropriate to the construction discipline. (SLO 2)
    c. Create a construction project safety plan. (SLO 3)
    d. Create construction project cost estimates. (SLO 4)
    d. Create construction project schedules. (SLO 5)
    e. Analyze professional decisions based on ethical principles. (SLO 6)
    f. Analyze methods, materials, and equipment used to construct projects. (SLO 7)
    g. Apply electronic-based technology to manage the construction process. (SLO 8)
    h. Apply basic surveying techniques for construction layout and control. (SLO 9)
    i. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process. (SLO 10)
    j. Understand construction accounting and cost control. (SLO 11)
    k. Understand construction quality assurance and control. (SLO 12)
    l. Understand construction project control processes. (SLO 13)
    m. Understand the legal implications of contract, common, and regulatory law to manage a construction project. (SLO 14)
    n. Understand the basic principles of sustainable construction. (SLO 15)
    o. Understand the basic principles of structural behavior. (SLO 16)
    p. Understand the basic principles of HVAC, electrical and plumbing systems. (SLO 17)

17. Overall, I think the program is:
18. Please use the space below to provide suggestions for improving this survey.

    Name:
    Email Address:
    Mailing Address:

SLO Industry Survey

To obtain program data from employers and alumni who are on the IAB, they are surveyed every three years. The survey questions are presented below.

1. I am a graduate of the program. Yes or No
2. I/my company hire(s) graduates from the program. Yes or No
3. The program provides opportunities for students to participate in professional development (student organizations, presentations to IAB, field trips, etc.) Yes, No or Unsure
4. The program produces graduates with strong communication skills so they can advance the profession Yes, No or Unsure
5. SLO 1: Create written communication appropriate to the construction discipline 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
6. SLO 2: Create oral presentations appropriate to the construction discipline 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
7. SLO 3: Create a construction project safety plan 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
8. SLO 4: Create construction project cost estimates. 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
9. SLO 5: Create construction project schedules 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
10. SLO 6: Analyze professional decisions based on ethical principles 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
11. SLO 7: Analyze construction documents for planning and management of construction processes 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
12. SLO 8: Analyze methods, materials, and equipment used to construct projects 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
13. SLO 9: Understand the role of the construction manager as a member of different multidisciplinary teams 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
14. SLO 10: Apply electronic-based technology to manage the construction process 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
15. SLO 11: Apply basic surveying techniques for construction layout and control 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding

16. SLO 12: Understand different methods of project delivery and the roles and responsibilities of all constituents involved in the design and construction process 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
17. SLO 13: Understand construction risk management 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
18. SLO 14: Understand construction accounting and cost control 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
19. SLO 15: Understand construction quality assurance and control1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
20. SLO 16: Understand construction project control processes 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
21. SLO 17: Understand the legal implications of contract, common, and regulatory law to manage a construction project 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
22. SLO 18: Understand the basic principles of sustainable construction 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
23. SLO 19: Understand the basic principles of structural behavior 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
24. SLO 20: Understand the basic principles of mechanical, electrical, and plumbing systems 1 = Completely Unprepared; 2 = Poor. Major Weakness; 3 = Fair. Minor Weakness; 4 = Good. No Weakness; 5 = Outstanding
25. Provide any comments about the preparedness of graduates to achieve program objectives
26. Please provide any comments about the stated program objectives
27. Please provide any additional comments about the program

SLO Assessment Cycle

The direct data is collected annually, when the course is taught. All required courses in the program are taught once a year (fall or spring). The semester the courses are taught are included in the assessment table above. The cycle for data collection is presented below.

The indirect data is collected each fall and spring as the students graduate.

The data is gathered annually and compiled on a bi-annual basis to make program improvements. The faculty review the data each fall so that changes to the program may be made in the Binder Process, which has a fall deadline. Odd year cycles means fall semester is in an odd year, i.e., 2023, 2025, etc., whereas even year cycles mean fall semester in an even year, i.e., 2024, 2026, etc.

Table 2. SLO Review Cycle

Odd Year (202O), i.e., 2023, 2025, etc.	Even Year (202E), i.e, 2024, 2026, etc,
SLO 1, SLO 2, SLO 9, SLO 11, SLO 15, SLO 16, SLO 17	SLO 3, SLO 4, SLO 5, SLO 6, SLO 7, SLO 8, SLO 10, SLO 12, SLO 13, SLO 14

SLO Assessment Results

SLO Direct Assessment Results

Direct assessment results are provided for all 20 Student Learning Outcomes. The revised, shortened list of SLOs will be measured into the future. The measure is *Beginning 1, Developing 2, Proficient 3, Exemplary 4.

SLO 1 - Create written communications appropriate to the construction discipline

Table 3 presents the direct assessment results for SLO 1. Based on the performance indicators measured in CMG 4120 and CEE 4905, the students in the program meet the target performance requirements.

Table 3. SLO 1 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Context of and Purpose for Writing	Organization and Conventions	>3, Proficient
CMG 4120	Final Reports	10	4.0	4.0	Attained
CEE 4905	Final Reports	4	4.0	4.0	Attained

SLO 2 - Create oral presentations appropriate to the construction discipline

Table 4 presents the direct assessment results for SLO 2. Based on the performance indicators measured in CMG 2140, CMG 4120, and CEE 4905, the students in the program meet the target performance requirements.

Table 4. SLO 2 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Organization and Patterns	Visual Aids	>3, Proficient
CMG 2140	Toolbox talk	10	3.9	--	Attained
CMG 4120	Final Presentation	10	4.0	4.0	Attained
CEE 4905	Final Presentation	4	4.0	4.0	Attained

SLO 3 - Create a construction project safety plan

Table 5 presents the direct assessment results for SLO 3. Based on the performance indicators measured in CMG 4210 and CMG 4400, the students in the program meet the target performance requirements.

Table 5. SLO 3 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Components of safety plan	Create a safety plan	>3, Proficient
CMG 4210	Lab 5	7	4.0	3.6	Attained
CMG 4400	Assessment	15	3.3	--	Attained

SLO 4 - Create a construction cost estimate

Table 6 presents the direct assessment results for SLO 4. Based on the performance indicators measured in CEE 3332 and CMG 3265, the students in the program meet the target performance requirements.

Table 6. SLO 4 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Identify a line item in data base	Develop a cost estimate	>3, Proficient
CEE 3332	Homework	19	3.6	3.7	Attained
CMG 3265	Final Presentations	4	4.0	4.0	Attained

SLO 5 - Create construction project delivery schedules

Table 7 presents the direct assessment results for SLO 5. Based on the performance indicators measured in CMG 1200 and CMG 4120, the students in the program meet the target performance requirements.

Table 7. SLO 5 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Schedule Task Breakdown and Duration	Schedule Task Relationship	>3, Proficient
CMG 1200	Homework	23	3.1	3.5	Attained

CMG 4120	Final Project	10	4.0	4.0	Attained

SLO 6 - Analyze professional decisions based on ethical principles

Table 8 presents the direct assessment results for SLO 6. Based on the performance indicators measured in CMG 3265 and CMG 4400, the students in the program meet the target performance requirements.

Table 8. SLO 6 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Ethical Reasoning	Application of Ethical Perspectives/ Concepts	>3, Proficient
CMG 3265	Project	4	3.5	3.5	Attained
CMG 4400	Homework	4	3.0	3.0	Attained

SLO 7 - Analyze construction documents for planning and management of construction processes

Table 9 presents the direct assessment results for SLO 7. Based on the performance indicators measured in CMG 1200 and CMG 2110, the students in the program meet the target performance requirements.

Table 9. SLO 7 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Context of and Purpose for Writing	Organizations and Conventions	>3, Proficient
CMG 1200	Quiz	27	3.8	3.0	Attained
CMG 2110	Project 2	22	3.5	3.5	Attained

SLO 8 - Analyze methods, materials, and equipment used to construct projects

Table 10 presents the direct assessment results for SLO 8. Based on the performance indicators measured in CMG 2100 and CMG 3265, the students in the program meet the target performance requirements.

Table 10. SLO 8 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Cycle times	Material Identification for Designed MEP Systems	>3, Proficient
CMG 2110	Project 3	22	--	3.6	Attained
CMG 3265	Lab 5	15	3.1	--	Attained

SLO 9 - Apply construction management skills as an effective member of a multidisciplinary team

Table 11 presents the direct assessment results for SLO 9. Based on the performance indicators measured in CEE 4905, the students in the program meet the target performance requirements.

Table 11. SLO 9 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Participated in meetings	Contributed to deliverables	Worked well with others	>3, Proficient
CEE 4905	Peer Review	2	4.0	3.9	4.0	Attained

SLO 10 - Apply electronic-based technology to manage the construction process

Table 12 presents the direct assessment results for SLO 10. Based on the performance indicators measured in CMG 1200 and CMG 3265, the students in the program meet the target performance requirements.

Table 12. SLO 10 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	3-D Modeling	Spreadsheet	>3, Proficient
CMG 1200	Exam	23	3.4	--	Attained
CMG 3265	Spreadsheet	15	--	4.0	Attained

SLO 11 - Apply basic surveying techniques for construction layout and control

Table 13 presents the direct assessment results for SLO 11. Based on the performance indicators measured in SU 2000 and CMG 3200, the students in the program meet the target performance requirements.

Table 13. SLO 11 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Principles of horizontal control	Principles of vertical control	Construction layout and control	>3, Proficient
SU 2000	Lab 5	11	4.0	--	--	Attained
	Lab 7	2	--	4.0	--	Attained
CMG 3200	Homework	12	--	--	3.3	Attained

SLO 12 - Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process

Table 14 presents the direct assessment results for SLO 12. Based on the performance indicators measured in CMG 3265 and CMG 4200, the students in the program meet the target performance requirements.

Table 14. SLO 12 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Roles and responsibilities	Understand the different methods of project delivery	Understand the roles and responsibilities of constituents	>3, Proficient
CMG 3265	Lab 4	15	4.0	--	--	Attained
CMG 4200	Homework	12	--	3.5	2.6	Attained

SLO 13 - Understand construction risk management

Table 15 presents the direct assessment results for SLO 13. Based on the performance indicators measured in CMG 3265 and CMG 4120, the students in the program meet the target performance requirements.

Table 15. SLO 13 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Understanding Risk Sources	Understanding Risk Impacts	>3, Proficient
CMG 3265	Project Memo	4	3.8	3.5	Attained

CMG 4120	Project	10	4.0	4.0	Attained

SLO 14 - Understand construction accounting and control

Table 16 presents the direct assessment results for SLO 14. Based on the performance indicators measured in CMG 4300, the students in the program meet the target performance requirements.

Table 16. SLO 14 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Understand and apply construction accounting and cost control	Monitor and control costs at a project level	Understand the basic cost accounting format, and apply construction accounting and cost control using financial instruments	>3, Proficient
CMG 4300	Cash Flow HW Q11	8	3.9	3.8	3.9	Attained

SLO 15 - Understand construction project control processes

Table 17 presents the direct assessment results for SLO 15. Based on the performance indicators measured in CEE 3101 and CMG 4210, the students in the program meet the target performance requirements.

Table 17. SLO 15 Direct Assessment Data

			Performance Indicators	Target Performance
Course	Evidence	Number of Samples	Understanding construction QA/QC	>3, Proficient
CEE 3101	Lab 3	7	4.0	Attained
CMG 4210	Lab 7	8	3.3	Attained

SLO 16 - Understand Construction Project Control Processes

Table 18 presents the direct assessment results for SLO 16. Based on the performance indicators measured in CEE 3332 and CMG 4300, the students in the program meet the target performance requirements. Please note, the SLO 16 Bloom's verb is understand. For three of the four measurements, the students attain the SLO. In one case, calculate, the students do not attain the desired target performance; however, the desired target performance exceeds the attainment level set forth by the SLO.

Table 18. SLO 16 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Understanding construction performance indicators	Calculating construction performance indicators	>3, Proficient
CEE 3332	Final Exam	21	3.0	2.5	Attained/Not Attained
CMG 4300	Chap 7 HW	8	3.9	3.8	Attained

SLO 17 - Understand the legal implications of contract, common and regulatory law to manage a construction project

Table 19 presents the direct assessment results for SLO 17. Based on the performance indicators measured in CMG 4200 and CMG 4400, the students in the program did not meet the target performance requirements for two of the three points measured.

Table 19. SLO 17 Direct Assessment Data

			Performance Indicators		Target Performance
Course	Evidence	Number of Samples	Implications of contract, common, and regulatory law	Legal implications of contract language	>3, Proficient
CMG 4200	Chapter 7 and Chapter 14 Homework	12	2.6	3.1	Not Attained / Attained
CMG 4400	Final Exam	16	2.8	--	Not Attained

SLO 18 - Understand the basic principles of sustainable construction

Table 20 presents the direct assessment results for SLO 18. Based on the performance indicators measured in CMG 2140 and CMG 4800, the students in the program meet the target performance requirements.

Table 20. SLO 18 Direct Assessment Data

			Performance Indicators				Target Performance
Course	Evidence	Number of Samples	Identify example of sustainable construction	Apply LEED sustainable building rating system	Understand and apply sustainable building standards and codes to sustainable construction projects	Analyze components of construction projects in terms of sustainability	>3, Proficient
CMG 2140	Quiz 12	20	3.4	--	--	--	Attained
CMG 4800	Homework 1	16	--	3.2	--	--	Attained
	Homework 4: Problem 1	18	--	--	3.0		Attained
	Homework 6	16	--	--	--	3.3	Attained

SLO 19 - Understand the basic principles of structural behavior

Table 21 presents the direct assessment results for SLO 19. Based on the performance indicators measured in CMG 2120 and CMG 3250, the students in the program meet the target performance requirements for 4 out of the 5 performance indicators.

Table 21. SLO 19 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Shear and Bending Moment	Load Path	Concrete Beam Flexural Strength	>3, Proficient
CMG 2120	Quiz 12	20	3.4	--	--	Attained
	Final Exam Problem	20	--	3.1	--	Attained
CMG 3250	Homework 1	16	--	3	--	Attained
	Homework 4: Problem 1	18	2.9	--	--	Not Attained
	Homework 6	16	--	--	3.3	Attained

SLO 20 - Understand the basic principles of mechanical, electrical, and plumbing systems

Table 22 presents the direct assessment results for SLO 20. Based on the performance indicators measured in CMG 2110, the students in the program meet the target performance requirements.

Table 22. SLO 20 Direct Assessment Data

			Performance Indicators			Target Performance
Course	Evidence	Number of Samples	Mechanical Systems	Electrical Systems	Plumbing Systems	>3, Proficient
CMG 2110	Exam	22	3.3	3.1	3.4	Attained

SLO Indirect Assessment Results

Graduates were surveyed as an indirect assessment of the SLOs. In spring 2020, survey distribution was disrupted due to COVID. Although the survey is administered to all of the students graduating in the program, some students choose not to participate. Approximately, 30% of the students completed the assessment. The indirect assessment results are aggregated for the time period of Spring 2019 to Spring 2023. A table with all of the data is located in the evidence folders. For reference, 5 = Outstanding; 4 = Good. No Weakness; 3 = Fair. Minor Weakness; 2 = Poor. Major Weakness, and 1 = Completely Unprepared.

Table 23. Indirect Assessment Results for SLOs (Spring 2019 - Spring 2023)

SLO	Average
SLO 1	4.3
SLO 2	4.4
SLO 3	4.0
SLO 4	4.3
SLO 5	3.5
SLO 6	4.3
SLO 7	4.2
SLO 8	4.2
SLO 9	4.3
SLO 10	3.8
SLO 11	4.0
SLO 12	4.2
SLO 13	4.3
SLO 14	3.9
SLO 15	4.3
SLO 16	4.2
SLO 17	4.1
SLO 18	4.2
SLO 19	4.3

SLO 20	3.9
Overall	4.2

Overall, the indirect student assessment results cluster slightly above "4 = Good. No Weakness," with the exception of SLO 5 discussed below. None of the SLOs were perceived as completely unprepared by the students.

Nevertheless, the program could enhance instruction of weaker rated SLOs. In particular, the students believe they need more instruction so that they can more effectively attain the following SLOs.

- SLO 10. Apply electronic-based technology to manage the construction process. Data seems to be maintaining the "Good. No Weakness" level, especially in the latest data points collected. Direct assessment data on SLO 10 finds attainment of learning outcomes. Program improvements, as presented later on, may impact SLO 10 attainment in the future; however, additional assessment data can inform the assessment process.
- SLO 14. Understand construction accounting and cost control. Clear majority of students rated as a 4. Not viewed as a program strength. The program has only one direct assessment point. Thus, as a program improvement, an additional assessment point should be added to the program's continuous improvement process.
- SLO 20. Understand the basic principles of mechanical, electrical and piping systems. Only two data points out of 12 indicated "Fair. No Weakness". Three direct performance indicators suggest the students have attained this SLO. However the program will continue to monitor this outcome. A new faculty member has been hired and will be teaching this course in the future. The course that is used to assess this SLO is taken in year two of the program. An additional assessment point, later in the program may assist with the data produced via the indirect measure.

SLO 5 is the one exception to the above discussion, whereby students rated SLO 5 at the 3.5 level during the period of time reviewed. Ratings included "Poor. Major Weakness" and "Fair. Minor Weakness." Construction schedules are covered in two courses: CMG 1200 - Introduction to BIM and CMG 4120 - Planning and Scheduling. As discussed below, the number of credit hours was increased from 2 cr to 3 cr in CMG 1200 (Intro to Building Info Modeling), which will allow more content and practice in attaining SLO 5 Creating construction project schedules.

Summary of Achievement by SLO

In review of the assessment data generated during the 2022-2023 assessment cycle, the students of the program met the target performance requires of 3 out of 4 for the direct measures, except for SLO 17 - Understand the legal implications of contract, common and regulatory law to manage a construction project; however, indirect data suggest the students believe their abilities are "Good. No Weakness".

Indirect data suggests the students believe they have “Fair. Minor Weakness” with respect to SLO 5 - Create construction project delivery schedules. However, direct assessment data suggests the program prepares the students to meet the target performance according to the two performance indicators used. While direct assessment found SLO 5 had been obtained, attention is warranted when assessment data infers areas for potential improvement.

Future Program Improvements for Next Assessment Cycle (2023-2024/2024-2025)

At the beginning of the fall semester, Michigan Tech units hold Fall Retreats to plan and begin work on the upcoming year. Curriculum management based on assurance of learning will be a central component of the Fall 2023 Retreat for Construction Management. The newly-hired faculty will be charged with execution of the assurance process, including curriculum improvements reflective of assessment results. Also, Ms. Miller will be attending the June 2023 ACCE conference in Salt Lake City to increase her understanding of ACCE Standards, including assurance of learning.

Other Program Changes

The document titled Construction Management Program Updates outlines the catalog changes made since 2017. Key revisions, as it pertains to the SLOs are discussed here. Changes were implemented to streamline the program delivery following the university restructuring of 2019 and positively impacted several SLOs, including old SLOs 3, 4, 5, 8, 10, 13, and 15. Other changes leveraged courses delivered by COB and CEGE, which decreases the resource needs of the program and increases program sustainability. By decreasing resource needs, specifically financial resources to support faculty, the program is providing a strong return on investment, which enables the program to better uphold Standard 7.

2017-18

- Revision to CMG4400 made a few years ago, based on student feedback (i.e., the opportunity for students to obtain an *OSHA30 card*). Here's a quick summary:
    - June 5-8th, 2017 Lynn Artman completed the **OSHA 510: OSHA Standards for Construction Industry**; June 12-15th, 2018 Ron Mauno completed **OSHA 500: Trainer course for Construction** and June 13th-15th Ron Mauno completed the **OSHA 502: Construction Trainer Update** course.
    - *Since 2017-2018, OSHA30 cards* issued in *CMG4400*:
        - 2018 - 9 students
        - 2019 - 18 students
        - 2021 - 7 students
        - 2022 - 9 students
        - A total of **43** students. (Note: No cards issued in 2020 due to *COVID restrictions* as all class sessions need to be live.)
    - The change to this program enhanced student attainment of SLO 3 - Create a construction project safety plan.

2020-21

- Dropped CMG 1140 (Basic Construction Materials) from major requirements 3 cr
- Added CEE 3101 (Civil Engineering Materials) as a major requirement 3 cr

The addition of CEE 3101 and the removal of CMG 1140 allows for the streamlining of the curriculum by reducing the number of classes taught by program faculty. CMG 1140 and CEE 3101 were identical classes. With the restructuring of the educational unit housing the program, a strong desire existed to minimize duplicate classes, which makes program delivery more sustainable. Both the direct and indirect data suggests that students are attaining this SLO 15. The course substitution did not negatively impact student SLO attainment.

- Increased CMG 1200 (Intro to Building Info Modeling) from 2 cr to 3 cr in major requirements

The increase in contact time allowed more content and practice in attaining SLO 5 - Creating construction project schedules and SLO 8 - Apply electronic-based technology to manage the construction process. Based on the direct assessment data, students attained the SLOs. The indirect data shows the program did not meet the desired attainment level for SLOs 5 and 8, but this needs further investigation as the change was implemented into the 2020-2021 Catalog. Students entering the university and complying with the 2020-2021 catalog are not likely to have graduated nor completed the indirect survey. We anticipate that the indirect data will show an improvement in the future.

- Replace CMG 4900 (Construction Project Simulation) 4 cr, with CEE 4905 (Engineering Design Project) 3 cr.

This change allowed for construction management students to work in multidisciplinary teams, which correlates to old SLO 10. However, SLO 10 has been removed from the list of Bachelor of Science SLOs; thus, no further action will be taken.

- Added in ENT 4960 (Enterprise Project Work V Capstone) in Enterprise option

This change will increase the ease at which program students can participate in Enterprise. With this change, we may see more students graduating having participated in Enterprise. This Catalog change is discussed in greater detail in the Program Objective continuous improvement section.

2021-22

- Dropped CMG 2265 (Construction Quantity Survey) from major requirements
- Added CEE 3332 (Fundamentals of Construction) 3 cr as a major requirement

The addition of CEE 3332 to the curriculum creates a second opportunity to directly assess student attainment of SLO 4 - Create Construction Cost Estimates and SLO 13 - Understand construction project control processes. Both SLOs are attained at a high level.

- Removed 3 credits of Technical Electives (down to 3 credits)
- Added CMG 4800 (Sustainable Construction) 3 cr as a major requirement instead of a technical elective

This change better enables the program to provide content and assess student attainment of SLO 15, Understand the basic principles of sustainable construction. Spring 2023 was the first semester CMG 4800 was added as a major requirement. However, both indirect and direct data sources suggest the SLO is attained. Future work will monitor the level of attainment to determine the impact of adding this course to the curriculum.

Program Objectives

Mission

The mission of the Construction Management Program is to produce skilled construction management graduates who embrace lifelong learning and power skills to advance the field through professional engagement with industry partners.

Program Objectives

The Construction Management program has three program objectives.

1. Provide opportunities for students to engage in professional development
2. Produce graduates who expect to continue their personnel development after graduation
3. Produce graduates with strong communication skills so they can engage the profession

Program Objective Assessment

The data sources used to measure attainment of the program objectives include Student Exit Survey (SES), an Alumni/Employer Survey, and SLO data as presented below. The SES is distributed each fall and spring semester. The Alumni/Employer Survey is administered every three years to the Construction Management Industrial Advisory Board Members.

The three program objectives are linked to the program's mission. In particular, the mission speaks to lifelong learning and professional engagement with industry which is mapped to program objectives 1 and 2. Program objective 3 communication skills is one of the key power skills required to engage and advance the profession.

Table 24. Program Objective Assessment Plan

Program Objectives	Evidence	Desired Attainment
PG 1: Provide opportunities for students to engage in student and professional organizations	SES Q 11: Other than the capstone project course, did you participate in any “Enterprise” or similar programs while in college? SES Q 12: While you were a student at Michigan Tech, were you a member of any student or professional organizations? If so, please note the organization(s) and your level of participation in each. Alumni/ Employer Survey Q 3: The program provides opportunities for students to participate in professional development (student orgs, presentations to the IAB, field trips, etc.)?	SES Q 11: 25% of graduating students participate in enterprise SES Q 12: 50% of graduating students participate in one or more student or professional organizations 80% of the alumni/employer survey respondents answer Yes
PG 2: Produce graduates who have expect to continue their personnel development after graduation	SES Q 13: Do you plan to go to graduate school? SES Q 14: Do you expect to take continuing education courses, seminars, etc. throughout your career? Alumni/ Employer Survey Q 4: The program produces graduates who expect to continue their personnel development after graduation (life-long learning, involvement with professional orgs, etc.)?	SES Q 13: At least one student interested in attending a graduate program SES Q 14: 75% of graduating students indicate Yes 80% of the alumni/employer survey respondents answer Yes
PG 3: Produce graduates with strong communication skills so they can advance the profession	SLO 1:Create written communications appropriate to the construction discipline SLO 2: Create oral presentations appropriate to the construction discipline Alumni/ Employer Survey Q 5: The program produces graduates with strong communication skills so they can advance the profession?	Student Attainment of SLO ⩾ 4 80% of the alumni/employer survey respondents answer Yes

Program Objective Assessment Results

Below is a summary of the data collected since Spring 2019 related to the Program Objectives.

Table 25. Student Exit Survey for Program Objective 1 and 2

Program Goals-Student Exit Survey Data	Results	Program Goal	Comments
Provide opportunities for students to engage in student and professional organizations			
Q 10 Other than the capstone project course, did you participate in any “Enterprise” or similar programs while in college?	8%	>25% Yes	Results: Many CMG students work during school or are members of sport teams like football leaving little time for Enterprise. Goal not met. Future Work: Program can work with Enterprise to find projects applicable to degree program such as new projects with Built World Enterprise. The change in the degree requirements to expand Enterprise opportunities should result in higher participation in the future. Promote other similar programs/opportunities, like “TheProject” competition.
SES Q 12: While you were a student at Michigan Tech, were you a member of any student or professional organizations? If so, please note the organization(s) and your level of participation in each.	42%	>50% Yes	Results: A healthy percentage of the students did participate, but the goal was not met. COVID was not helpful as student orgs were very limited in their activities. Student work schedules and membership on sports teams were a factor. This impedes participation in extracurricular organizations. Goal not met. Future Action: Program can enhance relationship with Husky Construction, ASCE, Steel Bridge, Concrete Canoe to recruit CMG students into those organizations. New faculty member has agreed to be the Faculty Advisory for construction student organization.
Produce graduates who expect to continue their personnel development after graduation			
SES Q 13: Do you plan to go to graduate school?	1	1 or more students	**Results:** Graduate school is one way to continue lifelong learning and professional development. **Goal Met.** **Future Work:** Promote graduate school to CMG students.
SES Q 14: Do you expect to take continuing education courses, seminars, etc. throughout your career?	83%	>75% Yes	**Results:** Over 82% of the students see the need to continue to learn throughout their professional career; **Goal Met.** **Future Work:** Continue to provide opportunities for students to participate in continuing education events like seminars and Construction Days.

The Alumni/Employer Survey contained three direct questions related to the Program Objectives. This data indicates the program is meeting its program level objectives.

Table 26. Alumni/ Employer Survey for Program Objectives

Program Objectives	Evidence	Target Performance
PG 1: The program provides opportunities for students to participate in professional development (student orgs, presentations to the IAB, field trips, etc.)?	Survey Q 3: Over 90% of the alumni/employer survey respondents answered Yes	Attained
PG 2: The program produces graduates who expect to continue their personnel development after graduation (life-long learning, involvement with professional orgs, etc.)?	Survey Q 4: Over 90% of the alumni/employer survey respondents answered Yes	Attained
PG 3: The program produces graduates with strong communication skills so they can advance the profession?	Survey Q 5: Over 81% of the alumni/employer survey respondents answered Yes	Attained

Table 27. Program Objective 1 and 2 Alumni/Employer Survey Data -

Based on the direct assessment results of SLO 1 and 2, program students achieve greater or equal to a 4. As such, the program achieves PG 3: Produce graduates with strong communication skills so they can advance the profession.

Program Objective Assessment Results Discussion

The student exit survey data suggests that the program is producing graduates who expect to continue their personnel development after graduation as evidence of attending graduate school or agreeing with the statement that they expect to continue their education via courses and seminars. Likewise 90.9% of alumni/employers surveyed agreed that the program produces graduates that continue life-long learning and professional development. Thus, the program objective is met.

However, student exit survey data suggests the program needs to work on student participation in professional and student organizations and Enterprise. As a matter of explanation, Enterprise at Michigan Technological University is when students—of any major—work in teams on real projects, with real clients, in an environment that's more like a business than a classroom. With coaching and guidance from faculty mentors, our 26 Enterprise teams work to invent products, provide services, and pioneer solutions (https://www.mtu.edu/enterprise/).

Based on the results, less than 50% of the students participated in a student or professional organization or Enterprise. There had been an Enterprise team focused on program students; however, the Enterprise team ended before 2019. Student participation in student organizations

was negatively impacted by COVID. Moreover, the lack of participation in student and professional organizations may also be impacted by the isolation of the program in the School of Technology. Beginning Fall 2019, the program moved from the School of Technology, which was rebranded as the College of Computing, and became a program shared by College of Business and the Civil, Environmental, and Geospatial Engineering Department. By being in these other two units, students have greater exposure to organizations that may meet their educational and professional goals.

Continuous Improvement Actions Impact on the Program Objectives

Continued work includes increasing student opportunities for students in the construction management program to participate in Enterprise and other student and professional organizations. In 2020-2021, the program made a catalog change to include ENT 4960 (Enterprise Project Work V Capstone) in the Enterprise option, which was necessary for students to be able to use the Enterprise experience to meet the capstone design. The change appears to have an impact.

In the 2022-2023 academic year, members of the Built World Enterprise participated in the ASCE Timber Strong Competition (https://www.asce.org/communities/student-members/conferences/timber-strong-design-build-competition). This year, the team recruited a construction management student to participate in the Timber Strong Team and the Enterprise. This student is a second year student so it will be a couple of years before the student's data is reflected in the student exit survey data. However, the team was successful at the competition, placing third out of five teams, and the momentum exists to recruit other students into the Enterprise and student competition team.

Another appropriate Enterprise team is the Built World Enterprise (BWE). In BWE, students of all majors compete in design competitions and solve problems that relate to civil and environmental engineering, which includes construction management. Program students may want to participate in BWE so they can support the Steel Design Team. The ASCE-AISC Steel Bridge Competition incorporates many activities that align with ACCE accreditation and the program's objectives. Thus, more time is needed to measure the impact of the program change on meeting the program's objectives.

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