

## **Bachelor of Science in Construction Management Program**

FY 2016-2017 Student Learning Assessment Report  
Department of Construction Management and Engineering  
North Dakota State University

This report presents the assessment activities on student outcomes for the Bachelor of Science in Construction Management (CM) Program in FY 2016-2017. The Department of Construction Management and Engineering (CM&E) has continued the implementation of the assessment plan, which was submitted in the FY2013-2014 report but with newly developed student learning outcomes. Therefore, this report will be beyond the 5-page limit.

### **Mission Statement, Program Educational Objectives, and Student outcomes**

The mission statement of the Department of Construction Management and Engineering remains the same as it has been in the previous years. The 5 Educational Objectives of the Bachelor of Science degree program in construction engineering have also remained the same. However, the student learning outcomes have been revised to a new set of 20 outcomes based on new accreditation requirements.

### **New ACCE Student outcomes**

The Bachelor of Science in construction management degree program is accredited by ACCE (American Council of Construction Education). Recently, ACCE changed from an hour-based system subject content system to a set of 20 student learning outcomes. In accordance with the implementation of the system, new accreditation and reaccreditation processes and actions are required to use the new SLOs system. Recently, ABET has also developed a competing accreditation process aimed at accrediting construction management programs under their famous ABET's criterion 3. One feature that is of paramount importance in the new ACCE outcomes is the extensive use of Bloom's taxonomy of educational outcomes/learning in penning the student learning outcomes. The words which were used to describe the SLOs in decreasing order of complexity or cognitive learning are create (C), analyze (A), apply (A), understand (U), remember (R). Each SLO has been assigned a skill to achieve as well as a Bloom's taxonomy-based level of achievement, thus creating a hierarchy of learning outcomes. The department elected to remain with ACCE accrediting organization for the construction management program. The construction management program must satisfy ACCE's new outcome-based accreditation requirements.

The new student learning outcomes are listed below:

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. Apply construction management skills as a member of a multi-disciplinary team.

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.

Figure 1 is a depiction of the intensity of use of Bloom’s taxonomy in the new SLOs.



Figure 1: Use of Bloom’s Taxonomy in ACCE’s New SLOs.

It is apparent from the analysis that “understand” is the most used, followed by “create”, “analyze” and “apply”. “Create” and “apply” are used to the same level.

### Materials and Methods

The approach used to assess student learning is depicted in Figure 2.

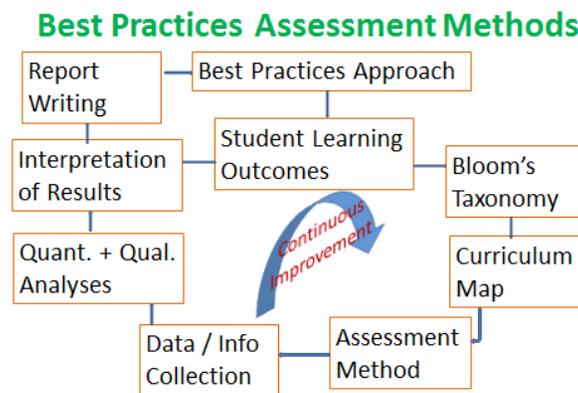


Figure 2: Best Practices Assessment Approach.

Upon adoption of the new ACCE outcome-based accreditation system (which is based on 20 Student Learning Outcomes-SLOs), the department is redeveloping its accreditation processes for the construction management program. The approach is quite similar to the ABET system and thus addresses the concerns raised in last year's review. The following actions are being undertaken:

1. Select and define performance targets for each of the outcome indicators (Program level activity);
2. Analyze, identify and select the courses which will be used to address the skills, knowledge and attitudes defined by the program outcomes. Present the findings in a curriculum map (Program level activity);
3. Define observable and quantifiable student learning outcomes for each relevant course and develop requisite assessment methods for them (Course level activity);
4. Use the program outcomes and course learning objectives to develop a course assessment matrix. Identify the courses that satisfy a particular student learning and indicate to what level each course addresses the outcome (create = 4; analyze = 3; apply = 2; and understand = 1). Bloom's taxonomy could also be employed to define the level of contribution. ACCE specifically (Course level activity);
5. Use the program outcomes, outcome indicators and the list of core courses to prepare a program outcome assessment matrix. The level of involvement could be defined as high (3), medium (2), and low (1) or Bloom's taxonomy (Program level activity);
6. Ensure that each core course is taught to address the targeted program outcome and use an FCAR to record the course outcome at the end of each semester. Faculty should be encouraged to initiate appropriate actions in the next offering of the course to address any shortcomings identified in the FCAR (Course Level and Program level activity); and
7. Perform a semi-annual and/or annual review of all the activities enumerated above and address any shortcomings identified in the shortest possible time frame - coming semester or year (Course Level and Program level activity).

The methods used to collect assessment/accreditation data for the construction management program are:

- (1) Senior Graduation Survey;
- (2) Senior Exit Interviews by the Department Chair;
- (3) Senior Exit Interviews by IAC Members;
- (4) Alumni Survey, (5) Employer Survey;
- (5) Student Rating of Instruction (SROI);
- (6) Faculty Course Assessment Report (FCAR);
- (7) IAC Course Review; and
- (8) AC Exam Results.

A total of three outcomes are used for the assessment in this report and they are defined as follows; (3) Senior Exit Interviews by IAC members; (6) SROI; and (7) FCAR.

A brief description of these assessment tools is presented:

*Senior Exit Interviews Conducted by IAC Members:* This face-to-face interview is conducted and recorded by the department's Industry Advisory Board at the end of each semester. The department is not involved in the interview. This statistic/information serves as a type of audit by a group of outsiders; lending credibility to the process. IAC members are industry leaders in North Dakota, Minnesota and other parts of the country. The question that is most useful for the assessment is as follows "How would you rank the educational experience in the CM&E Department (1 to 10, 10 being the highest)? The target is 80% (8 out of 10).

*Student Rating of Instruction (SROI):* The student rating of instruction is a standard course assessment report which is compiled from an in-class course assessment conducted by an independent person during the last two or three weeks of the semester. The course assessment report consists of several questions. However the question that is used in the department's assessment reporting the most is Question 11: "I met/exceeded the course objectives for this course". A score of 4 out of 5 (80%) is the benchmark.

*Faculty Course Assessment Report (FCAR):* In the case of the FCAR, course instructors use various student class activities to evaluate if students are achieving the course student learning outcomes. These activities include assignments, exams, quizzes, projects, papers, presentations, labs, and class participation. The program's target is on 80% attainment level of any student outcome by weighted the applicable measurement results.

### **Construction Courses and Student Outcomes**

An ACCE accreditation curriculum map depicting the courses that satisfy various SLOs is presented in Table 1 in next page.

The critical SLOs are: **11**-Apply basic surveying techniques for construction layout and control; **18**-Understand the basic principles of sustainable construction; and **20**-Understand the basic principles of mechanical, electrical and piping systems. However, ACCE requires a single data point to satisfy an SLO, for accreditation purposes. In such a situation, the course should be rigidly controlled or monitored to ensure compliance.

A histogram of the SLOs is presented in Figure 2 in next page. A statistical analysis of the SLOs indicated that the minimum number of times and SLO is measured was one and the highest number of times an SLO is documented was 11. The mean is approximately 4, the median was 3 or 4 (3.5) and the mode was 2.

### **Selected Construction Management Outcomes for Reporting**

This department is using the new SLOs for the first time (decision taken about a year ago). Thus three outcomes, which are satisfied by three courses were used as a trial run in this reporting period. The selected outcomes are:

**SLO1:** Create written communications appropriate to the construction discipline;

**SLO2:** Create oral presentations appropriate to the construction discipline; and

**SLO4:** Create construction project cost estimates.

Table 1: ACCE Accreditation Curriculum Map

COURSE # / SEMESTER CREDITS		STUDENTS LEARNING OUTCOMES (SLOs)																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
CM&E 111	1	X								X												
CM&E 200	3	X						X	X													
CM&E 212	3							X		X												
CM&E 204	3	X						X		X		X										
CM&E 250	3								X												X	
CM&E 203	3	X	X						X	X											X	
CM&E 240	3	X	X	X		X			X					X								
CM&E 260	3	X		X	X	X	X	X														
CM&E 301	3	X	X						X	X												
CM&E 305	3					X							X									
CM&E 315	3					X							X					X				
CM&E 380	3			X																		
CM&E 405	3	X	X	X		X							X		X		X					
CM&E 403	3	X	X		X	X				X						X						
CM&E 421	3	X	X					X	X				X								X	
CM&E 430	3																					
CM&E 450	3					X		X													X	
CM&E 488	3	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	
CM&E 453	3		X			X		X													X	
Totals		11	8	2	4	3	9	6	9	5	4	1	4	2	2	2	2	2	2	1	5	1

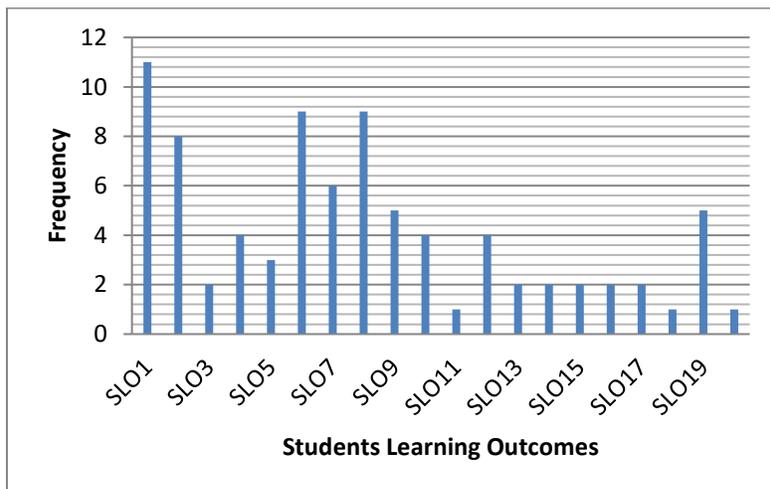


Figure 2: SLO Assessment Frequency for CM Program

The courses, which were used to assess these outcomes Table 2:

Table 2: SLOs Assessed.

Courses	Student Learning Outcomes (SLOs)			Remarks
	SLO1	SLO2	SLO4	
CM&E 111	X			
CM&E 203	X	X	X	
CM&E 240	X	X		
CM&E 403	X	X		
CM&E 453	X			

### Assessment of ACCE’s SLO1, SLO2, and SLO4

Table 3 lists the tools that were used to assess the three (3) student outcomes. A minimum of a single course was used for SORI and FCAR statistics. A statistics from the IAC exit interviews was also used. The weights of the assessment tools are listed in Table 3.

Table 3: Assessment Tools.

Assessment Tools	Student Outcomes (Benchmark = 80%)		
	SLO1	SLO2	SLO4
1 course SORI (Q11): 40%	CM&E 111 CM&E 453	CM&E 203 CM&E 403	CM&E 203
FCAR: 40%	CM&E 111 CM&E 453	CM&E 403	CM&E 203
IAC Exit Interviews: 20%	Question 2	Question 2	Question 2
Weighted Average			
<b>Overall Attainment</b>			

### Discussion of Results

A simple mean was used to calculate each line item. In the case of IAC interviews, the program aims for a score of 8 out of 10.

A column chart of the SORI (Q11) is depicted in Figure 3. The mean, median and mode of the SORI are 83.99, 83.76 and 83.76 respectively; approximating a score of 84%.

The results of the assessment are summarized in Table 4. In summary the weighted averages of all the outcomes were above 80% bench mark. The IAC exit interview scores were a little lower than expected. The SORI values are well above average, with the least being 83.2%. The least FCAR result was 85 and the highest was 89.

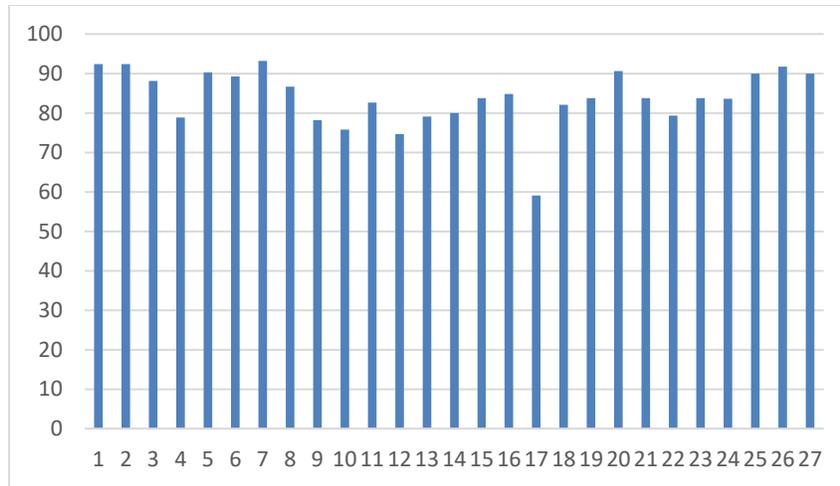


Figure 1: Histogram of ABET Student Outcomes.

Table 4: Results of Assessment of Student Learning Outcomes SLO1, SLO2, and SLO3.

Assessment Tools	Student Outcomes (Benchmark = 80%)		
	SLO1	SLO2	SLO4
SORI (Q11): 40%	85.6	80.5	80.5
FCAR: 40%	89	87.5	85
IAC Exit Interviews: 20%	76	76	76
Weighted Average			
<b>Overall Attainment</b>	<b>85</b>	<b>82.4</b>	<b>81.4</b>

The department has been involved in ACCE assessment over the past several years. A number of rigorous assessment processes have been invented and applied and the department has changed over to the new ACCE system of accreditation. The department continues to improve our processes and analyses of the results to ensure students outcomes are achieved, maintained and improved.

### Continuous Improvements

Faculty members have been involved in the ACCE assessment process and especially extensively involved in the FACR analysis every semester. There are several suggestions for continuously improving outcome assessment including review comments from last year report. To address these suggestions or comments. Faculty members have done the following changes:

- The capstone class has been significantly changes and improved.
- Faculty are fully involved to develop new learning outcomes in their courses

In conclusion, various instruments were used to assess three learning outcomes to complete the ACCE assessment process commenced about a year ago. The three outcomes were all satisfactory as their values were above the 80% benchmark.