

Bachelor of Science in  
Construction Engineering  
(BSCNE)  
Program Assessment Manual

**NDSU** CONSTRUCTION MANAGEMENT  
AND ENGINEERING

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# CHAPTER 1. INTRODUCTION

The Department of Construction Management and Engineering (CM&E) offers a quality Bachelor of Science in Construction Engineering (BSCNE) program, preparing nationally competitive undergraduate students for successful careers within the profession of construction engineering through a comprehensive curriculum. This curriculum incorporates the planning, design, and management of facilities in four construction disciplines including: commercial, residential, infrastructural, and industrial. During the first two years of study, students develop a thorough knowledge of the sciences, mathematics, and engineering, which is followed by construction management and engineering courses in the last two years. Requirements in writing, the humanities, social sciences, and communications assist in balancing the technical aspects of the BSCNE program, creating a well-rounded curriculum. The Bachelor of Science in Construction Engineering (BSCNE) is accredited by the Engineering Accreditation Commission (EAC) of ABET, <http://www.abet.org>.

Systematically and continually assessing the BSCNE program in regard to teaching and learning allows for the identification of needed improvements and up to date information from the construction industry, ensuring quality and excellence, which proves critical to student success both on campus and eventually in the construction field. In order for the CM&E Department to implement a comprehensive self-assessment, faculty members within the Bachelor of Science in Construction Engineering (BSCNE) program must thoroughly familiar with the contents of this manual for implementation purposes.

This Assessment Manual is divided into the following five (5) sections:

1. Chapter 2 Background: briefly explains the need for the ABET assessment and other important background information.
2. Chapter 3 Program Educational Objectives and Student Outcomes: lists current NDSU mission, CM&E mission, BSCNE Program Educational Objectives, and student outcomes.
3. Chapter 4 Assessment Plan: describes the BSCNE Assessment Plan including assessment procedure, tools, methods, and criteria for continuous improvements.
4. Chapter 5 Assessment Implementation Plan: outlines assessment implementation schedule on a semester basis and data evaluation methods.
5. Chapter 6 ABET Self Study Documentation: explains how to organize documents and data for the preparation of ABET Self-Study Report and the on-campus visit.

## **CHAPTER 2. BACKGROUND**

### **The Need for Accreditation**

Maintaining the accreditation for the BSCNE program provides assurance that graduates entering the construction industry have a solid educational foundation and are capable of designing and constructing facilities in order to meet desired needs within realistic constraints. The CM&E Department has fully realized the value and the need to maintain the accreditation of the BSCNE program at NDSU. As a result, the BSCNE program has been accredited by ABET since 1983, which demonstrates the commitment of the CM&E Department to fostering a superior program which produces graduates who are prepared to professionally contribute to the construction industry. Over the years, graduates of the BSCNE program have had numerous employment prospects and the opportunity to obtain the PE license as well as the chance to enter graduate degree programs throughout the nation. ABET accreditation ensures the BSCNE program provides current and relevant knowledge to students which assists in not only providing an understanding of the construction industry but also assists in the development of critical thinking skills, creativity, and enthusiasm for the subject, potentially inspiring excellence and stimulating innovation.

### **ABET Criteria**

ABET is recognized as the accreditation leader in the United States as well as in the world in regard to applied science, computing, engineering, and engineering technology education. ABET currently accredits, according to its website, [www.abet.org](http://www.abet.org), “over 3,100 applied science, computing, engineering, and engineering technology programs at more than 670 colleges and universities in 24 countries worldwide. Approximately 85,000 students graduate from ABET-accredited programs each year.” In addition to accrediting programs, another ABET mission is to promote quality and innovation within educational programs.

### **General Criteria**

ABET accreditation evaluates baccalaureate level engineering programs in the following eight general criteria:

- Criterion 1 – Students
- Criterion 2 – Program Educational Objectives
- Criterion 3 – Student Outcomes
- Criterion 4 – Continuous Improvement
- Criterion 5 – Curriculum
- Criterion 6 – Faculty
- Criterion 7 – Facilities
- Criterion 8 – Institutional Support

These criteria are the guiding principles of accreditation decisions. Detailed descriptions of these criteria can be found on ABET’s website, [www.abet.org](http://www.abet.org). ABET is changing the

assessment focus from inputs to outcomes. Among these criteria, criteria 2, 3, and 4 are three of the most important elements in the assessment process.

- Criterion 2 describes what graduates are expected to attain within a few years after graduation, which are determined based on the consensus of the BSCNE constituencies.
- Criterion 3 describes what students are expected to know and be able to do by the time of graduation, based on the ABET A-K outcomes.
- Criterion 4 requires regularly using appropriate, documented processes for evaluating the student outcomes and incorporating relevant data to improve program quality.

### **Program Criteria**

ABET Construction Engineering Program Criteria provide the specificity needed for interpretation of the criteria as applicable to the BSCNE program, which, however, are limited to only curriculum and faculty. The BSCNE program must satisfy the ABET program Criteria, as stated below (Note: for the 2014-2015 cycle):

1. *Curriculum: The program must prepare graduates to apply knowledge of mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus based physics; to analyze and design construction processes and systems in a construction engineering specialty field, applying knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry; to explain basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics, engineering management, and cost control.*
2. *Faculty: The program must demonstrate that the majority of faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The faculty must include at least one member who has had full-time experience and decision-making responsibilities in the construction industry.*

### **Required Participation**

An ABET visit team must evaluate a BSCNE program every six years in order for the program to maintain ABET accreditation. Preparation of a Self-Study Report must be completed prior to the visit, which will provide evidence that the BSCNE program meets the accreditation standards. One important aspect of such evidence is to prove that graduates' achievement of student outcomes has been continuously assessed in the years between visits, not just the year before the visit. This manual provides the guidelines for the CM&E Department to perform the needed assessment. The results of the assessment will be utilized for the continuous quality improvement of the BSCNE program.

Many ABET documents are available on the ABET website to assist the program in preparing for the Self-Study Report and the ABET visit. Among them, the Self-Study Questionnaire is a Word document that describes the items and data that must be included

in the Self-Study Report. Additionally, the following two guides for accreditation observers provide insight into how an observer visits the program.

- Guide for Observers on Accreditation Visits
- EAC Observer Workbook

The Accreditation Criteria and the Accreditation Policy and Procedure may change from one accreditation cycle to the next. All faculty and staff are encouraged to review the most current ABET documents in addition to this manual.

## **CHAPTER 3. PROGRAM EDUCATIONAL OBJECTIVES AND STUDENT OUTCOMES**

Based on the requirements of ABET General Criterion 2 and 3, the BSCNE program has established a set of program educational objectives (PEOs) and student outcomes (SOs). These PEOs and SOs are consistent with the NDSU and CM&E Department mission statement and goals.

### **NDSU Mission**

With energy and momentum, North Dakota State University addresses the needs and aspirations of people in a changing world by building on our land-grant foundation.

### **CM&E Mission**

The Department of Construction Management and Engineering provides quality educational programs that prepare nationally competitive undergraduate and graduate students for successful careers in the engineering and construction professions.

### **BSCNE Program Goals**

Based on the NDSU and CM&E mission statements, the CM&E Department has established five goals for the BSCNE program as listed below:

1. To provide a positive environment that promotes the scholarship of teaching, the scholarship of research, and the scholarship of service.
2. To provide a positive environment that promotes collaboration, teamwork, discovery, and professional development for both faculty and students.
3. To establish and maintain the institutional support and financial resources to recruit, develop, and retain faculty and students who are committed to fulfilling the educational objectives and outcomes of the Construction Engineering Program.
4. To provide the resources required to support the Construction Engineering Program.
5. To maintain accreditation for the Construction Engineering Program by the ABET.

### **BSCNE Program Educational Objectives**

In order to fulfill the BSCNE program goals, five PEOs have been established which describe what the department will do to assure that the professional accomplishments of the B.S. in BSCNE graduates are achieved within the first few (3-5) years after graduation.

1. To maintain a sustained program of continuing education and life-long learning with a focus on contemporary issues.

2. To be productive construction engineers and/or construction managers who are pursuing or have attained professional registration.
3. To be effective communicators who work on multi-disciplinary teams.
4. To be engaged engineering professionals who are aware of and comprehend the ethical, social, environmental, and economic impacts of engineering solutions.
5. To be engaged citizens who become involved and seek leadership roles in professional societies and community organizations.

## **Student Outcomes**

With five established PEOs, the BSCNE program has identified 11 SOs, which describe what students are expected to know and be able to do by the time of graduation. These SOs align with the a-k student outcomes described in ABET general criterion 3. The BSCNE SOs are as follows:

- a. An ability to apply knowledge of mathematics, science, and engineering to the field of Construction Engineering.
- b. An ability to design and conduct experiments, as well as to analyze and interpret data.
- c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability, with a focus on Construction Engineering systems, components, or processes.
- d. An ability to function on multi-disciplinary teams.
- e. An ability to identify, formulate, and solve Construction Engineering problems.
- f. An understanding of professional and ethical responsibility within the general field of Construction Engineering.
- g. An ability to communicate effectively.
- h. The broad education necessary to understand the impact of Construction Engineering solutions in a global, economic, environmental, and societal context.
- i. A recognition of the need for, and an ability to engage in life-long learning.
- j. A knowledge of contemporary issues.
- k. An ability to use the techniques, skills, and modern engineering tools necessary for Construction Engineering practice.

These SOs are related to the PEOs in a way that they are viewed as the future projections of attaining PEOs. SOs a, b, and k are used to project PEO 1. SOs e, h and k are used to project PEO 2. SOs a, b, and c are used to project PEO 3. SOs d, g, and h are used to project PEO 4. SOs f, i, and j are used to project PEO 5. These correlations are represented in the Table 3-1.

**Table 3-1: Relationships between PEOs and SOs**

Educational Program Objectives	Student Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	x	x									x
2					x			x			x
3	x	x	x								
4				x			x	x			
5						x			x	x	

These PEOs and SOs are published on the CM&E website:  
[http://www.ndsu.edu/construction/programs/bs\\_in\\_construction\\_engineering/](http://www.ndsu.edu/construction/programs/bs_in_construction_engineering/). The BSCNE's PEOs and SOs are reviewed every three years by program constituencies (students, faculty, staff, Industry Advisory Council members, alumni, and employers of graduates) via conversations, meetings, and e-mails.

## CHAPTER 4. ASSESSMENT PLAN

The CM&E Department has established an assessment plan for the BSCNE program including process, tools, methods, and schedule. The purposes of the assessment plan are to measure SOs and to identify areas of potential weakness within the curriculum using both qualitative and quantitative data. The plan allows the CM&E Department to set up the direction and the priority for the continuous improvements of the BSCNE Program.

### BSCNE Assessment Process

The BSCNE program uses the following process to assess the SOs, which is illustrated in Figure 1.



Figure 1: Major steps of BSCNE assessment process

Assessment is to identify, collect, and prepare data in order to measure the attainment of student outcomes. This assessment determines growth in student learning and how the BSCNE program has contributed to student knowledge, techniques, and skills. Relevant direct or indirect, quantitative or qualitative measures and sampling methods can be used for assessment. Following the assessment, an evaluation is performed in order to interpret the accumulated assessment data and evidence which in turn determine the extent to which student learning outcomes are attained. With the results of evaluation, required actions will be proposed and implemented to improve the BSCNE program.

## BSCNE Assessment Tools and Methods

The BSCNE program utilizes various assessment tools and methods for measuring each SO, including direct and indirect measures. Direct measures record student performance or achievement in specific areas and indirect measures record student performance or achievement from the third party (e.g., employers). The assessment process engages not only current students but also alumni, faculty members, employers, and the Industrial Advisory Council (IAC) members.

Assessment tools and methods are divided into two (2) main levels. Level I utilizes interview and survey techniques to collect data in a broad scale. Level II includes tools and methods targeted to each construction course and the FE (Fundamentals of Engineering) exam. There are five assessment tools in the Level I and four tools in the Level II.

At Level I, methods used are:

- Senior Graduation Survey
- Senior Exit Interviews by Chair
- Senior Exit Interviews by IAC Members
- Alumni Survey
- Employer Survey

Table 4-1 shows the five assessment tools and how they are used to measure each SO.

**Table 4-1: Student Outcomes Measured by Level I Methods**

Student Outcomes	Graduation Survey	Exit Interviews by Chair	Exit Interviews by IAC Member	Alumni Survey	Employer Survey
a	X			X	X
b	X			X	X
c	X			X	X
d	X			X	X
e				X	X
f	X	X		X	X
g	X	X	X	X	X
h	X			X	X
i	X			X	X
j				X	X
k		X	X	X	X

For each method at Level I, quantitative results are converted to a scale of 1 to 5. The Department goal for all tools is at the scale of 4 or above (80% or above). If a result is below this scale, the Department looks for ways to improve the score in the specific area.

### Senior Graduation Survey

The Senior Graduation Survey is developed by the CM&E Department to collect comments from graduating seniors to assess the program in benchmarking performance. Survey questions are grouped into nine (9) categories: General, Teaching, Communication Skills

and-Teamwork, Mathematical and Science Preparation, Techniques and Modern Tools, Overall Education, Advising, Practical Experience, and Plans after Graduation. Seniors are asked to respond to questions by circling one of the five ratings: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), or 5 = Strongly Agree (SA). The Department aims for an average value of 4 or above, and if the average value is below 4, corrective action will need to be taken in the specific area.

Spring and summer graduates are required to complete the survey in March after spring break, and fall graduates are required to complete the survey in October. The surveys are conducted by the NDSU Group Decision Center (GDC) in order to ensure the anonymous manner. Students are reminded by emails. The survey results are summarized and sent back to the program for further evaluation. Table 4-2 shows example questions in the teaching category of the Senior Graduation Survey

**Table 4-2: Example Questions of BSCNE Senior Graduation Survey**

Please respond to the following statements by circling one of the five categories unless otherwise specified: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, or 5 = Strongly Agree Please feel free to give your specific comments on each area							
#	Teaching	SD	D	N	A	SA	Special Comments
7	The texts used in my major courses were well chosen.	1	2	3	4	5	
8	The quality of teaching my major courses was generally good.	1	2	3	4	5	
9	Instructors in my major courses were accessible for questions.	1	2	3	4	5	
10	Assignments in my major courses were generally adequate.	1	2	3	4	5	
11	My knowledge of contemporary issues was developed through major course instruction.	1	2	3	4	5	
12	I am able to identify, formulate and solve engineering problems.	1	2	3	4	5	
13	My professional and ethical responsibilities were included in my instruction.	1	2	3	4	5	
14	Modern tools necessary for engineering practice were used in instruction.	1	2	3	4	5	

## Senior Exit Interviews

The BSCNE program establishes two different senior exit interviews. One is conducted by the department chair and the other is conducted by IAC members. All graduating seniors are encouraged to participate in these two exit interviews. Following the Senior Graduation Survey, the chair interview provides an opportunity to ask students specific questions, listed in Table 4-3, about the overall student experience in the program. The chair interview allows for the department to collect constructive comments and suggestions.

**Table 4-3: Questions of Senior Exit Interview by Chair**

No.	Questions	Student Outcomes
1.	How long does it take you to complete the BS in Construction Engineering degree program?	
2.	How do you rank the educational experience in the CM&E department (1 is the lowest and 10 is the highest)?	
3.	What are the courses that you believe most helpful in your career?	
4.	What are the contents that you believe missing from the courses you have taken?	
5.	Do you feel confident on technical writing and oral presentation?	g
6.	Do you feel that you have sufficient knowledge on computer programs used in the construction industry?	k
7.	Do you feel that the topic of ethics has been discussed sufficiently in the courses?	f
8.	Are faculty members available when you need help?	
9.	Are staff members available when you need help?	
10.	Do you satisfy the quality of advising?	
11.	Are you a member of any student organizations?	
12.	Do you participate in student competition?	
13.	Have you has an intern position or a working position in a construction company during the summer?	
14.	Have you had a job offer or are you still looking for a job?	
15.	Do you satisfy the service from the Student Career Center when you are looking for job?	
16.	Do you plan to get an advanced degree in the future either part-time or full-time?	
17.	Knowing what you know, will you still attend NDSU?	
18.	Do you have any suggestions for improvements?	

All but one of the responses of the Exit Interviews by the Chair are replies to open-ended questions. These responses are important in showing specifically where strengths in the Department are located as well as identifying specific ways that the Department can strive for improvement. The participants are also asked to rate their experience in the Department from 1 to 10, with one being the lowest possible score and 10 being the highest possible score. The Department aims for a mean value of 8 or above, and if the mean is below this, corrective action will need to be taken. In addition, the Department measures how well the three student outcomes (f, g, and k) are measured. The Department aims for 80% or above of responses to these questions to be “yes,” and if the average value is less than 80% “yes,” corrective actions will need to be taken.

Questions used in the IAC interview are shown in Table 4-4. The results of the IAC interview provide a second opinion of the BSCNE program without staff and faculty present at the interview. All but one of the responses of the Exit Interviews by IAC Members are replies to open-ended questions. These responses are important in showing specifically where strengths in the Department are as well as specific ways that the Department can improve. The students are also asked to rate their experience in the Department from 1 to 10, with one being the lowest possible score and 10 being the highest possible score. The Department aims for a mean value of 8 or above, and if the mean is below this score, corrective action will need to be taken. In addition, the Department measures how well the two student outcomes (g and k) are measured. The Department aims

for 80% or above of responses to these questions to be “yes,” and if the average value is less than 80% “yes,” corrective action will need to be taken.

**Table 4-4: Questions of Senior Exit Interview by IAC Members**

No.	Questions	Student Outcomes
1.	How do you rank the educational experience in the CM&E department (1 is the lowest and 10 is the highest)?	
2.	What course do you wish you had opportunity to take at NDSU?	
3.	What skills do you wish you had opportunity to learn at NDSU?	
4.	Do you feel confident on technical writing and oral presentation?	g
5.	Do you feel that you have sufficient knowledge on computer programs used in the construction industry?	k
6.	Tell us about one of the best experiences you had in the CM&E department?	
7.	Tell us about one of the worst experiences you had in the CM&E department?	
8.	What course(s) have benefited you the most? Why?	
9.	If you could change one thing about your educational experience at NDSU, what would it be?	
10.	Do you have any advice for underclassmen?	

## Alumni/Employer Surveys

The BSCNE program developed the Alumni/Employer survey to gain perspective on the educational preparedness and workplace performance of the BSCNE graduates. These two surveys have separate viewpoints from which to answer the designed questions: (1) from perspective of the graduates of the BSCNE program, and (2) from the perspective of employers of the graduates. These surveys are conducted every three years and the data is used to determine how the BSCNE program achieves its SOs. The NDSU GDC helps to make the survey questions available online and analyze the data after the surveys. The program maintains email lists of alumni and employers and updates both lists regularly. These two lists are used by the department staff as a reminder to request employers and alumni to complete the online survey. The majority of questions can be found in Table 4-5; a complete list of survey screenshots is included in Appendix A.

**Table 4-5: Key Questions Used for Alumni/Employer Survey**

No.	Questions (rating in 1-10 scale with 10 = very well)
1.	An ability to apply knowledge of mathematics, science, and engineering.
2.	An ability to design and conduct experiments, as well as to analyze and interpret data.
3.	An ability to design a system, component, or process (including bids, estimates, schedules, etc.) to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability.
4.	An ability to function on multi-disciplinary teams.
5.	An ability to identify, formulate, and solve Construction Engineering problems.
6.	An understanding of professional and ethical responsibility.
7.	An ability to communicate effectively.
8.	The broad education necessary to understand the impact of Construction Engineering solutions in a global, economic, environmental, and societal context.
9.	A recognition of the need for, and an ability to engage in, life-long learning.

10.	A knowledge of contemporary issues.
11.	Ability to use the techniques, skills, and modern engineering tools necessary for industry practice

The responses of the Alumni/Employer Survey range from 1 to 10, with 1 being the lowest possible score, and 10 being the highest possible score. The Department aims for a mean value of 8 or above, and if the mean is below this score, corrective action will need to be taken. Space is provided in sections of the survey in an effort to record any additional comments offered by survey participants.

At Level II assessment, tools and methods used are:

- Student Rating of Instruction (SROI)
- Faculty Course Assessment Report (FCAR)
- IAC Course Review
- FE Exam Results

Table 4-6 shows how SROI of each construction course is used to measure the SOs. Each BSCNE student is required to take a total of 12 construction courses.

**Table 4-6: Relationship between Course SROI and Student Outcomes**

Courses Number	Semester	Student Outcomes										
		a	b	c	d	e	f	g	h	i	j	k
CM&E 111	Fall						X	X		X	X	
CM&E 200	Fall							X				X
CM&E 204	Fall	X				X		X				X
CM&E 212	Spring	X										X
CM&E 240	Spring	X				X	X	X	X			
CM&E 301	Spring	X			X	X	X	X				X
CM&E 305	Fall					X	X	X	X		X	X
CM&E 315	Spring						X	X	X		X	
CM&E 380	Fall	X		X				X				X
CM&E 403	Fall	X		X		X	X	X			X	X
CM&E 405	Spring	X					X	X		X	X	X
CM&E 489	Spring	X	X	X	X	X	X	X	X	X	X	X

## Student Rating of Instruction

NDSU requires an in-class student evaluation of each course typically one or two weeks before Dead Week (the week before finals week). The evaluation is called the Student Rating of Instruction (SROI). Appendix B shows the first page of SROI Form that was adopted in fall 2013. The BSCNE SROI Form extends the NDSU's form and contains three parts. An example of an SROI for CME 489 Construction Design Capstone is shown in Table 4-7. Part I is the university standardized questions from 1 to 16. Part II is the specific questions used to assess the SOs. Question numbers and details vary with each course, but must match with the SOs specified for the course, as shown in Table 4-6. Part III collects students' written comments about the instructor and course. Analysis of data collected by Part I in this SROI form shows a comparison of the performance of an instructor and course with that of courses in other engineering departments and other colleges. Part II data directly measures how the course achieves the SOs from students' perspectives. Part III provides room for students to justify their rating numbers and to give specific feedback on how teaching and learning can be improved. The comments generated from Part III could be used by the instructor for course improvement actions as well. The Department aims for a mean value of 4 or above, and if the mean value is below 4, corrective action will need to be taken.

**Table 4-7: SROI Questions used in the Capstone Course**

<b>Part I</b>	<b>Standardized University Questions</b>
Questions 1-6	Questions using Scales of (Very Poor, Poor, In Between, Good, Very Good)
	1. Your satisfaction with the instruction in this course
	2. The instructor as a teacher
	3. The ability of the instructor to communicate effectively
	4. The quality of this course
	5. The fairness of procedures for grading this course
	6. Your understanding of the course content
Questions 7-16	Questions using Scales of (Strongly disagree, disagree, Neutral, Agree, Strongly Agree)
	7. The instructor created an atmosphere that is conducive to learning
	8. This instructor provided well-defined course objectives
	9. This instructor provided content and materials that were clear and well organized
	10. I understood how my grades were assigned in this course
	11. I met or exceeded the course objectives given for this course
	12. The instructor was available to assist students outside of class
	13. The instructor provided feedback in a timely manner
	14. The instructor provided relevant feedback that helped me learn
	15. The instructor set and maintained high standards that students must meet
	16. The physical environment was conducive to learning
<b>Part II</b>	<b>Questions for Assessing SOs (Very Poor, Poor, In Between, Good, Very Good)</b>
	17. Your understanding of the course content.
	18. Do you have an ability to apply the knowledge of mathematics, science, to construction and engineering related problems?
	19. Do you have an ability to analyze and interpret data?
	20. Do you have an ability to design a system, component, or process to meet desired needs?
	21. Do you have an ability to function on multi-disciplinary teams?
	22. Do you have an ability to identify, formulate, and solve engineering and construction problems?
	23. Do you have an understanding of professional and ethical responsibility?
	24. Do you have an ability to communicate effectively?

	25. Do you have the broad education necessary to understand the impact of construction and engineering solutions in a global and societal context?
	26. Do you have recognition of the need for, and an ability to engage in lifelong learning?
	27. Do you have knowledge of contemporary issues?
	28. Do you have an ability to use the techniques, skills, and modern construction and engineering tools necessary for the real-world?
<b>Part III</b>	<b>Comments</b>

## Faculty Course Assessment Report (FCAR)

The CM&E Department has developed the Faculty Course Assessment Report (FCAR) for instructors to assess the effectiveness of teaching/learning after each course is taught. The report should be submitted to the chair within 30-45 days following the completion of the course. The major items in the FCAR are listed in Table 4-8. Faculty members may add/delete certain items depending on the nature of a course.

**Table 4-8: Major Components of Faculty Course Assessment Report**

No.	Components
1	Course Information
2	Student Outcomes (highlight SOs just for this course)
3	Course Assessment Techniques and Tools
4	Grade Distribution
5	Modifications Made to Course
6	Course Objectives (Related to SOs) and Data Collection Summary
7	Data Analysis and Evaluation
8	Contemporary Issues Component
9	Student Feedback
10	Proposed Actions for Future Course Improvement

- Item 1 includes course title, semester/year, time, instructor and the number of students.
- Item 2 indicates which student outcomes (a-k) are assessed in the course.
- Item 3 describes what tools are used to measure the highlighted student outcomes (a-k).
- Item 4 gives the distribution of the final student grades (A, B, C, D, F, and W).
- Item 5 outlines the improvement actions taken based on last cycle of assessment.
- Item 6 describes what specific course objectives relate to the a-k SOs identified for the course and data collection procedure.
- Item 7 evaluates the data and discusses the results of SOs.
- Item 8 describes how contemporary issues such as societal issues were addressed in the course.
- Item 9 summarizes student feedback received.
- Item 10 proposes what will be done differently the next time the course is offered based on evaluation results.

During the evaluation process (Item 7), SOs that are related to technical knowledge in a specific course are assessed through quantitative measures such as exam, assignments, quizzes, etc. SOs that are related to communication and context are assessed through qualitative measures such as reports and/or presentations. A FCAR allows an instructor to assess the course from his/her judgments as well as from students' opinions (such as SROI data) on the learning outcomes as identified in the course syllabus. In particular, if a score of the SROI on a SO is below 4, the instructor needs to find the possible reasons of low score and propose ways to improve it in the future. The faculty member is also required to provide feedback about the students' written comments regarding the quality of the course. The major benefit of FCAR is to provide the direction of improvement at the course level. A FCAR example can be found in Appendix C.

## **IAC Course Review**

The CM&E Department requires each construction course to be evaluated by an IAC member once every three years. An example worksheet used for this review can be found in Appendix D (PART I). An IAC member can add/delete questions during the course review. In addition, IAC members may spend extra time interviewing students for their comments. After the visit, an IAC member is required to complete and send an evaluation report to the department chair. An example of the report can be found in Appendix D as well (PART II).

In contrast to the internal faculty assessment such as FCAR, an IAC course evaluation is an external review at the course level. The first page of the evaluation poses a number of questions related to the course material, assessment, and presentation. This assessment tool provides an unique industry perspective, which indicates whether or not the course delivered the knowledge and skills that students will need to retain in order to be successful in the construction industry. The instructor can then modify their course contents in response to the IAC member's comments.

The responses of the IAC Course Evaluations are replies to open-ended questions. Two questions that are of special importance are as follows:

1. Are they teaching any information that is outdated?
2. Was the professor able to communicate effectively with students?

IAC members are experts about current needs in the construction industry, and if it is determined that the course material is outdated, corrective action will need to be taken. Also, if an IAC member feels that the professor is unable to communicate effectively with students; corrective action will need to be taken. Some IAC members also provide an overall rating of the course, although it is not mandatory. The IAC review provides another layer of assessment at the course level.

## FE Exam

The CM&E Department does not require each BSCNE student to take the FE exam in order to graduate from NDSU, but encourages students to do so. Since the FE exam is a computer based test offered multiple times each year, the Department provides reminders of exam registration throughout the fall and spring semesters. Registration can be done on the following website: <http://ncees.org/exams/>. Students must select a state for registration but verification will be done electronically between the National Council of Examiners for Engineering and Surveying (NCEES) and State Boards of Registration (in North Dakota, State Board of Registration for Professional Engineers and Land Surveyors). FE results are sent to the Department. Student participant rate and passing rate are tracked by the BSCNE program. The goal for this assessment tool is to have an 80% passing rate or above measured against the total number of students who take the exam. If the individual subjects within the FE exam are covered in the BSCNE coursework, the Department goal is to have an 80% passing rate or above on those subjects in addition to the general participant/passing rate. The results of the FE exam will provide the improvement direction regarding which courses should be modified, reinforced, and/or updated.

Besides tools and methods mentioned above, other information related to the BSCNE program is collected as well, which can be used as supplements for the ABET visit. The titles of the information are listed in the Table 4-9.

**Table 4-9: Additional BSCNE Information for ABET Visit**

No.	Title of Information
1	BSCNE Program Goals Review Survey
2	Construction Engineering Program Educational Objectives Review Survey
3	Industry Advisory Council Meeting Minutes
4	Employment, Co-op, and Internship Placement Records
5	Student Chapter Memberships, Activities, and Meetings Minutes
6	Awards, Honors, and Recognition for Faculty, Staff, and Students (Dean's list, graduate list and student achievement such as Cum Laude, Magna Cum Laude, and Summa Cum Laude)
7	Graduate Audit and Advising Data
8	Annual Department Retreat Meeting Minutes
9	Department Annual Report (to the University)
10	Department Annual BSCNE Assessment Report (to the University)
11	Scholarship Recipients
12	Fundraising from Industry
13	Contact Information of IAC Members
14	Field Trip Form: including site location, number of participants, and associated courses
15	Guest Lectures Form: including lecturer's name, topic, date, and course of meeting
16	Facility Upgrades

## CHAPTER 5. ASSESSMENT IMPLEMENTATION PLAN

Based on the assessment plan described in Chapter 4, the assessment implementation plan has been enacted. Most assessment tools and methods are utilized every semester; however, the Alumni and Employer Surveys are utilized once every three years. The IAC Course Reviews are also utilized once every three years but are spread over two semesters to account for all courses. These activities are conducted by a joining effort of faculty, staff, students, and IAC members. Data generated from these activities are stored in the binders located in the department office for the evaluations. The results of the evaluations will provide the direction for the continuous improvement of the BSCNE Program.

### Assessment Timeline

Table 5-1 illustrates when and by which tool or method data is collected and evaluated for assessment. At the beginning of each academic year (in August), the department chair and the ABET coordinator will work together to identify the needed assessment tasks the following year, developing a detailed work schedule and allocating adequate resources in order to accomplish the established tasks. Besides the tasks indicated in the table, the chair and ABET coordinator will also attend the ABET coordinators' meetings in the College of Engineering. The purpose of this meeting is to share knowledge and practices with other departments in the College.

**Table 5-1: ABET Assessment Timeline**

Assessment Tools/Methods	Fall 2014	Spr 2015	Fall 2015	Spr 2016	Fall 2016	Spr 2017	Fall 2017	Spr 2018	Fall 2018	Spr 2019	Fall 2019	Spr 2020
<b>Level I (Broad Scale)</b>												
Senior Graduation Survey	x	x	x	x	x	x	x	x	x	x	x	x
Exit Interviews by Chair	x	x	x	x	x	x	x	x	x	x	x	x
Exit Interviews by IAC Members	x	x	x	x	x	x	x	x	x	x	x	x
Alumni Survey					x						x	
Employer Survey					x						x	
<b>Level II (Course Level)</b>												
SROI	x	x	x	x	x	x	x	x	x	x	x	x
FCAR	x	x	x	x	x	x	x	x	x	x	x	x
IAC Course Review					x	x					x	x
FE Exam	x	x	x	x	x	x	x	x	x	x	x	x

Note: x = data collected and evaluated

## IAC Course Review Schedule

The CM&E Department requires each course be evaluated by an IAC member once every three years. The process is spread over two semesters to account for all courses. Table 5-2 shows IAC course review schedule by semesters. The IAC members who conduct the review will be determined during the annual IAC meetings (twice a year). Following the IAC reviewer determination, the departmental staff will provide course information to the selected IAC members.

**Table 5-2: IAC Course Review Schedule**

Course Title	Fall Semester	Spring Semester
CM&E 111 Intro to CM&E	x	
CM&E 200 Documents & Codes	x	
CM&E 204 Construction Surveying	x	
CM&E 212 Graphic Communication		x
CM&E 240 Financial Cost Concepts		x
CM&E 301 Equipment & Technology		x
CM&E 305 Pre-Construction Management	x	
CM&E 315 Specs & Contracts		x
CM&E 380 Estimating	x	
CM&E 403 Scheduling & Project Controls	x	
CM&E 405 Support Operations		x
CM&E 489 Construction Design Capstone		x

## Evaluation of Data

The department chair and the ABET coordinator will evaluate the data at the end of each semester or when the data becomes available. The main purposes of the evaluation are to identify weaknesses in terms of achieving predetermined SOs and set up direction and priority for future improvements. For each assessment method, quantitative results are converted to a scale of 1 to 5 or 1 to 10. The Department goal for all methods is set up at the scale of 4 or above for 1 to 5 scale, or 8 or above for 1 to 10 scale. The Department goal for assessment data is 80% or above if measured in percentage. If a result of measurement within an area is below the specified scale, then this area will be labeled as a weakness and actions will be taken to improve this area.

The CM&E Department will regularly review the evaluation results and discuss ways to improve the weaknesses within the BSCNE Program. It is possible that several items may be placed on the future improvement list at one time. To better utilize the department resource and focus on the most important issues, we will use techniques such as the Pareto Chart to determine the priority for future improvement. In addition, we will use the Run Chart to track trends from semester to semester and monitor the effectiveness of improvement actions. The Department will also evaluate the written comments provided by the students, alumni, employers, and IAC members to determine the areas that require correction and improvement. Because assessment is a recurring process, the BSCNE

program possesses the ability to continuously identify successes and areas in need of improvement as well as ways to remedy those areas.

## CHAPTER 6. ABET SELF-STUDY DOCUMENT DEVELOPMENT

The ABET Self-Study Report must be developed and submitted before the on-campus visit. This will be done by following the most current ABET instructions available on the website. Among them, the ABET Self-Study Questionnaire explains what must be included in the report. Chapter 6 highlights and explains requirements that are particularly applicable to the BSCNE program.

### Starting Point

It is recommended that the department chair or ABET coordinator begins with an electronic copy of the last Self-Study Report. Necessary changes must be made to reflect the new requirements of ABET criteria and the current state of the department. Facility and other improvements done after the last visit must be updated. An invitation to the preparation process extends to all faculty and staff.

### ABET Course Syllabus

It is important and required that faculty address SOs in each of their courses. Therefore, instructors need to develop an ABET-style syllabus that lists all SOs that are covered in the course along with methods for assessment of each SO. The major components of an ABET Course Syllabus is shown in Table 6-1. The first five components are self-explanatory, so is component seven. However, component 6 requires a match between course objectives and SOs. This information can be found in Table 4-6.

**Table 6-1: Information Required by ABET Course Syllabus**

No.	Required Components
1.	Course number and name
2.	Credits and contact hours
3.	Instructor's or course coordinator's name
4.	Textbook title, author and year
	a. Other supplemental materials
5.	Specific course information
	a. Brief description of the content of the course (Catalog Description)
	b. Prerequisites or co-requisites
	c. Indicate whether a required, elective, or selected elective course in the program
6.	Specific goals for the course
	a. Specific outcomes of instruction.
	b. Explicitly indicate which of the student outcomes listed in Criterion 3 are addressed by the course.
7.	Brief list of topics to be covered

Based on these requirements an example of ABET-style course syllabus was developed and can be found in Appendix E. Component six of the example contains a three-column table that lists SOs in the third column. All SOs addressed in this course are marked with “X” in the first column.

## **Course Binders**

The visit team will verify if the curriculum is up to date and course materials reflect the claims in the Self-Study Report. Each instructor must assemble sufficient course materials in order to demonstrate the contents of the course. Materials that should be compiled include, but are not limited to, the course syllabus, grade sheet, SROI, FCAR, homework, quizzes, exams, semester projects, lecture notes, and textbooks. Faculty should include one or two copies of representative homework providing an example of good, average, and poor work for each assignment to demonstrate the range of student performance.

## **Student Transcript**

During the visit, the Department will provide a random sample of six transcripts for the visiting team.

## **Alumni Data**

Employment data is gathered from multiple sources including the NDSU Career Office and the Alumni Survey. The department staff works with the Alumni Association to maintain the accuracy of the data. The alumni data prove very useful while conducting the three-year alumni surveys. Data of alumni who graduated over five years ago are separated since ABET is most concerned with the alumni who graduated from the program three to five years ago.

## **Facilities**

The visit team will ask for a tour of program facilities. The CM&E Department needs to work with the Department of Civil and Environmental Engineering to ensure the geotechnical, material, and structure laboratories are prepared for the visit. In addition, the CM&E Computer Lab needs to be equipped with all software and hardware used for teaching and learning.

## **Other Materials**

Additional materials listed in Table 4-9 will also be available for the visit team.

## **On-campus Visit**

One of the major events of re-accreditation is the on-campus visit. The visit team is composed of faculty members from peer institutions and industry experts. This event provides the visit team an opportunity to verify claims made in the Self-Study Report. For this reason, every attempt should be made to have any and all data related to the BSCNE

assessment process available for review. General guidelines for the preparation of the visit include:

1. Strive to provide evaluators with the data they need, ensuring it is easy to find,
2. Show that there is a continuous program improvement process in place,
3. Show evidence that the process is being implemented, and
4. Show evidences that improvements have been made as a result of the implementation.

During the on-campus visit, the ABET team members will interview faculty, staff, students, IAC members, and other related people. The Department will coordinate the interview activities and provide needed information to all of the people involved.

## APPENDIX A. EMPLOYER/ALUMNI SURVEY

North Dakota State University  
Construction Management and Engineering  
Employer / Alumni Survey

The purpose of this survey is to gain some perspective of the educational preparedness and workplace performance of the graduates of the Department of Construction Management and Engineering (CM&E) at NDSU.

There are two viewpoints from which to answer the questions: 1) from the perspective of a graduate of the CM&E Department, or 2) from the perspective of an Employer of CM&E graduates. For question 1, please indicate from which perspective you are answering the questions. If you happen to be both an alumnus of the CM&E Department and an Employer of CM&E graduates, select the one perspective that you feel you can best answer the questions. For question 2, select the degree you graduated under or as an employer, the degree you are evaluating.

Submit

Figure 1 Employer/Alumni Survey Screenshot - Purpose

North Dakota State University  
Construction Management and Engineering  
Employer / Alumni Survey

My response to the following questions is from the perspective of:

- a CM&E alumnus    an Employer of CM&E graduates

My responses are based on B.S. degree in:

- Construction Management    Construction Engineering

Which year did you or the employee graduate?

- 2010    2011    2012

Submit

Figure 2: Employer/Alumni Survey Screenshot – General questions

**North Dakota State University  
Construction Management and Engineering  
Employer / Alumni Survey**

**For questions 4 - 16:  
How well do you think you (or CM&E graduates, from the employers perspective)  
have attained the following skills or attributes?**

**An ability to apply knowledge of mathematics, science, and management)?**

Not all |            | Very well

**An ability to analyze and interpret data?**

Not all |            | Very well

**An ability to design a system or process (including, bids, estimates, schedules,  
etc.) to meet desired needs within realistic constraints such as economic,  
environmental, social, political, ethical, health and safety, manufacturability, and  
sustainability?**

Not all |            | Very well

**An ability to function on multi disciplinary teams?**

Not all |            | Very well

Figure 3: Employer/Alumni Survey Screenshot – SLO 1-4

**An ability to identify, formulate, and solve management problems?**

Not all |           | Very well

**An understanding of professional and ethical responsibility?**

Not all |           | Very well

**An ability to communicate effectively?**

Not all |           | Very well

**The broad education necessary to understand the impact of management solutions in a global, economic, environmental, and societal context.**

Not all |           | Very well

**A recognition of the need for, and an ability to engage in, life long learning?**

Not all |           | Very well

**A knowledge of contemporary issues.**

Not all |           | Very well

**An ability to use the techniques, skills, and modern management tools necessary for industry practice?**

Not all |           | Very well

**In the space below, please provide any additional comments that you may have.**

Figure 4: Employer/Alumni Survey Screenshot – SLO 5-11 questions

# APPENDIX B. SROI FORM

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Call #

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**Gender:**

Male  
 Female

**Level:**

Freshman  
 Sophomore  
 Junior  
 Senior  
 Graduate

**Course is:**

Elective  Required

**Expected Grade:**

A  B  C  D  F

Code

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## North Dakota State University

### Student Rating of Instruction

**Directions:**  
Using a #2 pencil only, blacken the bubble that best represents your response to each item.

**Response Scale for Items 1-6 (from left to right):**  
VP=Very Poor, P=Poor, IB=In Between, G=Good, VG=Very Good

		VP	P	IB	G	VG
1. Your satisfaction with the instruction in this course. . . . .	<input type="radio"/>					
2. The instructor as a teacher. . . . .	<input type="radio"/>					
3. The ability of the instructor to communicate effectively. . . . .	<input type="radio"/>					
4. The quality of this course. . . . .	<input type="radio"/>					
5. The fairness of procedures for grading this course. . . . .	<input type="radio"/>					
6. Your understanding of the course content. . . . .	<input type="radio"/>					

---

**Response Scale for Items 7-16: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree**

		SD	D	N	A	SA
7. This instructor created an atmosphere that is conducive to learning. . . . .	<input type="radio"/>					
8. This instructor provided well-defined course objectives. . . . .	<input type="radio"/>					
9. This instructor provided content and materials that were clear and well organized. . . . .	<input type="radio"/>					
10. I understood how my grades were assigned in this course. . . . .	<input type="radio"/>					
11. I met or exceeded the course objectives given for this course. . . . .	<input type="radio"/>					
12. The instructor was available to assist students outside of class. . . . .	<input type="radio"/>					
13. The instructor provided feedback in a timely manner. . . . .	<input type="radio"/>					
14. The instructor provided relevant feedback that helped me learn. . . . .	<input type="radio"/>					
15. The instructor set and maintained high standards that students must meet. . . . .	<input type="radio"/>					
16. The physical environment was conducive to learning. . . . .	<input type="radio"/>					

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17. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	22. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	27. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
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21. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	26. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	31. <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

## APPENDIX C. FCAR EXAMPLE

**Faculty Course Assessment Report**  
**North Dakota State University**  
**Department of Construction Management and Engineering**  
CM&E course #, Name, No. credits  
Semester, Year – Faculty Name

**Course Information:**

**Student Outcomes (highlight SOs just for this course):**

**Course Assessment Techniques and Tools:**

**Grade Distribution:**

A	B	C	D	F	W	Total

**Modifications Made to Course:**

**Course Objectives and Data Summary (related to student outcomes):**

**Contemporary Issues Component:**

**Student Feedback:**

**Data Analysis and Evaluation:**

**Proposed Actions for Course Improvement:**

## APPENDIX D. IAC COURSE REVIEW FORMS PART I

### COURSE REVIEW WORKSHEET

Course Name:

Date of Class Attended:

1. Did the textbook present the technical issues that you want the students to know?
2. Are they teaching any information that is outdated?
3. Course Outline (Syllabus) received?
4. What kind of tools does the course use to measure knowledge week to week?

Quizzes?

Exams?

Classroom part?

5. What actual practical application (hands on) do you learn in class to help you understand how it is used.
6. Is the time allotted for this course adequate?
7. What prerequisites are needed for this course?
8. Was the professor able to communicate effectively with students?

## APPENDIX D. IAC COURSE REVIEW FORMS PART II

### CM&E IAC Course Evaluation

---

*Course Number and Name:*

*Instructor:*

*Date of Classroom Observation:*

*IOC Reviewer:*

---

Comments related to classroom instruction and interaction:

Comments related to course material and delivery (textbooks, Blackboard, exams, assignments, projects, etc.):

Other comments, suggestions and recommendations:

## APPENDIX E. ABET STYLE COURSE SYLLABUS

# NDSU CONSTRUCTION MANAGEMENT AND ENGINEERING

1. Course number and name: CM&E 403 Scheduling and Project Control
2. Credits and contact hours: 3 credits, 45 contact hours
3. Instructor's or course coordinator's name: Dr. Jerry Gao
4. Text book, title, author and year: Construction Planning and Scheduling, 4<sup>TH</sup> Edition, Jimmie W. Hinze, Prentice Hall, 2012.
  - a. other supplemental materials: Microsoft Office (Word and Excel) and Microsoft Project Professional 2013 are used as computer scheduling software. In addition, Primavera P6 will be introduced as well. Means Building Construction Cost Data is available from the Estimating software Timberline in CM&E and CEA clusters.
5. Specific course Information
  - a. brief description of the content of the course (Catalog Description): This course provides a discussion on the theories, principles, and techniques of construction planning and scheduling with an emphasis on time management, costs, and resources through the preparation and analysis of network schedules.
  - b. prerequisites or co-requisites: CM&E 380
  - c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: required
6. Specific Goals for the Course
  - a. specific outcomes of instruction. Specific (a-k) Student Outcomes are shown in [x]
    - Understand and describe the process of construction project planning, scheduling and control, and some of the ethical issues involved in the process; [c,f,g,j,k]
    - Develop a bar chart for a construction project; [a,c,e,g,k]
    - Manually create and calculate a schedule using network scheduling technique for a construction project using CPM; [a,c,e,g,k]
    - Explain and perform resource leveling; [a, k]
    - Update schedules and monitor the progress of work; [a,c,k]
    - Perform the project schedule calculation and analysis using computer software. [k]

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Addressed	No.	Student Outcomes
X	a	An ability to apply knowledge of mathematics, science, and engineering to the field of Construction Engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
X	c	An ability to design a system, component, or process to meet desired needs within realistic constraints such as, economic, environmental, social, political, ethical, health and safety, and sustainability, with a focus on Construction Engineering systems, components, or processes.
	d	An ability to function on multi-disciplinary teams.
X	e	An ability to identify, formulate, and solve Construction Engineering problems.
X	f	An understanding of professional and ethical responsibility within the general field of Construction Engineering.
X	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of Construction Engineering solutions in a global, economic, environmental, and societal context.
	i	A recognition of the need for, and an ability to engage in lifelong learning.
X	j	A knowledge of contemporary issues.
X	k	An ability to use the techniques, skills, and modern engineering tools necessary for Construction Engineering practice.

7. Brief list of topics to be covered:

- Introduction to Construction to Planning and Scheduling
- Parameters Affecting Project Planning
- Scheduling Process
- Activity and Duration
- Bar Charts and S-curve
- Top-down planning and Work Breakdown Structure
- Precedence Diagramming Method (PDM)
- Schedule Report and Presentation
- Fundamentals of Project Control
- Resource Allocation & Leveling
- Schedule Updating and Control
- Progress Measuring and Earned Value
- Impact of Changes and Time-cost Trade-off
- Short Interval and BIM Scheduling