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Departmental Plan
for the
Assessment of Student Learning
for the
Civil Engineering Program

System for the
Evaluation
of **Ed**ucation
SEED
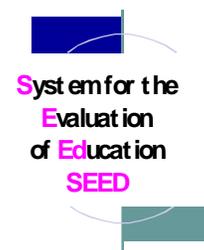
Original Plan: July 1, 2001
Last Revision: February 25, 2026 – Version #7

ABET TEAM
UPRM
CLOSING THE LOOP

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Plan for the Assessment of Student Learning
Civil Engineering Program
(Original: July 1, 2001 - Last Revision: February 25, 2026)

1. Introduction

The University of Puerto Rico at Mayagüez (UPRM) recognizes that excellent institutions are self-reflective and continually seeking to improve. The Department of Civil Engineering and Surveying (CE&S) at UPRM continually assesses its programs in a process consistent with its established vision and mission. As part of a continuous process of refinement and upgrade of our programs, our faculty maintains direct contact with practitioners in industry and government and with professional societies, which provide continuous support and collaboration. The CE&S continuously revises its curriculum to implement the feedback from our established student learning assessment processes. These processes are mostly based on the Accreditation Board for Engineering and Technology *(ABET)* Accreditation Commission's *(EAC & ANSAC)* Outcomes Assessments Criteria.

The *assessment of student learning* is one component of the department's overall assessment and, in fact, *the most important one*. The assessment of student learning has the *student as its primary focus of inquiry*; therefore the department recognizes that the assessment of student learning first occurs on an individual student basis within a particular course, is processed mainly at the department/ program level, and is supported by the institution when and where appropriate.

In fact, over the last twenty-six years, our College of Engineering (CoE) has been formalizing the *continuous quality improvement (CQI)* processes used in such matters as establishing program educational objectives, Student Outcomes, assessment tools and strategies, making changes in the curriculum, introducing new courses in response to the needs of industry, and incorporating outcomes assessments principles, among others.

2. Purpose of the Plan

The primary purpose and focus of this plan is on the design and implementation of programs or processes to assess student learning outcomes and lead to continuous quality improvement (CQI). The intention is to begin the assessment process by building and documenting on existing practices. Although some of the processes established in this plan are new, most are simply formalizations of procedures we have followed for many years.

It is important to recognize, however, that this student learning assessment plan will undoubtedly evolve, as academic programs evolve. Additionally, the plan is intended to be a source of guidance without constraining experimentation or alternate approaches that may be developed by the faculty or have already been proven effective elsewhere.

3. Applicability

This plan applies to all student-credit-generating academic units of the Department of CE&S at UPRM, its faculty, students and support staff.

4. Key Terms Definitions

For the purpose of avoiding confusion between our main professional accreditation agency (ABET), the Department of CE&S, and the Institution, and for the equal interpretation of key terms in the development of student learning assessment plans throughout UPRM, *the following definitions shall be adhered to:*

- **Program Educational Objectives (PEOs):** Broad statements that describe what graduates are expected to attain within the first few (we say 5) years after graduation, based on the needs of the constituencies.

- **Student Outcomes (SOs) = Program Student Learning Outcomes/Goals:** Statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program.

- **Course Learning Outcomes/Goals (CLOs):** Statements that describe what students are expected to know and be able to do by the end of the course.

5. Constituencies

The main four constituencies of the Department of CE&S are current *students*, *faculty*, *alumni*, and the *employers*/supervisors/managers of our alumni. On a less regular basis the department will seek input from other constituencies, such as: graduate schools, the CIAPR (College of Engineers and Land Surveyors of Puerto Rico), government agencies, parents, local community members, the UPR system administrators, and anyone who is willing to share experiences and needs. Each group plays an important role in establishing and evaluating the success of the Student Outcomes and educational objectives, and in providing direction for the department's future. Nevertheless, the emphasis will be on the main four.

6. Mission Statements

The Department's most recent vision and mission statements are the result of extensive review by faculty, students, and other members of our constituency. These versions were approved at a Faculty Meeting on 29 March 2001.

> ### *VISION*
>
> *We provide society with people serving, problem solving professionals in civil engineering and surveying.*

> **MISSION**
>
> **Provide our society with high quality professionals having a strong education in civil engineering and/or land surveying; with rich cultural, ethical, environmental, and social sensitivities; capacity for critical thinking; and the entrepreneurial skills to solve civil infrastructure problems. Search for and disseminate new knowledge. Provide services to solve engineering problems as members of interdisciplinary teams.**

In line with the vision and mission statements, a departmental *Slogan* was developed to motivate our students around their service to society and their problem solving responsibilities:

$$CES = (PS)^2$$ ➔   **(Civil Engineers and Surveyors = People-Serving, Problem-Solvers).**

The CE&S curriculum is designed to meet the needs of all students within the context of this vision and mission. This mission statement served as the basis for the development of specific Program Educational Objectives and Student Outcomes and for the selection of evaluation and assessment methods and tools to determine whether the outcomes and objectives are being met. These will all be discussed in the sections ahead.

The Civil Engineering Department's mission and objectives are clearly consistent with the mission of the UPRM College of Engineering (CoE), as approved by the College's faculty on 8 May 2001. It reads as follows:

> *Provide Puerto Rico, our neighbors, and the rest of the world with professionals having a strong education in engineering and related areas, with rich environmental, ethical, cultural, and social sensitivities; with capacity for critical thinking and for becoming leaders on their fields.*
>
> *It is also our mission to conduct research, expand and disseminate knowledge, promote an entrepreneurial spirit, provide service to the community, and pursue the innovation and application of technology for the benefit of our global society, with particular emphasis on Puerto Rico.*

And in turn, the CoE's mission statement is consonant with the UPRM's Institutional Mission Statement, which clearly describes our institutional academic product or outcome, as follows:

> *To provide excellent service to Puerto Rico and to the world:*
>
> *> Forming educated, cultivated, capable, critical thinking citizens professionally prepared in the fields of agricultural sciences, engineering, arts, sciences, and business administration so they may contribute to the educational, cultural, social, technological and economic development.*
> *> Performing creative work, research, and service to meet society's needs and to make available the results of these activities.*
> *> We provide our students with the skills and sensitivity needed to effectively resolve problems and to exemplify the values and attitudes that should prevail in a democratic society that treasures and respects diversity.*

The structure and scope of all UPRM's student learning assessment plans must flow from this mission. Thus, these mission statements and the student learning assessment program at the Department of CE&S are clearly interdependent – each more clearly defined and understood in light of the other.

7. Program Educational Objectives (PEOs)

The Department of CE&S has developed and published **Program Educational Objectives (PEOs)** that are consistent with the institutional mission and goals of the UPR, with ABET's General Criteria for Accreditation in the United States, with ASCE's Program Criteria for Civil Engineering Programs, and with the expressed needs of its constituencies. The department's faculty initially approved **six (6) PEOs** on **29 March 2001,** and has **revised them several times over the years.** After completion of the most recent review and revision process, with the participation and approval of our Constituents, we decided to adopt the following **three (3) New PEOs**, which are more in alignment with what we perceive to be the current ABET definition and with the latest changes to ABET EAC's treatment of PEOs. Therefore, as of **January 2015**, our *new Program Educational Objectives (PEOs)* are:

> *After their graduation from UPRM, our Civil Engineering…*
>
> 1. *Graduates will meet the expectations of employers of Civil Engineers.*
> 2. *Qualified graduates will pursue advanced studies if they so desire.*
> 3. *Graduates will assume/undertake leadership roles in their communities, as well as in their profession.*

8. Student Outcomes (SOs) - -

Goals or outcomes for student learning are the foundation of meaningful assessment. The Department of CE&S has published **Student Outcomes (SOs)** that are consistent with the previously stated Program Educational Objectives and with the missions of the institution, college, and program.

Based on recommendations from ABET PEVs, and after thorough analysis, our program's faculty has *unanimously* agreed to *adopt ABET EAC's Engineering Criterion #3 Student Outcomes as the Civil Engineering Program's Student Outcomes (SOs)*.

Beginning in **Jan 2019**, the *Civil Engineering Program Student Outcomes* transitioned to the *[NEW] ABET EAC's Criterion #3 (1-7) Student Outcomes*. Therefore, **from that date on**, the *[NEW] Civil Engineering Program (1-7) Student Outcomes* are as follows:

> ***By the time of their graduation, our students will have developed:***
>
> 1. *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*
> 2. *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors*
> 3. *An ability to communicate effectively with a range of audiences*
> 4. *An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts*
> 5. *An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives*
> 6. *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*
> 7. *An ability to acquire and apply new knowledge as needed, using appropriate learning strategies*

9. Course Learning Outcomes/Goals (CLOs)

The Department of CE&S has developed and published *Course Learning Outcomes/Goals (CLOs)* for each and every course taught within the department. These CLOs are consistent with the previously stated program objectives and student learning outcomes, and are published within the individual *Course Syllabuses*. The syllabi of individual courses also specify which educational objectives and outcomes each course contributes to. An example of such a Syllabus is presented in *Appendix 1.*

10. Conceptual Relationship of Learning Outcomes at Different Levels

a. Conceptual Approach: Students learn specific content and skills in each *course.* In aggregate, those courses, together with other program experiences such as academic advising, internships, and research should result in the desired student learning outcomes at the *department/program* level. Similarly, outcomes at the program level combine with general education goals and other goals to create *institutional* outcomes. In other words, learning outcomes at the institution, department (or program), and course (or activity) levels are interconnected, complimentary, and reciprocal.

The relationship between our *Student Outcomes* and our *Program Educational Objectives* is very direct, as shown in *Tables 3* and *4* ahead. We placed most effort and care to ensure a precise relationship among them.

Ideally, a better approach would be to first design the objectives and outcomes of the program, and then design the curriculum based on that information. Clearly we could not do this

since we already had a full curriculum in place long before we drafted the first statement of objectives and outcomes for our programs and courses under ABET EAC's Outcomes Assessments Criteria. What the department did therefore was to ask professors involved in each particular course for their consensus on what contribution that particular course makes to each of our objectives and outcomes. These results are presented in the form of matrixes in ***Tables 5, 6, and 7*** further ahead. Having a clear understanding of the relation between the courses and the various program objectives and outcomes ensures that all required skills and outcomes are covered in the 5-year program curriculum.

b. Program Educational Objectives (PEOs) vs. Institutional Outcomes: The UPRM directs that every department/program within the institution shall develop and include in their Student Learning Assessment Plans a matrix depicting the relationship or connection of their ***Program Educational Objectives*** with the ***Institutional Learning Outcomes***. ***Table 3*** reflects this relationship for the Civil Engineering Program.

c. Program Educational Objectives vs. Civil Engineering Program Student Outcomes and ABET EAC's Student Outcomes: Since our Program's Faculty unanimously adopted ABET EAC's Criterion 3 Student (1-7) Outcomes as its Program Student Outcomes (SOs), ***Table 4*** reflects the relationship between our Civil Engineering ***Program Educational Objectives*** and both ***Program's*** and ***ABET EAC's [NEW] Criterion 3 Student (1-7) Outcomes.*** These outcomes are consistent with the previously stated program objectives and with the mission of the Institution, the College of Engineering, and the department/program. This table shows multiple links between them. Again, ***learning outcomes at the institution, department (or program), and course (or activity) levels are interconnected, complimentary, and reciprocal.*** The matrix is a result of a participatory process with departmental consensus.

d. Curriculum Courses vs. Student Outcomes: The Department of CE&S examined all core curriculum courses and main civil engineering elective courses to ensure total coverage of proposed student learning outcomes and of ABET EAC's Outcomes Assessments Criteria. This coverage is reflected on each individual syllabus and on various matrixes. ***Table 5*** provides a mapping of ***Student Outcomes [new (1-7)*** to the ***required core curriculum*** courses in the Civil Engineering Program (for both old and new/revised curriculum). ***Table 6*** do the same for all ***civil engineering elective and selective courses***. All ***other core curriculum courses*** are mapped in ***Table 7,*** in the same manner*.* These tables demonstrate that all student outcomes have been in the past, and continue to be addressed in numerous courses, although often to different degrees.
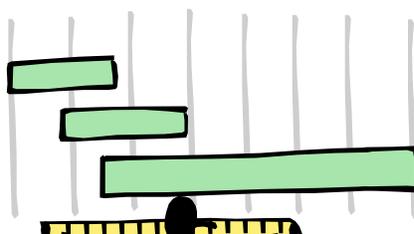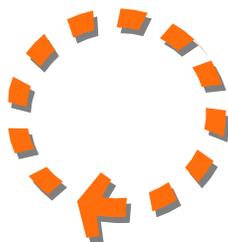
TABLE 3. Program Educational Objectives (PEOs) vs. UPRM's Institutional Learning Outcomes

PROGRAM EDUCATIONAL OBJECTIVES

After their graduation from UPRM, our Civil Engineering…

1. *Graduates will meet the expectations of employers of Civil Engineers.*
2. *Qualified graduates will pursue advanced studies if they so desire.*
3. *Graduates will assume/undertake leadership roles in their communities, as well as in their profession.*

UPRM's Institutional Learning Outcomes	Program Educational Objectives (PEOs)		
	1	*2*	*3*
a. Communicate effectively.	X	X	X
b. Identify and solve problems, think critically, and synthesize knowledge appropriate to their discipline.	X	X	X
c. Apply mathematical reasoning skills, scientific inquiry methods, and tools of information technology.	X	X	
d. Apply ethical standards.	X	X	X
e. Recognize the Puerto Rican heritage and interpret contemporary issues.	X	X	X
f. Appraise the essential values of a democratic society.		X	X
g. Operate in a global context, relate to a societal context, and demonstrate respect for other cultures.	X	X	X
h. Develop an appreciation for the arts and humanities.		X	X
i. Recognize the need to engage in life-long learning.		X	X

TABLE 4. Program Educational Objectives (PEOs) vs. Program Student Outcomes and ABET EAC's Criterion 3 - Student (1-7) Outcomes

PROGRAM EDUCATIONAL OBJECTIVES

After their graduation from UPRM, our Civil Engineering…

1. **Graduates will meet the expectations of employers of Civil Engineers.**
2. **Qualified graduates will pursue advanced studies if they so desire.**
3. **Graduates will assume/undertake leadership roles in their communities, as well as in their profession.**

Student Outcomes (1-7 SOs)*	Program Educational Objectives (PEOs)		
	1	*2*	*3*
1. math / science / engineering / problem solving…	X	X	X
2. engineering design/safety / many societal considerations…	X		X
3. communication skills …	X		X
4. professionalism / ethics/broad educ / global Impact / contemporary issues…	X	X	X
5. teamwork / leadership / collaborative environment...	X	X	X
6. develop & conduct experiments / interpret data / judgement…	X	X	X
7. acquire & apply new knowledge / lifelong learning…		X	X

Attainment of these Student Outcomes will ensure that our Civil Engineering Program's graduates are prepared to attain the Program Educational Objectives.

TABLE 5. Program's *[NEW 1-7]* **Student Outcomes (SOs) vs. "Required" Civil Engineering Program's Courses**

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Course Codes	Course Name	Student Outcomes (Old Curriculum)							Student Outcomes (New Curriculum)						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
INCI 3000	Contemporary Issues in Civil Engineering								x	x					x
INCI 4001	Geomatics I	x				x		x	Replaced by INCI 4201 and INCI 4202						
INCI 4002	Geomatics II		x			x	x								
INCI 4007	Highway Location and Curve Design	x	x						Replaced by INCI 4211 and INCI 4212						
INCI 4008	Introduction to Environmental Engineering	x			x				x			x			
INCI 4011	Structural Steel Design		x						Selective Course						
INCI 4012	Reinforced Concrete Design		x							x					
INCI 4019	Civil Engineering Seminar			x				x	Course removed						
INCI 4021	Structural Analysis I	x				x			x				x		
INCI 4022	Structural Analysis II	x							Selective Course						
INCI 4026	Highway Engineering		x		x				Selective Course						
INCI 4035	Civil Engineering Materials			x		x	x		Replaced by INCI 4231 and INCI 4232						
INCI 4049	Foundations Engineering		x						Selective Course						
INCI 4055	Construction Engineering & Management I			x	x						x	x			
INCI 4056	Construction Engineering & Management II			x	x						x	x			
INCI 4095	Mathematical Methods in Civil Engineering	x						x	Course removed						
INCI 4136	Applied Statistics for Civil Engineering	x							Replaced by INCI 4236						
INCI 4137	Introduction to Transportation Engineering	x							x						
INCI 4138	Water Resources Engineering		x		x					x		x			
INCI 4139	Introduction to Geotechnical Engineering			x		x	x		Replaced by INCI 4241						
INCI 4145	Waterworks and Sewerage Design		x		x				Selective Course						
INCI 4146	Information Technology Applications In Construction				x		x		Selective Course						
INCI 4201	Land Surveying and Plan Reading	New Course							x			x	x	x	
INCI 4202	Land Surveying and Plan Reading Lab	New Course								x		x	x		
INCI 4211	Location and Design of Linear Projects	New Course							x	x				x	
INCI 4212	Location and Design of Linear Projects Lab	New Course									x		x	x	
INCI 4231	Civil Engineering Materials	New Course							x			x		x	
INCI 4232	Civil Engineering Materials Lab	New Course									x		x	x	
INCI 4236	Probability and Statistics in Civil Engineering	New Course							x					x	
INCI 4241	Geotechnical Engineering	New Course							x						x
INCI 4242	Geotechnical Engineering Lab	New Course									x		x	x	
INCI 4950	Integrated Civil Engineering Project (CAPSTONE)	x	x	x	x	x		x	x	x	x	x	x		x

DEPARTMENT of CIVIL ENGINEERING and SURVEYING
UNIVERSITY of PUERTO RICO
MAYAGUEZ CAMPUS
TABLE 6. Program's *[NEW 1-7]* Student Outcomes (SOs) vs. "Elective" Civil Engineering Program's Courses

Course Codes	Course Name	Student Outcomes (SOs)						
		1	2	3	4	5	6	7
INCI 4000	Introduction to Architecture		x	x	x			
INCI 4011	Structural Steel Design		x					
INCI 4022	Structural Analysis II	x						
INCI 4026	Highway Engineering		x		x			
INCI 4028	Geometric Design of Highways	x	x	x				
INCI 4049	Foundations Engineering		x					
INCI 4057	Civil Engineering Practice	x		x	x	x		x
INCI 4061	Legal Aspects I				x			x
INCI 4145	Waterworks and Sewerage Design		x		x			
INCI 4146	Information Technology Applications In Construction				x			x
INCI 4242	Geotechnical Engineering Lab			x		x	x	
INCI 4995	Engineering Practice for COOP Students	x		x		x	x	x
INCI 4998	Undergraduate Research	x		x				x
INCI 5006	Applied Hydraulics	x	x				x	
INCI 5007	Solid Waste Management	x	x				x	
INCI 5008	Introduction to Hydrology	x	x		x			
INCI 5009	Fundamentals of Air Pollution	x	x		x			
INCI 5012	Applied Sanitary Engineering Chemistry	x		x		x	x	
INCI 5015	Water Treatment and Pollution Control	x	x	x			x	
INCI 5017	Prestressed Concrete Structures	x	x				x	
INCI 5018	Matrix Analysis of Structures I	x					x	
INCI 5026	Bridge Design	x	x				x	
INCI 5027	Model Analysis of Structures	x	x			x	x	
INCI 5029	Principles of City Planning	x	x	x				
INCI 5047	Introduction to Rock Mechanics	x		x	x		x	
INCI 5049	Geosynthetics in Civil Engineering	x	x				x	
INCI 5055	Design of Timber Structures	x	x				x	
INCI 5056	Structural Analysis III	x					x	
INCI 5057	Design of Reinf. Concrete Struct. *(Old INCI 4013)*	x	x				x	
INCI 5065	Production of Bituminous Materials	x	x	x				
INCI 5146	Introduction to Traffic Engineering	x		x			x	
INCI 5995	Special Topics	x	x				x	x
INCI 5996	Special Problems	x		x			x	x

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TABLE 7. Program's *[NEW 1-7]* Student Outcomes (SOs) vs. "Other Core Curriculum" Civil Engineering Program's Courses

Course Codes	Course Name	1	2	3	4	5	6	7
INGE 3011	Engineering Graphics I			x		x	x	
INGE 3012	Engineering Graphics II			x		x	x	
INGE 3016	Algorithms and Computer Programming	x		x			x	
INGE 3031	Engineering Mechanics Statics	x						
INGE 3032	Engineering Mechanics Dynamics	x						
INGE 4001	Engineering Materials	x						
INGE 4011	Mechanics of Materials I	x	x					
INGE 4012	Mechanics of Materials II	x	x					
INGE 4015	Fluid Mechanics	x	x					
INGE 4016	Fluid Mechanics Laboratory	x		x		x	x	
MATE 3005	Pre-Calculus	x						
MATE 3031	Calculus I	x						
MATE 3032	Calculus II	x						
MATE 3063	Calculus III	x						
MATE 4009	Ordinary Differential Equations	x						
MATE 4145	Differential Equations With Linear Algebra	x						
FISI 3171	Physics I	x	x				x	
FISI 3172	Physics II	x	x				x	
FISI 3173	Physics Laboratory I	x		x		x	x	
FISI 3174	Physics Laboratory II	x		x		x	x	
GEOL 4015	Geology for Engineers	x				x	x	
ECON 3021	Principles of Economics Microeconomics	x		x	x	x		x
INGL 3101	Basic Course in English			x		x		
INGL 3102	Basic Course in English			x		x		
INGL 3103	Intermediate English I			x		x		
INGL 3104	Intermediate English II			x		x		
INGL 3201	English Composition and Reading			x	x	x		
INGL 3202	English Composition and Reading			x	x	x		
ESPA 3101	Basic Course in Spanish I			x	x	x		
ESPA 3102	Basic Course in Spanish II			x		x		
PHED 3058	Physical Education Elective			x		x		
PHED 3076	Physical Education Elective			x		x		
PHED 3077	Physical Education Elective			x		x		
PHED 3205	Physical Education Elective			x		x		
PHED 3215	Physical Education Elective			x		x		
QUIM 3131	General Chemistry I	x		x		x	x	
QUIM 3132	General Chemistry II	x		x		x	x	
QUIM 3133	General Chemistry I Lab	x		x		x	x	
QUIM 3134	General Chemistry Lab II	x		x		x	x	
CHECK	**Covered (1-7) Student Outcomes (Y or N)=>**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

11. Assessment Process, Methods, and Tools

a Conceptual Assessment Cycle: The assessment processes at UPRM are cyclical and continuous, as conceptually reflected on *Figure 2*. These assessments cycles are repeated after changes have been implemented. The time for completion of a cycle up to implementation, or the *"closing of the loop",* as it is commonly referred to, may be different for the different assessment levels. An assessment cycle or loop at the course level will likely take the least time to complete as professors, within their authority, can use assessment results to make positive changes in their courses almost immediately. In the other hand, at the program level, the implementation of a course or curricular change may take months or years, as the approval may take it through various levels of authority within the institution.

Assessment Cycle

Gather
Evidence

Interpret
Evidence

Mission/Purposes
Educational
Objectives

Identify
Outcomes

Implement
Change
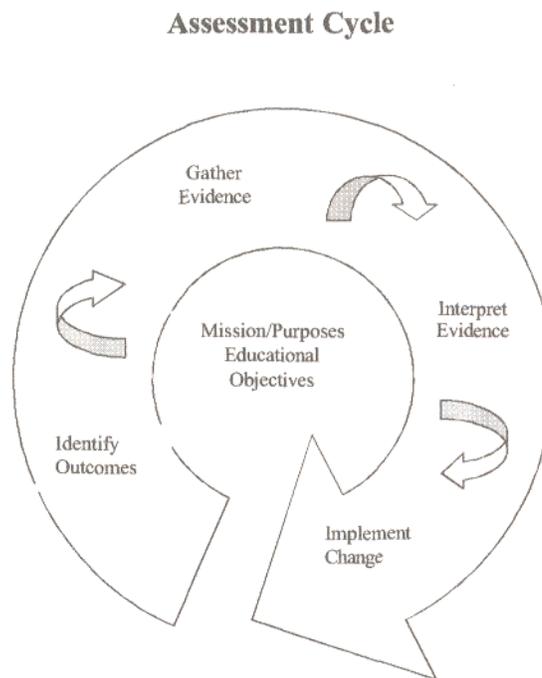
Figure 2. A conceptual assessment cycle or loop

b.   Assessment Process: The Department of CE&S put into place a well-defined *continuous quality improvement (CQI)* process to ensure that the results of the assessments are used in an on-going manner, to ensure the attainment of our educational objectives and outcomes, and to improve the quality of our programs. *Figures 3* and *4* complement each other in graphically outlining this process. Although elements of this process are continuous in nature, we have recognized our responsibility to assure that the cycles are completed and documented.

Figure 3 depicts graphically our main *data gathering mechanisms* within their place in our assessment process. A detailed listing of assessment tools, with strategies and timing, is presented in *Tables 8, 9, and 10* further ahead in this plan.

Data Gathering Mechanisms
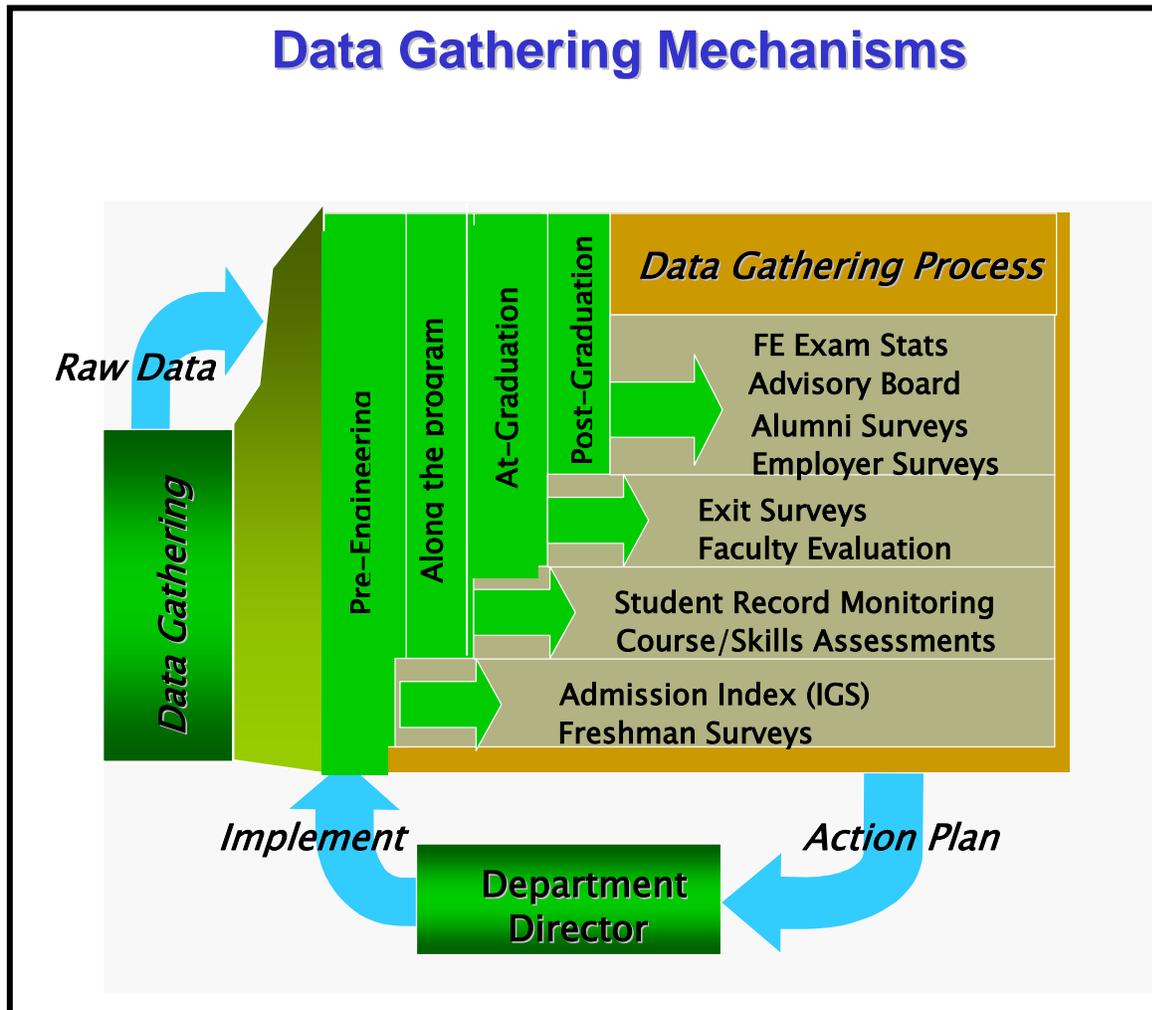
Figure 3. Data Gathering Mechanisms

Good assessment mechanisms or instruments, by themselves, are not of much use. We also need to use the data they provide to identify and implement program improvements. *Figure 4* is a graphic depiction of a *full assessment cycle* for our program.

c. Assessment Office: For a continuous quality improvement (CQI) process to be effective and "continuous", the process must be institutionalized; it must become part of the formal infrastructure of the department. With that purpose the Department of CE&S developed a new educational research office, namely, *System for the Evaluation of Education (SEED) Office*, to support the department's outcomes assessment efforts. A conceptual diagram of the Department's SEED Office is depicted in *Figure 5.*
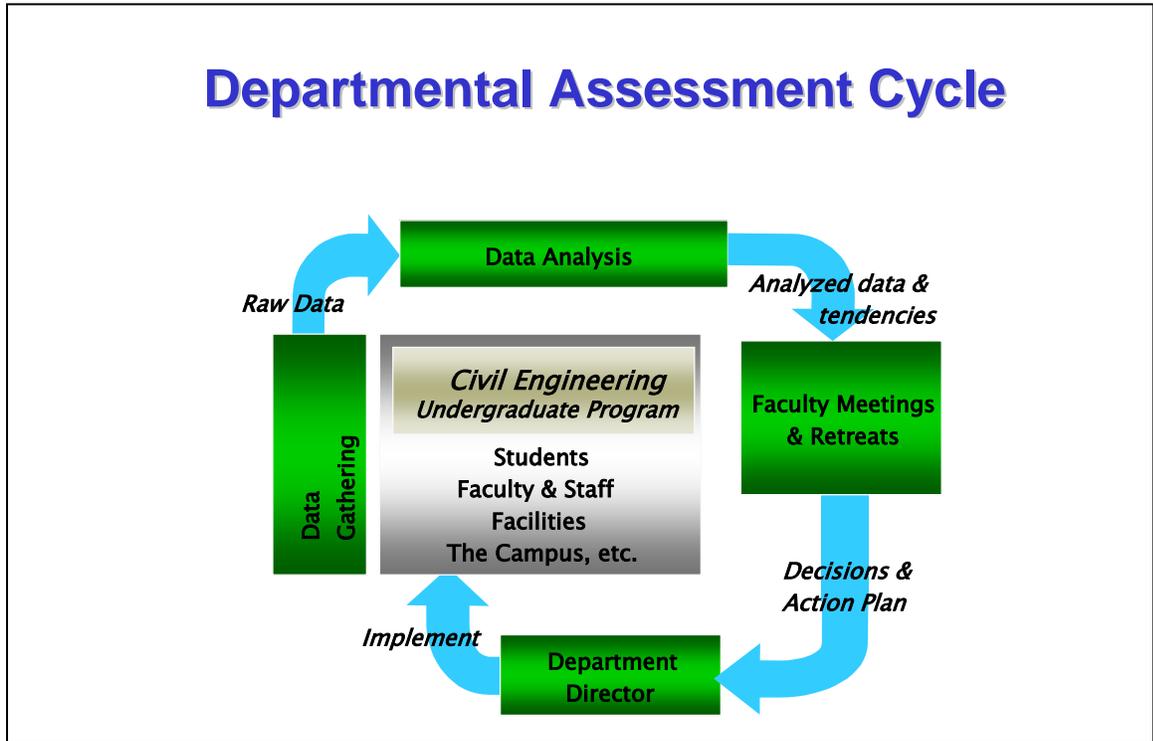
Figure 4. Departmental Assessment Cycle/Process
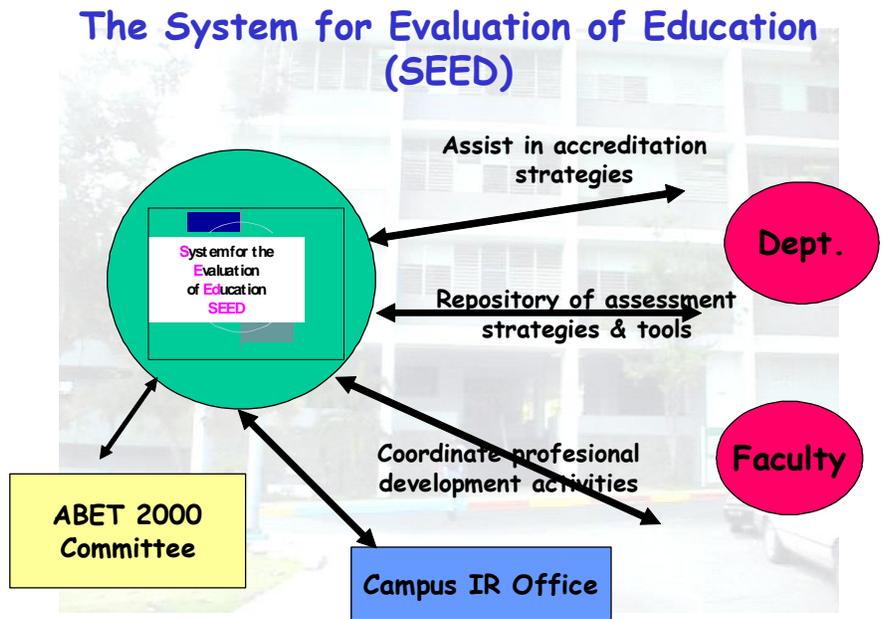
Figure 5. Conceptual Diagram for the Department's SEED Office

d. Assessment Methods/Tools:

The ***primary assessment tools*** used to monitor and to assure achievement of Student Outcomes and objectives are listed in ***Table 8.*** The assessment tools and procedures set forth in this Student Outcomes Assessment Matrix have been developed in the Department of CE&S through consensus, with great acceptance by all involved. When analyzed closely, most professors execute only one, two, or three of these assessments per semester, on things they are already doing in their courses, which does not necessarily constitute an additional heavy load on the faculty. The actual ***tools, rubrics,*** and ***forms*** chosen are available in ***Appendix 2*** of this plan.

The concept behind the more commonly used is briefly discussed below:

1. ***Direct Evaluation of Course Learning Outcomes (CLOs) in the Classroom (Assignments, Examinations, Quizzes, among others):*** Each course in the program relies heavily on the time-tested method of evaluating assignments, quizzes, examinations, and other student works. Each ***Course Syllabus*** contains a Course Learning Outcomes/Assessment Tools Table, as can be seen in the samples in ***Appendix 1.*** The 1st column identifies the Course Learning Outcomes ***(CLOs)*** that are to be achieved with every offering of the course. The 2nd column identifies linkages between each ***CLO*** and the ***Student Outcomes (SOs)***. The 3rd column identifies the assessment tool(s) used to determine achievement of the ***CLO***, which is linked to the attainment of the associated ***SOs.*** The following direct assessment tools are usually utilized by the faculty (although they can use others):

- **Exam or Quiz Question** – A question on an exam or quiz that is designed specifically to assess achievement of the ***CLO***. Average levels of performance can be the typical performance criterion (e.g., 80% of the students will earn a grade of 75% or better on this question).

- **Competency Question** – A question designed to assess achievement of a ***CLO*** that is so central to the course that only a 100% correct solution is acceptable for demonstrating that the student has acquired this competency. The level of difficulty of the question is intended to set a minimum acceptable threshold of ability for each student in the class. Multiple opportunities are provided to demonstrate each Competency. To earn a passing grade for the course, a student must demonstrate all of the Competencies specified for the course.

- **Project** – An assignment designed specifically to assess achievement of the ***CLO.*** Average levels of performance can be the typical performance criterion (e.g., 80% of the students will earn a grade of 75% or better on this question).

- **Report** – A report or section of a report that is evaluated specifically to assess achievement of the ***CLO***. Average levels of performance can be the typical performance criterion *(e.g., 80% of the students will earn a grade of 75% or better on this question).*

- **Homework Assignment** – An assignment that is designed specifically to assess achievement of the ***CLO***. Average levels of performance can be the typical performance criterion (e.g., 80% of the students will earn a grade of 75% or better on this question).

Each ***Course Syllabi*** clearly states which ***Student Outcomes*** are addressed in the course and the emphasis placed on each. It also provides an overview of the instruments being used to assess and evaluate the extent of attainment of each outcome. As the program's assessment

processes continue to mature it is expected that these ratings will be useful for identifying where improvements are to be sought if an increased level of attainment of a particular *SO* is sought.

Although we realize that course grades based on performance on homework, quizzes, exams, and projects are not a tool for direct assessment of individual *SOs*, they remain an important standard evaluation component. Since our *CLOs* are thoughtfully aligned with *SOs* on every course, our faculty is confident that our course grade evaluations generally provide an acceptable measure of the knowledge and *SOs* attained in the course. *Course Syllabi* clearly state the *metrics* used in *CLOs, SOs,* and in assigning grades. Sample evidence is maintained and available electronically in a drive.

This *Direct Evaluations of CLOs an student performance* serve a number of purposes: First, they allow instructors to identify common problems and misunderstandings among students so that the next time they teach the course, they can *make appropriate adjustments* in the way the topic in question is approached, or in the amount of time spent on the topic. Second, they allow instructors to identify any potential problems in prerequisite courses or topics that should have been presented in those courses. Third, they allow individual students to get a very good feel for how well they have mastered the material in the course. And fourth, they similarly allow instructors to determine to what degree each of the students has achieved the various *CLOs* of the course. This is especially critical given the direct correlation described earlier between the various courses in the program and our program's *SOs.*

Examples of Student Work, such as notes, oral presentations, written reports, group (team) experiences, ethical modules, and quizzes and exams compiled by faculty for each course provide a means to assess *Student Outcomes (SOs),* and to monitor and demonstrate student learning of the course material as well as their leadership, teamwork, organizational, and communications skills. Faculty members summarize the results, identify areas needing attention, and take corrective and/or improvement action to *"close the loop"* themselves within their course, or bring them to the attention of the Department's faculty for corrective and/or improvement action to *"close the loop"* at the program or higher levels. Faculty maintains evidentiary documentation in their individual *Course Binders/Portfolios.*

2. *Course Surveys on Student Outcomes and Skills:* Course outcomes and skills assessments will be completed by all students for every course they take. Some of these assessments are performed during the semester; i.e., oral presentations, written reports, group (team) experiences, and ethical considerations. Others are performed at the end of the semester. Faculty members summarize the results, identify areas needing attention, and take corrective and/or improvement action to *"close the loop"* themselves within their course, or bring them to the attention of the Department's faculty for corrective and/or improvement action to *"close the loop"* at the program or higher levels. Faculty also maintains completed assessment forms as evidentiary documentation.

TABLE 8

STUDENT OUTCOMES (SOs) ASSESSMENT MATRIX

Assessment Tools	Student (1-7) Outcomes						
	1	*2*	*3*	*4*	*5*	*6*	*7*
Pre-Engineering	*Diagnostic*						
Freshman Orientation Questionnaire	X		X	X	X	X	
Ethics Integration Assessment Form				X			
Course Assessment	*To Assess Student Outcomes (SOs)*						
Laboratory Reports (copies of)	X		X		X	X	
Exams, Quizzes, Homeworks (copies of)	X	X	X			X	
FE Exam Statistical Report	X	X				X	
Written Report Evaluation				X	X	X	
Oral Presentation Assessment				X	X		
Teamwork Assessment Form (I)					X		
Teamwork Assessment Form (II)					X		
Peer Evaluation Form					X		
Undergrad Research Exp Assessm. Form	X	X	X			X	
Course/Project Skills Assessment Form	X	X	X	X	X	X	X
Student Evaluation of Teaching (SET)	X	X	X	X		X	X
Faculty Course Assessment Report (FCAR)	X	X	X	X	X	X	X
Videos of Presentations	X	X	X	X	X	X	
Program Assessment	*To Assess Student Outcomes (SOs)*						
Faculty Course Assessment Report (FCAR)	X	X	X	X	X	X	X
Ethics Integration Assessment Form				X			
Graduating Student Exit Survey	X	X	X	X	X	X	X
Internship Assessment Form (Student)	X			X	X		
Internship Assessment Form (Mentor)	X			X	X		
COOP Supervisory Evaluation Form	X			X	X		
COOP Student Evaluation Form	X			X	X		
FE Exam Statistics (Enrolled Students)	X	X	X	X		X	X
Student Resume *(Special Format)***	X	X	X	X	X	X	X
Post-Graduation	*To Review Program Educational Objectives (PEOs)*						
Alumni Survey	X	X	X	X	X	X	X
Employers Survey	X	X	X	X	X	X	X
Advisory Board Input	X	X	X	X	X	X	X
FE Exam Statistics (Graduates)	X	X	X	X			X
Targets of Opportunity, Recruiters, etc.	X	X	X	X	X	X	X

NOTE: Student **RESUME (Special Format):** Students are instructed about this requirement, to maintain up-to-date throughout their time as students in the Civil Engineering Program, and to be turned in on the 1st week of the senior year to the Department's Academic Counselor, who will collect/file them in Resume Binders, for use at employment opportunities and/or for statistical analysis. The Resume will not exceed 2 pages in length, and will include as a minimum:

- ▪ *Name*
- ▪ *Mailing Address*
- ▪ *Contact Telephone Numbers, emails, etc.*
- ▪ *Education*
  - • *Schools/Colleges/Universities*
  - • *Departmental GPA*
  - • *General GPA*
- ▪ *Undergrad Research and Work Experiences*
- ▪ *Seminars and Workshops Attendance*
- ▪ *DESIGN Projects and Engineering Competitions*
- ▪ *Special Skills*
- ▪ *Membership in Professional Societies*
- ▪ *Honors, Recognitions and Awards*

3. ***Exit Survey:*** This survey contains several standard sets of questions that are asked in exit surveys performed by other departments in the College, while other questions that are specific to civil engineering students. Perhaps the most useful parts of the survey are the written comments that students provide. Periodically the raw responses are analyzed and the results discussed by Academic Affairs Committees as indicated earlier.

4. ***Internship/Undergraduate Research/Co-op Surveys:*** The Civil Engineering CO-OP Program, Internship, and Undergraduate Research Programs routinely survey both students and employers. All working students are asked to evaluate their experiences. At the end of each work term, students must also submit a written performance appraisal from their supervisor.

5. ***Fundamentals of Engineering Exam (FE):*** This nationally administered exam is required in the process of obtaining a professional engineering license. We use it as a tool to evaluate our academic program with reference to a national norm or standard, realizing that accreditation requirements are becoming progressively driven by accountability and benchmarking. The FE exam is nationally recognized as an extremely attractive tool for ***Student Outcomes*** assessment. Through careful analysis, FE exam results may be used to assess particular aspects of the following ***ABET Criterion 3 Student (1-7) Outcome***s: (***1***) *an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;* (***2***) *an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;* (***4***) *an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;* and (***6***) *an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*. More than for simple comparison, we use the statistical analysis of the exam results over periods of time to identify those curricular areas and associated ***Student Outcomes*** that may require particular attention for improvement. We believe this is a somewhat practical and objective way to do it. The FE exam is particularly important because it is the only nationally normed test of upper-level engineering knowledge. When combined with other standardized tests, assessment tools, alumni surveys, and placement data, the detailed reports of performance by subject area provide information that can help to evaluate the program's success in attaining the ***Student Outcomes.***

6. ***Alumni Survey:*** The Department will, every 3 or 4 years, as resources allow, send

this survey is out to alumni who graduated in the past five years; this allows us to gather input from alumni who graduated relatively recently as well as some who graduated a while ago, without at the same time asking for input from the same group of people year after year. The intent of this survey is to gauge how well the program has prepared our graduates for positions in industry and graduate school, mainly as part of our review process for *"Program Educational Objectives"*.

7. *Employer's Survey:* The Department and the UPRM Placement Office will routinely perform employer surveys of supervisors of our graduates to find out how well the program prepared our graduates that they supervise with respect to our learning outcomes, and as part of our **review process** for *"Program Educational Objectives".*

8. *Advisory Board:* We also seek input in face-to-face discussions with members of our external *Advisory Board*, by means of periodic meetings at the Department or College of Engineering levels. Due to time and budget constraints, it has become necessary to get this input through individual exchanges, conversations, and/or consultation with the members of the Board.

9. *Input from Targets of Opportunity:* We take advantage of any possible chance to seek input on the quality of our graduates, from what we call *"targets of opportunity",* such as *visiting managers* from companies and government, and from *visiting recruiters*.

10. *Surveys on Student & Faculty Satisfaction:* While we recognize that student and faculty satisfaction surveys cannot be considered direct measures of student learning, they serve as formal needs assessments to "strategically and systematically target areas in need of immediate improvement" [Noel-Levitz, Inc., 2005].

11. *Additional Special Surveys/Studies on Particular Areas:* From time to time, a special study or survey is designed and administered to assess areas that may need particular attention, such as infrastructure conditions, satisfaction with facilities, services, or any other subject of interest to our students and/or faculty. The results are used to justify requests for funding support to fix the particular problem/situation and are usually very effective in achieving improvement actions.

12. *Mock (ABET Accreditation) Visits:* One year before an ABET Accreditation Visit we will conduct at least one Mock/Diagnostic visit, coordinated through ABET Headquarters, and utilizing ABET-Certified Evaluators (PEVs). These Mock Visits are an excellent assessment tool by themselves, which provide us with a thorough external evaluation from an ABET-focused standpoint of our internal assessment and continued improvement processes, while helping us fine-tune our preparation for the upcoming real ABET Accreditation Visits.

Results from these assessment tools and surveys are compiled, analyzed, and made available to the members of Academic Affairs Committees, and then to the rest of the program's faculty and student representatives for discussion and decision making, in accordance with the established processes.

Each spring at the end of the semester the Civil Engineering Department thoroughly discusses the data obtained during that academic year from the various assessment instruments. The faculty analyzes summary data from each of the assessment instruments, which includes student representatives, initiates discussions based on the inputs from the various constituencies. Committee meetings are announced in advance and are open to all interested students and faculty.

e. Metric Goals / Levels of Attainment of Student Outcomes:

The initial metric goals for the first two to three years of this implementation are simple. We intend to review them and possibly increase them as we analyze value-added charts throughout the process.

Briefly stated, most of our assessment tools rate responses from *1* to *5*, where *5* is *"excellent, extremely satisfied, or equivalent",* and *1* is *"poor, extremely dissatisfied, or equivalent",* all depending on the assessment tool being used or the question being asked. By faculty consensus, we have established a *benchmark* or goal of *3.00,* which stands for *"good, neutral, or equivalent"…* or more for all Student Outcomes. Thus, on a *1* through *5* point scale system, a value of *4.00* is considered much closer to *"excellent"* than to *"poor."* We intend to periodically review this benchmark/goal and possibly increase it as we analyze results and value-added charts throughout the process.

For the *Course Learning Outcomes (CLO) Assessments*, which are completed in all courses every semester, courses are rated with respect to the achievement of *Student Outcomes* as aligned with *CLOs,* with an *expected level of attainment of 3.00* or more for all outcomes, on the 5-point scale system.

Since we have identified *CLOs* for each of our courses, with careful course alignment with *Student Outcomes (SOs)*, we can safely state that our students must convincingly demonstrate attainment of both *CLOs* and *SOs* to pass our courses. *CLOs, SOs*, and passing/approval metrics for each course are clearly stated in each *Course Syllabi*. In all cases for our Civil Engineering Program courses, an average score of *70%* (equivalent to a *grade of C*) is required for passing the course, and for continuation into the next level or sequential course.

For the *Fundamentals of Engineering Exam (FE)* our goal is to have a *Scaled-Score* near or higher than a *Beta Goal of 0.0* on each subject matter tested, and a passing ratio near or higher than *1.0* when compared to the National passing rates. This "scaled-score" analysis concept was proposed by Dr. Walter LeFevre et al. on their 2010 study and white paper for the NCEES entitled *"Using the Fundamentals of Engineering (FE) Examination as an Outcomes Assessment Tool".* The *scaled score* allows us to present the data in a form that represents the number of standard deviations above or below the national average for each topic (as compared to the percentage above or below the national average given by the ratio method), while allowing a range of uncertainty in the university's performance to account for small numbers of examinees. The scaled score is defined as follows:

$$\textit{Scaled-Score} = \frac{\textit{(\# correct at UPRM)} - \textit{(\# correct Nationally)}}{\textit{National Standard Deviation}}$$

We also look at the *percentage (%) of correct answers* from both our enrolled students and alumni (graduates) in each and every examined area of study, as compared with National and Carnegie Comparator results for every administered FE Exam (twice per year). Keeping in mind that effective assessment should result in continuous program improvement, we evaluate the results of student performance in all individual subject areas and associated *Student Outcomes* to identify those in which students are performing below the goals established by the faculty and perhaps significantly below national or state averages.

f. Assessment Strategies and Operational Actions for Achieving Outcomes: To implement these strategies more effectively we came up with this general *action plan*:

- Maintain regular correspondence with graduates and their employers to know their needs and to evaluate whether modifications to the program are necessary and appropriate.

- Establish an annual process in which a faculty/student committee reviews course and senior design projects to evaluate how well students in the *Capstone Design Course* are applying material throughout the curriculum.

- Draw upon students' co-op/intern/undergraduate research experiences as a source for interdisciplinary experiences, class problems, and information to other students.

- Require students to prepare written reports and oral presentations targeted to different audiences and topics.

- Make use of available resources to present case studies of actual examples in which the consequences of ethical and safety-related decisions were not properly considered.

- Require a large number of courses to have at least one major writing assignment.

- Require students to evaluate peer performance in team settings.

- Document and distribute official department policies on sexual harassment and academic and ethical misconduct.

- Have faculty design research projects appropriate for undergraduate students.

- Establish seminar series for undergraduates to present their research work results.

- Promote the use of programming, spreadsheets and the most modern hardware and software tools at all levels in the curriculum.

- Have faculty make greater use of informational sources beyond the course textbook.

- Promote student participation in the local student chapter of ASCE and support activities sponsored by this organization. Encourage and provide funds for student participation in local and regional events sponsored by professional and civic organizations.

g. Evidence to Show Achievement of Learning Outcomes: Listed below in *Figure 6* are the evidentiary documentation that will be filed/maintained (as appropriate for the particular levels) to prove that processes for the Assessment of Student Learning that lead to the continuous improvement of our educational programs are in place.

At Course level -- *COURSE PORTFOLIOS/Binders, for each course, with:*
- o *Syllabi with detailed course outlines, descriptions, and course learning outcomes*
- o *Examples of student works for required courses, including representative samples of homework assignments, quizzes, exams, and project works.*
- o *Copies of completed assessment tools/instruments and summaries of results*
- o *Videos of student oral presentations*
- o *Any other materials that support student learning outcomes assessment efforts*

At Department/Program level -- *PROGRAM PORTFOLIOS/Binders and/or FILES, with:*

- o *Posters/Catalogs/Brochures listing Student Learning Outcomes, Educational Objectives, etc.*
- o *Graduation Exit Survey documentation and results*
- o *Alumni Survey documentation and results*
- o *Employer Survey documentation and results*
- o *Stats from Licensing Exam (where applicable)*
- o *Copies of minutes of the Department's Faculty Meetings, Academic Affairs Committees, and Advisory Board meetings and recommendations (where applicable)*
- o *Copies of curriculum development/revisions*
- o *Student transcript samples*
- o *Copies of completed assessment instruments and summaries of results*
- o *Minutes of faculty meetings where assessment results considered and actions taken*
- o *Any other materials that support student learning outcomes assessment efforts*

At Other levels/Offices -- *GOOD FILES, with:*

- o *Institutional research results/statistics, with their analysis, recommendations, and actions taken (if any).*
- o *Students/Graduates/Alumni/Employer Satisfaction Survey results/statistics, with their analysis, recommendations, and actions taken (if any).*
- o *GPA/Grade trends, Graduation Rates, Retention Rates, etc., and any other statistical data gathered throughout the institution, with their analysis, recommendations, and actions taken (if any).*

Figure 6. Evidentiary Documentation to be Maintained as Proof of Assessment & Evaluation

12. Reporting and Utilization of Assessment Results

All reporting shall be accomplished in upon completion of the assessments at the end of each semester, and in accordance with the Timeline and Strategies presented in *Section 14* of this plan. Utilization of assessment results shall be in accordance with guidelines and suggestions presented throughout this plan.

13. Responsibility for Enacting and Maintaining the Plan

The following is a brief listing of the major responsibilities of key personnel as related to the assessment of student learning within the Department of CE&S. This list is not necessarily all encompassing, as additional guidance is presented throughout this plan:

a. **Director of the Department:**

- Lead the department's development and implementation efforts of a student learning assessment process with documented results.
- Encourage the full participation process of faculty, students, staff, and other stakeholders of the department.
- Ensure that evidence is maintained and that the results of the assessment process are applied to the further development and improvement of the department's programs.
- Provide the support, infrastructure, resources, and constructive leadership to assure the quality and continuity of the continuous quality improvement (CQI) process.
- Lead the academic advising activities of the department.
- Ensure that all of this planning and execution is done in accordance with the general guidelines established throughout this plan.

b. **Associate Director of the Department:**

- Support the Director's responsibilities and assume them in his absence.
- Supervise the department's centralized *Academic Advising* activities, including the efforts of the professional and academic Counselors.
- Conduct the assessment activities in accordance with this plan.

c. **Department's SEED Office / Assessment & Accreditation Coordinator:**

- Be the lead agent of the Director in the development, implementation, and continuous support of the department's outcomes assessment efforts.
- Lead the educational research efforts of the department.
- Send out, receive, and analyze the annual Assessment Surveys.
- Prepare the Annual Assessment Summary Reports for the Department.
- Provide clerical and operational support to the Department's SEED Committee.
- Maintain the assessment evidentiary documentation listed in *Section 11g* of this plan.

d. **Department's SEED Committee (which includes student representatives):**

- Initiates discussions on program objectives and outcomes, based on the inputs from the various constituencies.
- Conduct regular Committee meetings, announced in advance and open to all interested students and faculty.
- Analyze and discuss summary data and results from each of the assessment instruments to make recommendations to the Department.

e. Department's Academic Affairs Committee:

- Coordinates all curriculum related processes.
- Following appropriate discussion approves relatively minor changes in individual courses, such as minor changes in prerequisite courses.
- Submits proposals for major changes in course content and for new courses to the appropriate academic authorities.

f. Department's Faculty:

- Support all departmental student learning assessment efforts as outlined in this plan.
- Participate in the assessment efforts review process that leads to its improvement and further development.
- Perform the scheduled assessments and evaluations in accordance with the processes and timelines outlined in this plan.
- Collect and analyze summary data from each of the assessment instruments.
- Based on the assessment results, prepare proposals for changes in courses and for new courses.
- Provide academic and professional advice to students continuously during published office hours.
- Maintain Course Binders (at SEED Office) with up-to-date assessment evidentiary documentation, as suggested in *Section 11g* of this plan.
- Use assessment information to make appropriate adjustments on how to present the courses, to suggest changes in courses and prerequisites, and to ensure that program objectives and outcomes are met.

h. Department's Couselors:

- Monitor student learning and academic progress through the program.
- Review student grades at the end of each semester.
- Identify and help students having problems.
- Take steps to correct irregularities in student academic records as soon as possible.
- Conduct thorough reviews of student academic records with the assistance of the Registrar's Office to ensure that students complete all institutional requirements for the degree.

14. Time Line / Frequency of Assesment:

The Program Educational Objectives *(PEO)* system focuses on the graduates (alumni), and deals mostly with *long-term* issues. The Student Outcomes *(SO)* system focuses on *short-term (annual loop),* day-to-day issues faced by faculty and administration, and interfaces with students.

Although the general timeline for this plan calls for **immediate & continuous implementation**, *Table 9* sets *timing/frequency* and *responsibilities* for each assessment tool and/or mechanism. *Table 10* graphically depicts a typical Annual Student Learning Assessment Schedule for the Department of CE&S.

15. Process for Reviewing the Plan

The Departments of CE&S will review this assessment plan during and, as part of, the cyclic reviews of assessment results. This review should lead to the refinement or improvement of the plan and to the elimination of ineffective assessment practices. Furthermore, the Department's SEED Office shall review this student learning assessment plan on an annual basis.

The process to establish and review the current Program Educational Objectives and Student Learning Outcomes within this plan involves the following steps:

a. A review of the institution's, college's, and department's mission statements;

b. A review of the ABET EAC's Outcomes Assessments Criteria, along with definitions and examples of key terms;

c. The writing of broad program educational objectives and student outcomes that could be linked to the department's mission statement;

d. The identification of Strategies and Actions, i.e., statements that described how the program objective could be achieved;

e. The linking of these outcomes to ABET EAC's Outcomes Assessments Criteria, specifically to Criterion 3 Student (1-7) Outcomes; and,

f. The identification of effective Assessment *strategies*, *methods/tools, metrics,* and *benchmarks* that can measure the impact of the program objectives and outcomes.

16. Provision for Funding and Support Resources

Resources can be generally defined as any input to an educational program that is necessary for the program to succeed, as shown in *Figure 7*. Adequate resources must be available to the department/program at all times to be successful and have on-going accreditation.

TABLE 9
TIMING STRATEGIES for OUTCOMES ASSESSMENT

Assessment Tools	Utilization Strategy – Timing – Responsibility
Pre-Engineering	*Diagnostic*
Freshman Orientation Questionnaire	At UNIV-0004 Freshman Orientation Course (by Departmental Counselor)
Ethics Integration Assessment Form	At UNIV-0004 Freshman Orientation Course (by Departmental Counselor)
Course Assessment	*To Assess Student Outcomes (SOs)*
Laboratory Reports *(copies of)*	At all Laboratory Courses (by Lab Instructors)
Exams, Quizzes, Homeworks *(copies of)*	retain examples of these tools (by Professors/Instructors)
FE Exam Statistical Report	obtain annually from Examining Board (by Department)
Written Report Evaluation	anytime written reports are required (labs, etc) (by Professors/Instructors)
Oral Presentation Assessment	At all student oral presentations (by Professors/Instructors)
Teamwork Assessment Form (I)	At end of semester where work done in groups (by Professors/Instructors)
Teamwork Assessment Form (II)	At end of semester where work done in groups (by Professors/Instructors)
Peer Evaluation Form	At end of semester where work done in groups (by Professors/Instructors)
Undergrad Research Exp Assessm. Form	At end of any such experience (by Mentors)
Course/Project Skills Assessment Form	At end of every course (by Professors/Instructors)
Student Evaluation of Teaching (SET)	At end of every course (by all students)
Faculty Course Assessment Report (FCAR)	At end of every course (by Professors/Instructors)
Video of Presentations	At Design/Project Presentations (by Professors/Instructors)
Program Assessment	*To Assess Student Outcomes (SOs)*
Faculty Course Assessment Report (FCAR)	At end of every course (by all Professors/Instructors)
Ethics Integration Assessment Form	At end of CAPSTONE Courses (by CAPSTONE Professors)
Exit Survey (Graduating Students)	On-line At Graduation time (by Department)
Internship Assessment Form (Student)	At completion of all Internships (by Mentors)
Internship Assessment Form (Mentor)	At completion of all Internships (by Mentors)
COOP Supervisory Evaluation Form	At completion of COOP terms (by Mentors)
COOP Student Evaluation Form	At completion of COOP terms (by Mentors)
FE Exam Statistics (Enrolled Students)	Obtained every year (by College of Engineering - CoE)
Placement Data	At Graduation time (by Department, on Exit Surveys)
Student Resume *(Special Format)***	Start At UNIV-0004 Course; maintain up-to-date thru college years
Post-Graduation	*To Review Program Educational Objectives (PEOs)*
Alumni Survey	On-line to 5-yr alumni, approx. every 3-4 yrs, Summer (by Department)
Employers Survey	On-line to employers of 5-yr alumni, as above, Summer (by Department)
Advisory Board Input	Obtained at periodic meetings, as resources/funding allow
FE Exam Statistics (Graduates)	Obtained every year (by College of Engineering - CoE)
Targets of Opportunity, Recruiters, etc.	Obtained at every possible opportunity

TABLE 10

ANNUAL STUDENT LEARNING ASSESSMENT SCHEDULE
Department of Civil Engineering and Surveying

| Assessment Action	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pre-Engineering												
Freshman Orientation Questionnaire							■	■	■			
Ethics Integration Assessment Form							■	■	■			
Course Assessment												
Laboratory Reports *(copies of)*	(Sample copies of these technical evaluations)											
Exams, Quizzes, Homeworks *(copies of)*	(Sample copies of these technical evaluations)											
EIT Exam Statistical Report	■	■	■									
Written Report Evaluation	(At every possible such experience)											
Oral Presentation Assessment	(At every possible such experience)											
Teamwork Assessment Form (I)					■							■
Teamwork Assessment Form (II)					■							■
Peer Evaluation Form					■							■
Undergrad Research Exp Assessm. Form					■		■	■				
Course/Project Skills Assessment Form					■							■
Student Evaluation of Teaching (SET)					■							■
Video of Presentations	(At every possible such experience)											
Program Assessment												
Ethics Integration Assessment Form					■							■
Graduating Student Exit Survey (Part I)				■							■	
Graduating Student Exit Survey (Part II)						■	■					
Internship Assessment Form (Student)	(At the end of any such experience)											
Internship Assessment Form (Mentor)	(At the end of any such experience)											
COOP Supervisory Evaluation Form	(At the end of any such experience)											
COOP Student Evaluation Form	(At the end of any such experience)											
Student Resume *(Special Format)* **	■	■	■	■	■	■	■	■	■	■	■	■
Post Graduation												
Alumni Survey			■	■	■							
Employers Survey			■	■	■							
FE Exam Statistics	■	■	■									
Advisory Board Input										■	■	■
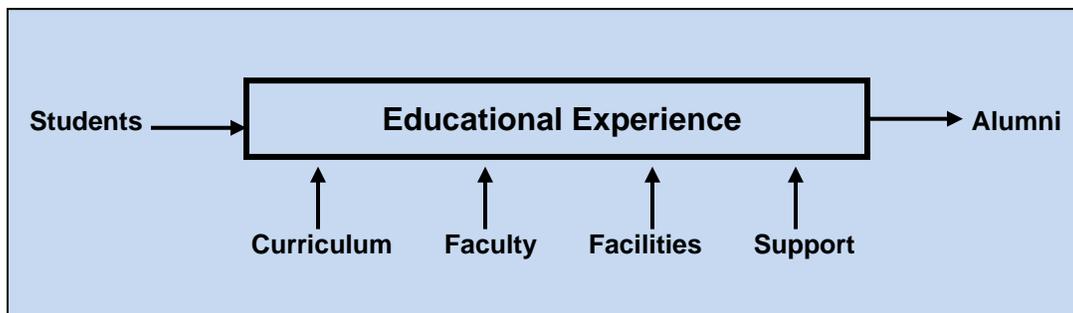
Figure 7.   Resource Perspective

The following subsections highlight the major resource categories and the means by which the department will monitor progress in each category.

a. Students:

- The department will evaluate, advice, and monitor students to determine long-term success in meeting learning outcomes.
- The institution will retain responsibility to ensure that students admitted to the departments/programs meet the qualifications needed and that correspond to the expected achievement level.
- Further, the department will have assessment processes and improvement mechanisms in place to monitor the progress of their students. The department will also monitor the progress of its alumni and solicit their input for program improvement.

b. Curriculum:

- The department establishes its uniqueness through its educational objectives, learning outcomes, and curriculum design.
- The institution assumes responsibility to ensure that all departments/programs operate within a certain envelope and to ensure that all graduates matriculate with specific qualifications. Towards this end, the Office of the Dean of Academic Affairs is charged with the responsibility to "Review and approve or disapprove proposals for new courses and proposals for changes in courses and curricula which are recommended by departments."

c. Faculty:

- The faculty must be sufficient number; and must have competencies to cover all of the curricular areas of the program.
- It is the responsibility of the department to assure that no Program of Study is offered or continued unless requirements for faculty are met or exceeded.

d. Facilities:

- Classrooms, laboratories, and associated equipment must be adequate to accomplish the program educational objectives and provide an atmosphere conducive to learning.
- The department assumes the responsibility to periodically assess priorities for equipment purchase and replacement, and to plan for the maintenance of adequate laboratory facilities.
- The institution will support by coordinating the distribution of student computing funding based on the student laboratory fees and matching funds.

e. **Institutional Support and Financial Resources:**

- Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program.
- To assure that this is monitored, the Department Chairs must keep their faculty informed about resources and expenditures of the departments in all categories, using both internal and external benchmarks.

17. Implementation Deadline

This plan shall continue to be implemented and followed **UPON RECEIPT**.

APPENDICES

1. Course Syllabus (ABET Outline – Short Version) Template and Samples
2. Student Record Form (SRF) Template with Instructions and Example
3. Department of Civil Engineering and Surveying (UPRM) Assessment Tools Package

APPENDIX 1

Course Syllabus (ABET Outline – Short Version) Template and Samples

<div align="center">

TEMPLATE

SYLLABUS OUTLINE (ABET)

</div>

Course number & title: INCI XXXX – "Official Course Tittle"

Required Course (X)   **Elective Course** (   )

Course catalog description: (Exact Description from the **Academic Catalog**)

Prerequisites: INCI XXXX – "Course Tittles" (for all pre- and c-requisites)

Textbook: Tittle, Author(s), Edition (Year), Publishing Company

Educational Objectives: After completing this course, the student should be able to:

Topics covered:
1.
2.
3.
4.
5.

Completed Sample

Course number & title: INCI 4139 - Introduction to Geotechnical Engineering

Required Course (**X**)   **Elective Course** (   )

Course catalog description: Sampling, identification and description of soils; index and hydraulic properties; interaction between mineral particles and water; permeability and seepage; stress-strain and consolidation characteristics of soils; shear strength determinations. Stress distribution and soil improvement.

Prerequisites: INGE 4011 – Mechanics of Materials I, and (INGE 4015 – Fluid Mechanics, or INQU 4010 – Momentum Transfer Operations)

Co-requisites: GEOL 4015 – Geology for Engineers

Textbook: <u>Principles of Geotechnical Engineering</u>, Das & Sobhan , 8th Edition (2013), Cengage.

Course Learning Outcomes (CLOs) / Assessment Tools: After completing this course, the student should be able to:

- Identify, understand, describe, and discuss the behavior and properties of natural soil deposits, as described in the Course Description, stressing the importance of Geotechnical Engineering in Civil Engineering projects.
- Apply the basic concepts of soil mechanics in the analysis and solution of practical problems in a global perspective and societal context.
- Identify, comprehend, analyze, predict, imagine, discuss, and evaluate the ethical implications related to the practice of the profession as it pertains to this area.
- Working in teams, conduct hands-on experiments and exercises, analyze the data, and effectively communicate their results and recommendations through oral and written means. Cooperative learning will be emphasized to develop teamwork skills.

Topics covered:
1. Introduction to Soil Mechanics. Soil problems in Civil Engineering. (2 classes)
2. Index Properties of Soils. Grain size distribution. Mineralogical Composition. Weight-Volume Relationships. (4 classes)
3. Atterberg Limits. Classification Systems. (4 classes)
4. Hydraulic Properties of Soils. Permeability. Effective and Pore water Pressures. Seepage and Flow Nets. (9 classes)
5. Soil Compaction. (3 classes)
6. Stresses in a soil mass. (2 classes)
7. Consolidation Characteristics of Soils. (9 classes)
8. Shear Strength Characteristics of Soils. (8 classes)

APPENDIX 2

Student Record Form (SRF) Instructions and Template Example

Student Record Form (SRF) [1]
Description & Instructions

The Student record Form (SRF) provides an assessment format for documenting ABET EAC Criterion 3 *Student Outcomes (SOs) assessment* and continuous improvement at the course level. In addition to assessment reporting, the SRF lists modifications incorporated into the course, reflection on the part of the instructor as to what was or was not effective, and suggestions for further improvements. Additional information collected by other means can be incorporated into the SRF. Reports are collected, discussed within the areas, and disseminated to allow instructors to inspect prior offerings of specific courses and adopt the accepted suggestions, thereby improving the course with each offering. Therefore, *the SRF effectively documents the "closing of loops" at course* and program levels.

The SRF consists of the following sections:

1. **Header** – Provide both the subject code and course number, followed by course title. If the course is taught by different faculty, then each faculty should submit an SRF that summarizes the assessment of all sections for which he/she is responsible. Indicate the section(s) within parentheses that the Report is covering. Also provide the academic term and the Instructor's name for the reporting period.

2. **Current Catalog Description** – Give the *exact* catalog description under which this course was taught. Providing this information will, over time, document changes made to the catalog description and why it was changed, indicating the feedback elements of the assessment process which led to the change. The SRF documents this activity (change) in the *"Course Modifications"* section.

3. **Improvements/Modifications Made to Course** – This section mentions the course improvements made based on recommendations coming from previous assessments. Please list any substantive changes made to the current offering of the course, and cite the source of the improvement (e.g. a previous SRF, an action plan, minutes of a committee meeting, etc.), especially if it has been documented. These references are necessary so that each modification can be traced back to its source and to demonstrate how the *loop was closed* for any particular modification. When the continuous quality improvement process is working, changes are fed back into the program, which is often referred to as *"closing the loop"* on the assessment process.

4. **Student Outcomes (SOs) Assessment ("by Components")** – Start by pasting here a copy of the applicable *(1-7) Student Outcomes (SOs) matrix* for the course (right from the *Course Syllabus*). The assessment of course outcomes is, by itself, insufficient to meet the criteria for student outcomes and assessment. The data presented for satisfying the requirements for Criterion 3 have to be relative to the adopted *(1-7)* **Student Outcomes (SOs).** This section of the Report is organized into *"components"* that roughly correspond to the individual items listed in the ABET (1-7) Student Outcomes that are *applicable to the course*. Merely stating that this activity is being accomplished is insufficient and would likely result in the citing of a shortcoming; *RATE your Direct Assessment using the Assessment Rating TABLE in next*

page. ***Documentation is needed to back up the claim***. Some of the areas that would be worth documenting if you are doing something of "sufficient substance" are the following: design of experiments, professional/ethical responsibility, communications (both written and oral), impact of solutions in a global and societal context, and contemporary issues. By providing contemporaneous documentation here, it at least demonstrates that these items have been addressed. A component should be listed only when there is something to report or when one is specifically instructed to do so as part of an assessment plan.

5. **Reflection** – The primary purpose of this section is ***to promote self-awareness on the part of the instructor.*** It is imperative to keep an open mind while looking at the results so that shortcomings can be identified and corrected.   This allows for documenting impressions regarding the effectiveness of instruction, extenuating circumstances that might have affected student performance or items that fall outside the scope of the current set of course and student outcomes. It also allows for the documentation of those things that are not easily measurable and of things that are measurable but not encapsulated into the current set of *CLOs* or *SOs*.

6. **Proposed Actions for Course Improvement** – The specification of proposed actions for course improvement begins the ***"closing the loop"*** process, as these items constitute the result of the instructor's evaluation of the course via assessment, student feedback, and reflection. There are ***no restrictions as to what can be proposed***; it could be ***as simple as a note to include material on a certain subject in an assignment***, or a ***recommendation to the curriculum committee to modify or create a course*** to better deal with some of the subject material. Whatever suggestions are recorded by the instructor, it is essential that the appropriate parties incorporate the FCAR review into the overall assessment process as a regularly scheduled activity.

The SRF templates/samples for INCI-UPRM should be used as a guide when completing your SRF Reports. Once reviewed by the areas and appropriate follow up (corrective or improvement) actions are identified and planned for, the ***SRFs will be placed/maintained in the particular Course Binders*** at the SEED Office, as documentary evidence of the continued assessment and improvement process.

STUDENT OUTCOMES (SOs)
Civil Engineering Program - UPRM

The Civil Engineering Program faculty at UPRM has adopted ABET EAC'S Criterion 3 Student Outcomes "1" through "7" as its Student Outcomes (SOs).

We expect that by the time of their graduation, our students will have developed:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. An ability to communicate effectively with a range of audiences

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Student Record Form (SRF) [1]
Description & Instructions

Student Record Form (SRF) for Whole Group/Class - CE Program - UPRM									
Term:									
	Course: INCI xxxx			Instructor: xxxxxxxx					
	Performance Indicators (PIs) for Student Outcome (SO) #7								
Students	Contemporary Curiosity	Initiative	Independence	Transfer	Reflection			**Sum**	**Overall Performance**
Sec. 036h	*(From Individual SO Assessment Sheets)*					Sum			
1							0	0	Poor
2							0	0	Poor
3							0	0	Poor
[ADD Rows for ALL Students HERE & COPY PREVIOUS Row to each NEW Row]							0	0	Poor
4							0	0	Poor
5							0	0	Poor
6							0	0	Poor
7							0	0	Poor
8							0	0	Poor
9							0	0	Poor
10							0	0	Poor
	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!			←Performance Level for Each PI	

	Performance	Count				PCT		
	Exceptional	0				0.00%		
	Acceptable	0				0.00%	0.00%	←SO Attainment (%)
	Marginal	0				0.00%		Equiv.(1-4) Metric Value
	Poor	11				100.000%		**0.0**
	Σ =	11				100.0%		

Analysis/Reflection: *(Please start by describing the Work selected for the assessment)*

Recommendations for Improvements: *(Please base it on the Analysis/Reflection of your Results)*

APPENDIX 3

Department of Civil Engineering and Surveying's Assessment Tools Package

DEPARTMENT OF CIVIL ENGINEERING AND SURVEYING
UNIVERSITY OF PUERTO RICO
MAYAGUEZ CAMPUS

ABET TEAM
UPRM
CLOSING THE LOOP

Assessment Tools & Strategies Package

[Omitted here; Available separately or ONLINE at:
http://engineering.uprm.edu/inci/?page_id=1061]

ABET
ACCREDITATION

February 25, 2026
(Revised – Version #7)

Syst em for t he
Evaluat ion
of **Ed**ucat ion
SEED