ABET
Self-Study Report

for the

Civil Engineering Program

at

Escuela Superior Politécnica del Litoral (ESPOL)

Guayaquil, Ecuador

June 30th, 2016

CONFIDENTIAL

Program Self-Study Report
for
EAC of ABET
Accreditation or Reaccreditation

BACKGROUND INFORMATION

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B. Program History

The Civil Engineering (CE) program in ESPOL was created on May 9, 1989, by resolution of the ESPOL Polytechnic Council (Governing Board). In the early 1990s, there were two technical areas in the program: Geotechnical Engineering, and Hydraulics. By 1992, four more areas were incorporated to our program: Structural Engineering, Sanitary and Environmental Engineering, Construction, and Transportation Engineering. In 1996, academic agreements were signed with the Concrete Technology Center at Guayaquil (now owned by Holcim Ecuador S.A.), and with the University of New Orleans (UNO). Those agreements improved the academic standards of our students, allowing them to conduct experiments on concrete technology and special concretes; and, to continue their undergraduate studies abroad, with possibility to pursue M.S. studies at UNO. In 2005, the boom of the construction sector in Ecuador significantly increased the overall number of students in the program, which went from an average of 70 on the early 2000s, to more than 500 in 2014. Throughout its existence, our program has experienced several academic reviews (1993, 1996, 1999, 2006, and 2009). Currently, ongoing major curricular changes are taking place, running

alongside both national and international academic accreditation processes (Higher Education Ministry of Ecuador, and ABET, respectively).

C. Options

Our CE program does not offer any standardized tracks or concentrations.

D. Program Delivery Modes

The CE program at ESPOL has 5 year duration. The modality is full time (on-campus lectures /lab sessions). The Geosciences College (FICT) offers CE undergraduate courses mainly during weekdays (M-F) between 07:30am and 08:30pm, and Saturdays, from 7h30am to 11h30am. All courses are supported by a learning management platform, known as SIDWEB (https://sidweb.espol.edu.ec/). Prior to be awarded with a CE diploma, students are required to fulfill pre-professional internship hours (see criterion 1), as well as a design capstone course (see criterion 5).

E. Program Locations

Most of the activities for our program take place at the ESPOL Campus "Gustavo Galindo Velasco". Laboratory sessions of the Concrete Technology course take place at the Concrete Technology Center (in Guayaquil). ESPOL holds international partnerships with some Universities, such as New Orleans University (UNO), and Universidade Estadual de Campinas (Unicamp – Brasil) for various programs, including Civil Engineering. Although 99% percent of our students use the local facilities, international agreements enables them also to continue and finish their CE degree at the aforementioned foreign universities.

F. Public Disclosure

The Program Educational Objectives (PEOs), and Student Outcomes (SOs) are publicly displayed in several locations across the FICT College, such as informative boards, lecture buildings, laboratories, and faculty's offices. Those statements, together with annual student enrollment and graduation data can be found at our website: http://www.fict.espol.edu.ec/?q=node/217

G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

This document contains a self-study for a first visit from ABET (initial accreditation).

GENERAL CRITERIA

CRITERION 1. STUDENTS

A. Student Admissions

As a publicly-funded university, ESPOL follows the admission process established by the National System of University Preparation and Admissions (SNNA, acronym in Spanish) – see figure 1.1. The process is managed by ESPOL's Admissions office. This process consists of the four stages described in the following figure:

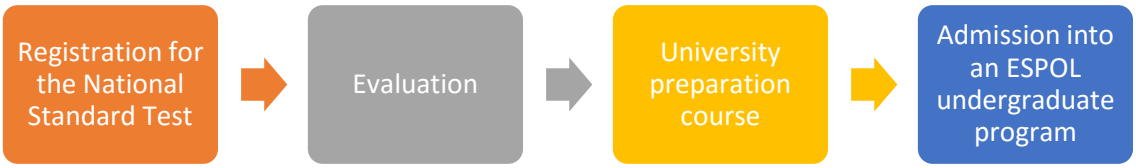


Figure 1.1 Admission process at ESPOL

Prospective students that have finished high school register at the SNNA website to take the National Standard Test. The test evaluates critical reading, mathematics and abstract reasoning. An applicant who scores above 750 points out of 1,000 is eligible to enroll in the ESPOL preparation process. This process for engineering applicants at ESPOL includes Mathematics, Physics and Chemistry. Additionally, all ESPOL applicants have to take a communication and thinking skills course. The regular preparation process takes 6 months. However, applicants can apply for an intensive 3 month course. The minimum grade to pass any of the preparation processes is 8 points out of 10.

Every year, each program at ESPOL recommends to the Office of Admissions a quota of students to be admitted. Applicants enrolled in preparation courses are not considered Civil Engineering (CE) students. With the minimum grade and proper documentation, applicants are admitted into the CE Program.

In a typical admission year, from every 100 inscribed in the CE preparation courses, 37 approve them and become officially CE participants. Table 1.1 shows the history of student admissions to the CE program for the past five years.

Table 1.1 Students admitted to the Civil Engineering (CE) program

Acedemic Year	Admitted Students
2011	108
2012	118
2013	94
2014	96
2015	95
2016 (I Term)	50

B. Evaluating Student Performance

The progression of each student through his/her curriculum is regulated by prerequisites included in our program curriculum map. ESPOL also uses a robust computerized Academic System that allows the institution to keep track of each student's academic history, and ensures all prerequisites are being met. This system enables students to register for courses as well to faculty to monitor the student's academic progress.

Additionally, instructors monitor student performance within each course. If students are having difficulties in class, faculty can submit their names to the ESPOL Counseling Services in an effort to assist students. Students are also encouraged to discuss any academic concerns they might have during lectures with their instructor.

Moreover, academic advisors are responsible for making sure that students are meeting graduation requirements, including credit courses, capstone experience, internships and other academic activities, as well as monitoring each student's overall academic progress. Every semester, students are required to meet with their academic advisor before registering for courses. Regulations for academic advising require students to report to their academic advisors after the most recent grades are available for review. (See section on academic advising).

The evaluation process of student performance at ESPOL is based on the following considerations:

a. The evaluation process measures the achievement of the general objectives of each undergraduate program and the fulfillment of the specific objectives of each course of the CE program curriculum.
b. Evaluation is a component of the teaching-learning process so it is carried out throughout each course. This includes evaluations through homework, quizzes, group projects and exams. All these evaluations are subject to the institutional regulations bylaws for Undergraduate Evaluations and Grading (Code 1208).

At ESPOL, courses are classified as theoretical or practical. Theoretical courses are those with a high percentage (more than 50% of credits) involving activities within the classroom (such as lectures and collaborative work). For theoretical courses, the final grade is computed from three evaluations. For the first two evaluations, the grade is composed of the exam score (usually accounting for between 50% and 70% of the total score), and the overall score for other assignments such as quizzes, homework, short exams, and projects (accounting for between 50% and 30%). For the third evaluation (which is optional), 100% of the grade corresponds to a comprehensive exam. Each evaluation score is graded using a 100-point scale, using only integer numbers. For each course, the students' final grade is obtained by adding the two best scores of the three evaluations and dividing it by 20, obtaining a mark between 0.00 and 10.00.

On the other hand, practical courses are those including a strong practical component. This implies that at least 50% of the credits relate to lab sessions, fieldwork and similar activities outside the classroom. Such courses are evaluated with a single grade, reported at the end of the semester. This grade takes into consideration homework assignments, quizzes, reports, projects and other activities established by the instructor in the evaluation policy of the course. For practical courses, in the case that the course includes a final exam, the exam grade cannot be worth more than 20% of the total. The final exam, if it is considered, must be administered during the period allocated for the third evaluation. This grade have to be registered as the third evaluation using a 100-point scale, using only integer numbers. The final grade for practical courses is obtained by dividing it by 10, obtaining a mark between 0.00 and 10.00

The passing grade, for both theoretical and practical courses, is 6.00 out of a maximum of 10.00

C. Transfer Students and Transfer Courses

Admitted students may transfer credits from other universities through the process of validation of studies. It is ESPOL policy to accept credits earned from fully-accredited institutions, only if such credits have been earned in recognized universities as part of a regular academic program. This policy applies to credits earned from both Ecuadorian and foreign academic institutions. Requirements for the validation of studies include the submission of certified and legalized documents. Students requesting to transfer credits must present their application to the Vice Rector of ESPOL (position similar to Provost in US Universities), who in turn submits it to the college of the corresponding academic program for revision.

Representatives of the academic program review transfer applications to determine which of the applicant's credits apply to the Civil Engineering degree. The reviewing process requires an analysis by a faculty member(s) and further approval of both the Program Coordinator and the Vice Dean.

Additionally, according to Regulation 1206 for Undergraduate Studies, ESPOL students are able to transfer course credits from one program to another. Regulations for this dictate the following:

- A program shift may be granted a maximum of twice, according to the admission rules of the new program, and,
- Courses from an ESPOL program (other than CE) may apply as free electives for our program.

In general, there have been eight student transfer applications from the CE program in the last five academic years. During the same period, 126 students have migrated from other ESPOL programs to CE.

D. Advising and Career Guidance

Academic counseling at ESPOL has been mandatory since 2013. The goal is to provide students with orientation on issues related to their studies and their future profession, as well as to monitor their progress until they finish their curriculum. In order to support the academic advising process, ESPOL has an online Academic Advising System (AAS).

Every student at ESPOL is assigned an advisor. Advisors are faculty members selected by the Program Coordinator. Once assigned, a student's advisor will accompany him/her until graduation, unless the Program Coordinator makes any necessary changes. Every CE Faculty member advises approximately 50 students.

ESPOL determines that advisory meetings should occur three times during the academic year: twice during the first term and once during the second term. The AAS enables students to schedule meetings with their advisors. During this meeting, advisors discuss student academic progress, internships (if that be the case), and personal interests. Advisors also assist students with personal issues and career counseling.

In addition to the counseling provided during academic advising, ESPOL offers students Counseling Services through a staff of psychologists and social workers. These services aim to provide students emotional support and guidance.

Furthermore, ESPOL supports career services through its Placement Center (CEPROEM - acronym in Spanish). This unit aims to assist students and the employers who recruit them by:

1. Helping students prepare for and start an internship or job search, and
2. Maintaining continuous communication with organizations in the industry to explore ways to work together, such as helping them address their human resource requirements.

E. Work in Lieu of Courses

ESPOL and the CE program do not award credits for work experience in lieu of courses. Nonetheless, current graduation requirements include a minimum of 640 internship hours, which are divided in 480 pre-professional internship hours and 160 outreach program hours. Although, students can fulfill the 640 hours by contributing to outreach programs solely.

F. Graduation Requirements

In order to graduate, all CE students must complete all requirements in the curricular plan. These requirements are based on credits. These credits are earned through regular courses (which include a capstone course), pre-professional internships, and an optional activity chosen by the student that could be either a research project or a comprehensive exam. In addition, Ecuadorian Academic regulations require graduating students to present and defend a final project. The date of the defense is officially declared as the graduation date for CE students at ESPOL. Credits requirements are summarized in Table 1-2.

Table1-2. CE Credits Requirements.

Courses type	Required Credits
Technical elective	12
Free elective (General Education)	4
Math and Basic Sciences	91
Engineering Topics (Core courses)	140
Humanistic Elective (General education)	12
Capstone course (compulsory)	-
Total	**259**

To ensure that each graduate meets all graduation requirements and presents the required documentation, undergraduate regulations indicate students must obtain a *Report of approved courses*. In order to issue this certificate, the Office of the Registrar requests that the CE Program Coordinator confirm the fulfillment of the graduation requirements.

The degree that is awarded for the CE Program is that of "*Ingeniero Civil*" (Civil Engineer, which is equivalent to Bachelor of Science in Civil Engineering in U.S.).

G. Transcripts of Recent Graduates

A list of CE students who recently fulfilled their graduation requirements is presented in Table 1-3. It includes the students' registration numbers, names, graduation dates, and GPAs.

Table1-3. CE graduates, 2015.

	Registration number	Name	Graduation date	GPA* (over 10)
1	201017811	AGUILAR PAREDES KAREN ANDREA	May 5, 2016	8.07
2	200405918	APOLO IÑIGUEZ WILMER ALBERTO	December 2, 2015	7.83
3	201020492	ARÉVALO PAREDES JONATHAN EDEN	October 27, 2015	8.09
4	201018116	BARRAGÁN BENITES JOSÉ FERNANDO	November 17, 2015	7.44
5	200901098	BARRAGÁN SUBÍA ALFREDO ALONSO	May 5, 2016	7.53
6	200521961	BARRIGA GÁRATE MARIA GABRIELA	October 27, 2015	7.13
7	200900595	BAZURTO PALMA HERNÁN ANDRÉS	November 6, 2015	7.58
8	201017613	BONILLA CASTRO EDUARDO ALEXIS	May 5, 2016	7.24
9	200915759	CEVALLOS ALVARADO JOSÉ ISRAEL	May 5, 2016	7.44
10	200609808	CEVALLOS GOROZABEL MARIA FERNANDA	May 5, 2016	7.28
11	200821262	CEVALLOS VILLAMAR GABRIELA JACQUELINE	May 5, 2016	7.70
12	200422574	CHILÁN CÁRDENAS KLEBER ARTURO	October 27, 2015	7.44
13	200902724	DELGADO FERRÍN JAVIER ANDRÉS	November 6, 2015	7.45
14	201017449	ESPINOZA VALAREZO PEDRO ANTONIO	October 27, 2015	7.96
15	200914604	FRANCO NIETO JOSÉ GABRIEL	October 27, 2015	7.34
16	201020336	GÓMEZ RUGEL GABRIEL EDUARDO	May 5, 2016	7.71
17	200906014	INTRIAGO BURGOS WILMER GILSON	November 17, 2015	8.19
18	200415404	JARAMILLO RAMOS SUSANA CLARIBEL	October 27, 2015	7.36
19	201011392	LOOR MORÁN CHRISTIAN STALIN	May 6, 2016	8.06
20	201021045	MARAZITA VILLAO JUAN DIEGO	May 5, 2016	7.98
21	200826568	MEDINA ESCARABAY FABRICIO OLMEDO	October 27, 2015	7.37
22	201013745	MENA CAJO GABRIELA DEL CARMEN	May 5, 2016	7.54
23	201024247	MELENDRES ANCHUNDIA JINSON ROLANDO	May 6, 2016	9.26
24	201021508	PALADINES OJEDA IAN CARLOS	October 27, 2015	7.72
25	201021094	PONCE GUILLÉN RICARDO ANTONIO	October 27, 2015	7.63
26	201022977	QUIZHPE CARPIO EDISSON ABRAHAM	May 6, 2016	7.96
27	200806156	RODRÍGUEZ HANZE JUAN JOSÉ	November 18, 2015	7.31
28	201021573	SÁNCHEZ CAMPOVERDE MARCO ANTONIO	October 27, 2015	7.70
29	200919660	SÁNCHEZ MARTINEZ ANDREA MADELINE	May 5, 2016	7.51
30	201022167	SCHNABEL MANTUANO OSCAR OSWALDO	October 27, 2015	7.88
31	200224053	SILVA MENDOZA GLADYS VICTORIA	October 27, 2015	7.17
32	201021276	SOLEDISPA GALARZA ROGER RODRIGO	October 27, 2015	8.00
33	200920171	SOLEDISPA SIMBAÑA MARIO XAVIER	October 27, 2015	7.34
34	200622512	TUMBACO TOMALÁ VÍCTOR DAMIÁN	October 27, 2015	7.12
35	201021037	TIBÁN BRAVO KEVIN DANILO	May 6, 2016	8.18

36	201024288	VANEGAS YAGUANA LUIS XAVIER	October 27, 2015	8.00
37	201129697	VELASTEGUI ARRIAGA SOFÍA ESTEFANÍA	May 5, 2016	8.20
38	200902559	VERA QUIROZ DÁLIDA KAYMARA	May 5, 2016	7.57
39	200703510	VILLACIS GUZMÁN OSWALDO ANTONIO	October 27, 2015	7.72
40	200118503	VINCES BRAVO DAVID FRANCISCO	December 4, 2015	6.85
41	200909885	VITERI SERNA CARLOS ALBERTO	November 17, 2015	7.53

Transcripts for the students can be provided upon request. Internal reports prepared to check that students met all the requirements for graduation will be made available during the visit. GPA is calculated as the average (mean) from all courses taken throughout the program.

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement

The *Escuela Superior Politécnica del Litoral*, ESPOL, has the following mission:

"To form excellent, socially-responsible professionals, leaders, entrepreneurs, with solid moral and ethical values that contribute to the scientific, technological, social, economic, environmental and political development of the country, and to serve society by carrying out research, innovating, promoting technology transfer and providing high quality services."

This mission is posted on ESPOL's website at: http://www.espol.edu.ec/en/vision-and-mission

B. Program Educational Objectives

Civil Engineering (CE) graduates from ESPOL, after 3 to 5 years of professional practice, will have:

a. Provided effective civil engineering solutions to society, considering technical, economical, ethical, and environmental issues.

b. Achieved recognition due to excellence in either design, construction or infrastructure management.

c. Kept up-to-date with developments in the area of civil engineering throughout their careers by having undertaken continuous training or graduate studies.

d. Promoted employment or innovation by means of leading initiatives within their organizations.

These objectives can be found at the following link (FICT-ESPOL website):
http://www.fict.espol.edu.ec/?q=node/217

C. Consistency of the Program Educational Objectives with the Mission of the Institution

The following characteristics of the CE program ensure the consistency of the program educational objectives (PEOs) with ESPOL's mission:

- By providing effective civil engineering solutions, our alumni will contribute to the development of our country. Their projects will take into account technical, economic and environmental issues.
- By achieving recognition within their area of expertise, our professionals will become leaders in our society. Our alumni will attain recognition through excellence either in design, construction or infrastructure management.
- Throughout their studies, our students are motivated to undertake continuous training oriented at serving Ecuadorian society. It is expected that once they finish their formal undergraduate education, they will remain motivated, either to conduct research or update their professional knowledge and skills, and put them into practice.

- Our professionals will be leading and promoting employment opportunities and innovation within their work environment.

Table 2-1 shows how our PEOs and ESPOL's institutional mission are linked:

Table 2-1. Relationship between the CE PEOs and ESPOL mission.

Program Educational Objectives (PEO)	***ESPOL (Institutional) mission***
1. To have provided effective civil engineering solutions to society considering technical, economical, and environmental issues.	To form excellent, socially-responsible professionals, leaders, entrepreneurs … that contribute to the scientific, technological, social, economic, environmental and political development of the country
2. To have achieved recognition by excellence in either design, construction or infrastructure management.	To form excellent, socially-responsible professionals… that contribute to the … development of the country
3. To have kept up-to-date with developments in the area of civil engineering throughout their careers by having undertaken continuous training, or graduate studies.	To serve society by carrying out research, innovating, promoting technology transfer and providing high quality services
4. To have promoted employment opportunities or innovation by means of leading initiatives within their organizations.	To form … leaders, entrepreneurs that contribute to the … development of the country, and to serve society

D. Program Constituencies

The program constituencies comprise of:

- ✓ The Engineering Advisory Board
- ✓ Employers of our alumni
- ✓ Graduates
- ✓ Faculty members

In accordance with ESPOL internal regulations, the following members form the Advisory Board:

a) 4 to 6 representatives from companies in the private and public sectors, and strongly-related to our program areas (preferably employers of our alumni):

a.1) **Consultola Cía, Ltda**, a private structural engineering consultancy company
a.2) **Consulnac, Geotecnia y Materiales, Cía., Ltda**, a private geotechnics consultancy company
a.3) **Acesco S.A.**, a private manufacturer of metallic products
a.4) **Hidalgo e Hidalgo, S.A,** a private construction company specializing in road construction and major infrastructure works
a.5) **SENAGUA,** the Water Resources Ministry (public)
a.6) **INTERAGUA,** a private concessionary company that provides water supply and drainage for Guayaquil

b) 1 representative from the local civil engineering professional association (CICG, Guayas Province), in this case, its President.

c) 2 independent professionals/freelancers in civil engineering

The Advisory Board meets at least once every two years. On our last meeting, the program educational objectives were reviewed by the Advisory Board. In addition, a recent survey conducted by ESPOL´s Placement Center (CEPROEM) has given our program insight from employees about our graduates meeting these objectives.

E. Process for Review of the Program Educational Objectives

The CE faculty selected a list of recognized private and public institutions in the field of civil engineering, especially those frequently hiring our alumni. At the same time, a proposal for the PEOs was prepared by the faculty, to be submitted to the Advisory Board. An initial meeting of this board was held on November 14, 2014, where the PEO proposal was revised. All members of the Advisory Board agreed on the four goals proposed, especially those relating to leadership, continuous professional development, excellence in design, and construction and maintenance. The board members approved the PEOs and student outcomes (SOs). The board gather at least once every two years to discuss improvements to the program. Furthermore, board meetings are regarded as opportunities for crucial feedback from the public and private sectors.

Finally, these objectives have been one of the bases for the reform process of the new academic curriculum. This reform will take into account fruitful suggestions from our Advisory Board, graduates and other constituencies as well as requirements from the Ecuadorian Higher Education Law (LOES, acronym in Spanish) in terms of the maximum number of credits, the students' autonomous workload, and the maximum number of courses, amongst other requirements. This reform will be effective beginning May 2017.

Measurement of the PEOs is no longer required by ABET. In order to ensure consistency between our PEOs and the needs of the constituents, ESPOL, through the Career Development Center (CEPROEM, acronym in Spanish, http://www.ceproem.espol.edu.ec/), carried out surveys of both employers (industry) and alumni during 2015.

A Facebook webpage (https://www.facebook.com/ingcivil.fictespol?fref=nf) and a Twitter account (@Civil_ESPOLFICT) have been set up for our program. By means of these virtual resources, the CE program receives feedback from students and alumni, for continuous improvement.

As a final summary, Table 2.1 shows a 6-year cycle for the revision of the PEOs.

Table 2.1: Revision cycle for PEOs in the CE program

Year 1	SOs assessment
Year 2	SOs evaluation
Year 3	Proposed SOs & PEOs by faculty
Year 4	Feedback: Advisory Board - Students - Alumni
Year 5	Faculty review
Year 6	Final version of SOs & PEOs

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

By the end of their studies at ESPOL, Civil Engineering (CE) graduates are expected to attain the following student outcomes (SOs). Graduates will have:

a) An ability to apply knowledge of mathematics, sciences, and civil engineering.

b) an ability to design and conduct experiments, as well as to analyze and interpret data related to civil engineering.

c) an ability to design systems, components or processes related to civil engineering to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, manufacturability and sustainability considerations.

d) an ability to work as part of a multidisciplinary team.

e) an ability to identify, formulate and solve problems originating in different areas of civil engineering.

f) an understanding of ethical and professional responsibility.

g.1) an ability to communicate effectively in Spanish.

g.2) an ability to communicate in English.

h) an ability to understand the impact of civil engineering solutions in a social, environmental, economic and global 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 civil engineering practice.

l) a recognition of the need for entrepreneurship and the abilities to become an entrepreneur.

B. Relationship between the Student Outcomes and the Program Educational Objectives

The SOs of the CE program prepare graduates to attain our PEOs as follows:

Table 3-1 Civil Engineering program, Program Educational Objectives vs Student Outcomes.

	ProgramEducational Objectives			
Student Outcomes	a) Provided effective civil engineering solutions to society, considering technical, economical, ethical, and environmental issues	b) Achieved recognition due to excellence either in design, construction or infrastructure management.	c) Kept up-to-date with developments in the area of civil engineering throughout their careers by having undertaken continuous training or graduate studies.	d) Promoted employment and innovation by means of leading initiatives within their organizations.
a) Ability to apply knowledge of Mathematics Sciences, and Civil Engineering	X		X	
b) Ability to design and conduct experiments, as well as to analyze and interpret data, related to Civil Engineering.			X	
c) an ability to design systems, components or processes related to civil engineering to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, manufacturability and sustainability considerations.	X			
d) Ability to work as part of a multidisciplinary team.				X
e) Ability to identify, formulate and solve problems originated in different areas of Civil Engineering.	X			
f) Ability to comprehend ethical and professional responsibility.		X		
g.1) Ability to communicate effectively in Spanish.		X		X
g.2) Ability to communicate in English.		X		X
h) Ability to understand the impact of Civil Engineering solutions, in a social, environmental, economic and social context.	X		X	
i) A recognition of the need for, and an ability to engage in life-long learning.			X	
j) Knowledge of contemporary issues.			X	X
k) An ability to use the techniques, skills, and modern engineering tools necessary for Civil Engineering practice.	X	X		
L) a recognition of the need for entrepreneurship and the abilities to become an entrepreneur.				X

Through a macro-curricular plan, our program is designed for educational objectives to contribute to our institution mission statement. In a similar way, student outcomes contribute to students´ attainment of program educational objectives as shown in table 3.1. A systematic way of assessing and evaluating student outcomes along the 5 year program, together with a strong link between SO´s and PEO´s, enables us to know if students are meeting, at each stage, the SO performance.

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Student Outcomes

4.A.1. Listing and description of the assessment processes

Concentration area meetings / Assessment of SOs in specific courses

The Civil Engineering (CE) program carries out several area meetings during the year. In those meetings faculty members discuss the data collection processes, review the rubrics used to measure the student outcomes (SOs), and define the expected level of attainment for each SO.

Three assessment strategies used for data collection regarding SOs in our program are: (i) course assessment (direct for all SOs), (ii) Senior Students Survey (direct for SO_i), and (iii) Comprehensive Examination (indirect for SO: SO_a, SO_b, SO_c and SO_e).

(i) Course Assessment thru portfolios

During plenary sessions, faculty members define which courses are selected to conduct SO assessment. In 2014 and 2015, each CE student outcome was assessed in two or three levels of the program (starting, middle, advanced), representing students from junior, sophomore and senior level respectively, as depicted in table 4-1. For each student outcome, the Program Coordinator selects among faculty, a Student Outcome Coordinator, who leads the process of data collection. This process consists in selecting appropriate assessment tools, defining rubrics, collection times and reporting the findings to the Program Coordinator and Accreditation Coordinator. Details of the type of evidence taken into account to assess each SO are shown in Section 4.A.4.

Table 4-1 shows the assessment courses for each SO. For this purpose, courses have been classified into three groups: **Starting** (Red) for courses offered between levels 200 and 300; **Middle** (Yellow) for courses at the 400 level; and **Advanced** (Green) for courses at the 500 level. The level ###-1 indicates that the course is taught during the first semester (May to September), whereas the level ###-2 is during the second semester (October to March). The table also shows the total number of courses contributing to the SO assessment process. This ensures data collection (for every SO) is done at least twice across the academic flowchart. As stated before, these assessment courses were selected in discussion with the faculty. In addition, faculty members proposed strategies to achieve suitable measurements (e.g. exams, projects and oral presentations).

Table 4-1 Civil Engineering Program Course Assessment Plan (SOs), 2016.

FICT - ESPOL - CIVIL ENGINEERING - ASSESSMENT PLAN (1) - CURRICULUM 2016			STUDENT OUTCOMES (SO)													
			INSTITUCIONAL (SOI)							DISCIPLINARY (SOD)						
			SO 1: Ethical Responsability and profesional	SO 2: Speaking and Writing in Spanish	SO 3: Communication in English	SO 4: Continuous Learning	SO 5: Contemporary Issues	SO 6: Work in Group	SO 7: Entrepreneurship	SO 8: Manth, Science and Engineering Apply	SO 9: Laboratory and Data Control	SO 10: Design	SO 11: Solutions of Engineering Problems	SO 12: Understand the impact of Civil Engineering	SO 13: Techniques and modern tools for CE	
Equivalence Student Outcomes - ABET			f	g.1	g.2	i	j	d	l	a	b	c	e	h	k	
Course Name	Level	Term														Assessment Total for Course
Introduction to Geotechnical Engineering	200-2	2015 2T					1									1
Statics / Dynamics	200-2	2015 2T											1			1
Civil Engineering Materials	200-2	2015 2T			1									1		2
Soil Mechanics I	300-1	2015 1T							1							1
Applied Informatics	300-1	2015 1T				1									1	2
Technical Drawing and Plans	300-1	2015 1T		1												1
Strength of Materials I	300-1	2015 1T	1									1				2
Surveying I	300-1	2015 1T								1						1
Soil Mechanics II	300-2	2015 2T									1					1
Surveying II	300-2	2015 2T						1								1
Concrete Technology	300-2	2015 2T														0
Strength of Materials II	300-2	2015 2T											1			1
Reinforced Concrete Design I	300-2	2015 2T														0
Fluid Mechanics	400-1	2015 1T	1													1
Sanitary Engineering I	400-1	2015 1T										1				1
Rock Mechanics	400-1	2015 1T								1						1
Road Design I	400-1	2015 1T		1												1
Structural Analysis I	400-1	2015 1T							1						1	2
Reinforced Concrete Design II	400-1	2015 1T				1										1
Hydrology	400-2	2015 2T						1								1
Sanitary Engineering II	400-2	2015 2T			1											1
Foundation Engineering	400-2	2015 2T														0
Road Design II	400-2	2015 2T									1			1		2
Structural Analysis II	400-2	2015 2T					1									1
Prestressed Concrete Design	400-2	2015 2T														0
Hydraulics	500-1	2015 1T	1	1												2
Construction Cost Analysis	500-1	2015 1T							1							1
Structural Design	500-1	2015 1T				1				1						2
Structural Steel Design	500-1	2015 1T													1	1
Professional Legislation	500-2	2015 2T												1		1
Environmental Engineering	500-2	2015 2T					1									1
Building Installation Systems	500-2	2015 2T														0
Construction	500-2	2015 2T			1						1					2
Capstone Course	500-2	2015 1T										1				1
Capstone Course	500-2	2015 2T						1					1			2
Assessment Total for Student Outcome			3	3	3	3	3	3	3	3	3	3	3	3	3	

(ii) Survey to Asses SO_i:

A questionnaire administered to senior students has been utilized as an assessment tool to measure Performance Indicators for SO_i: "A recognition of the need for, and an ability to engage in life-long learning". This survey asks students questions related to their study habits, where do they usually look for information and how frequently they take continuous education and development courses. Without being explicit, the responses are compared to the SO rubric performance indicators. Results of the assessment process can be found in SO_i .section 4.A.4. of this criterion. Evidence of the questionnaire of the survey can be found in Appendix E.

(iii) Comprehensive Examination to Asses SO_a, SO_b, SO_c and SO_e.

By the end of the second term during 2015, a comprehensive pilot examination was administered to Senior Students. This examination was taken by 62 students and consisted of 60 questions related to 28 Civil Engineering courses. A match between each question and 4 Student Outcomes was determined for the purpose of assessing the attainment of each of these Student Outcomes.

Due to the format of the examination, which consisted in multiple choice questions, with a single correct answer, the level of attainment of the SO could not be assessed thru institutionalized rubrics, but rather provide a holistic view of the percentage of students solving problems or responding to questions related to Civil Engineering courses and their respective Student Outcome. Results of the assessment process can be found at the end Section 4.A.4 of this criterion. The question nary for the comprehensive examination can be found in Appendix F.

4.A.2. The frequency with which these assessment processes are carried out

The full assessment cycle for the CE program takes one academic year, and is carried out every two years, with the exception of the interval 2014 - 2016 which has been yearly due to the ABET accreditation candidacy process (see Table 4-2). Since most courses at the College of Geosciences (FICT, acronym in Spanish) are taught once a year (I or II term), each SO is measured only once during the designated assessment year. Seven SOs are assessed during the 1st semester (May to September), and six during the 2nd term (October to March). As a constraint, since the year 2016, 7 SO's have been declared institutional for all the engineering programs at ESPOL. Institutional SO's performance are measured also once during the assessment year and at the designated term. At the end of each semester, all faculty members who were assigned to conduct an SO assessment during that semester must submit a portfolio, which consists of the following:

1. Student Outcome Assessment
   1.1. Student Outcome Descripction
   1.2. Assessment tool selected
   1.3. Description of the assessment tool
   1.4. Rubrics
   1.5. Results
   1.6. Evidences
2. Student Outcome Evaluation
   2.1. Results analysis
   2.2. Improvement recommendations

The assessment plan for the period 2014-2019 is shown in table 4-2:

Table 4-2 Assessment plan (2014-2019)

Term\Outcome	SO_a	SO_b	SO_c	SO_d	SO_e	SO_f	SO_g1	SO_g2	SO_h	SO_i	SO_j	SO_k	SO_l
2014-1	X		X	X			X	X				X	
2014-2		X			X	X			X	X	X		X
2015-1	X		X			X	X			X		X	X
2015-2		X		X	X			X	X		X		
2016-1	X		X			X	X			X		X	X
2016-2		X		X	X			X	X		X		
2017-1	X		X			X	X			X		X	X
2017-2		X		X	X			X	X		X		
2019-1	X		X			X	X			X		X	X
2019-1		X		X	X			X	X		X		

4.A.3. The expected level of attainment for each of the student outcomes

Within an assessment course, each student stands in one of four levels for each performance indicator (PI), as follows:

a) *Unsatisfactory*: Does not understand the concept being presented.
b) *Developing*: Partially understands the concept, but does not apply it properly, and thus fails to meet expectations.
c) *Satisfactory*: Understands the concept and applies it properly thereby meeting minimum expectations or requirements.
d) *Exemplary* – Exceeds expectations about understanding and application.

As student performances are quantified, CE faculty have established (in meetings) as a threshold that at least 70% of all students in a course should be either in the satisfactory or the exemplary levels. In general, this assessment has been performed in a direct way, by means of program rubrics (one per SO).

4.A.4. Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained

The results of assessment (detected problems or situations) are discussed among faculty members in order to produce an evaluation report and continuous improvement strategies (for each assessed SO) for the next assessment/evaluation period.

The following tables show the summarized results for each SO and their performance indicators (PI), the problems found (due to the formative/learning process and due to the assessment tools) with the level of attainment of each SO, and the recommended actions for improvement (suggested by CE faculty members).

SA_A: "Ability to apply knowledge of Mathematics, Sciences, and Civil Engineering."

According to the current academic flowchart, the following courses reported an assesment process of the SO:

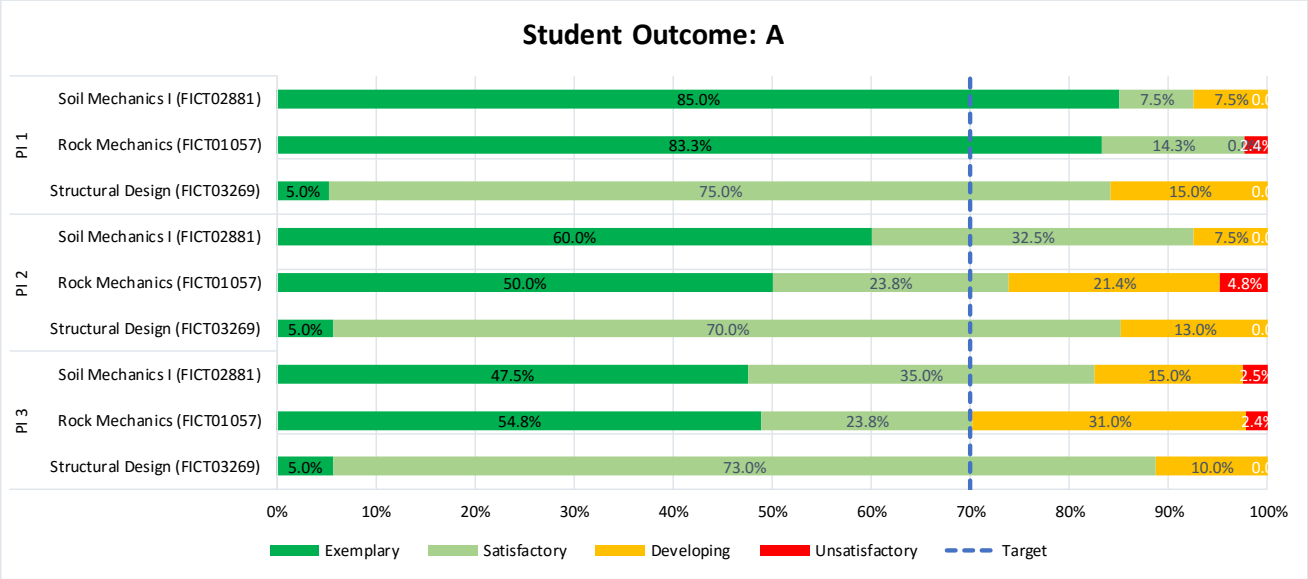
Course 1 (Starting) **Soil Mechanics I (FICT02881)**

Course 2 (Middle) **Rock Mechanics (FICT01057)**

Course 3 (Advanced) **Structural Design (FICT03269)**

Performance Indicator	Soil Mechanics I (FICT02881)	Rock Mechanics (FICT01057)	Structural Design (FICT03269)
1. Identifies variables graphically	Exam	Workshop	Exam
2. Relates the involved variables.	Exam	Exam	Exam
3. Calculates	Exam	Exam	Exam

I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

* It was identified that some students made mistakes in solving problems sets for not working in an organized way. This situation was observed specifically for the PI 3.

Due to assessment tools:

* Exam questions may not be the best way to collect information, due to time pressure (especially for the PI2 in the Rock Mechanics Course -FICT01057). Thus, it is suggested that measurements should be carried out using quizzes or workshops in which more working time can be allowed.

IV) Recommended improvement actions

For the learning (formative) process:

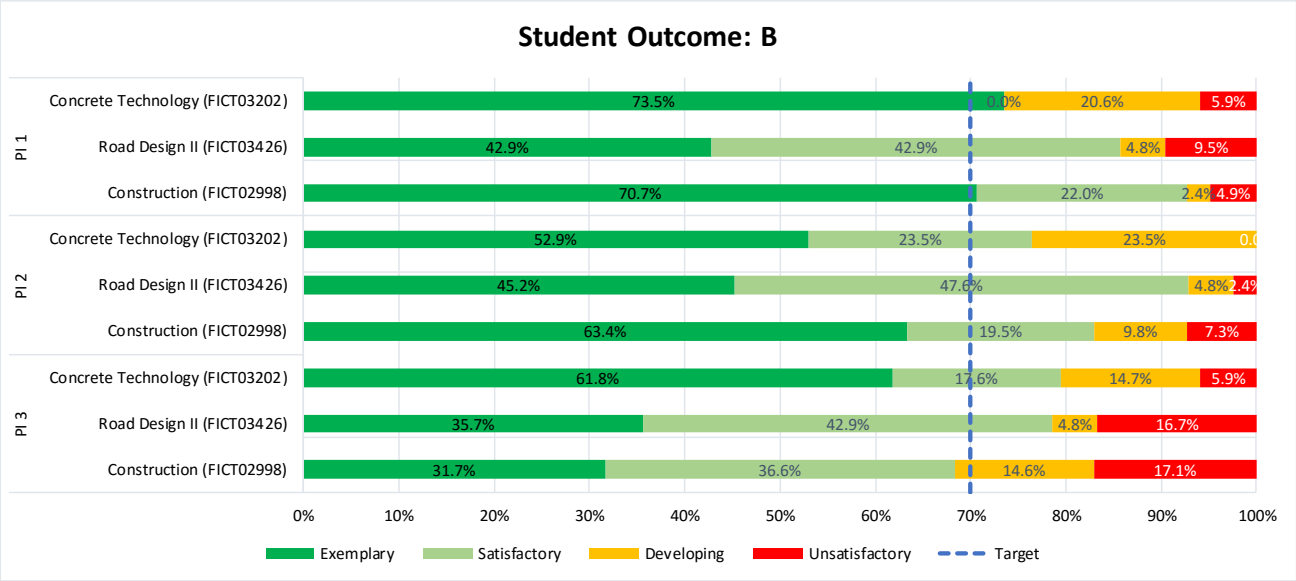
*It would be better to focus improvement on the PI 3. As indicated, calculation performance can be strengthen from the initial courses of the CE curriculum, separating the problem sets in different phases such as: data identication, problem statement (diagrams can greatly help), and finally computing an excercise in an step-by-step manner.

For the assessment tools:

*The SO Coordinator should hold a meeting with instructors measuring the same SO. At that meeting, an agreement can be reached to conduct measurements perhaps with the same activity (e.g. everyone with a project or a workshop). In addition, it is considered that it would be better to prefer other sort of assesment tools (e.g. homeworks, projects, workshops), rather than a final examination, as the pressure to deliver the exam on time may hamper an appropriate assessment of learning.

SO_B: Ability to design and conduct experiments, as well as to analyze and interpret data, related to Civil Engineering.	**Performance Indicator**	**Concrete Technology (FICT03202)**	**Road Design II (FICT03426)**	**Construction (FICT02998)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1. Sets up an experiment/ test/ project.	**Exam**	**Project**	**Exam**
Course 1 (Starting) **Concrete Technology (FICT03202)**	2. Runs the experiment or test.	**Exam**	**Project**	**Exam**
Course 2 (Middle) **Road Design II (FICT03426)**	3. Analyzes and interprets the results of the experiment or test.	**Oral Presentation**	**Project**	**Exam**
Course 3 (Advanced) **Construction (FICT02998)**				

I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):



II) General Overview: *The results obtained in the process show that the initial proposed goal was reached; since, in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (lerning) process:

* PI 3 seems to be still difficult to improve in students as they have the habit of following a lab procedure, collect data but lack of interpretation skills.

Due to assessment tools:

* The exam questions may not be the most appropiate to collect information. The course load that students undergo and the projects that they have to develop at the same time can influence the results obtained, due to time pressure or grade weight.

IV) Recommended improvement actions

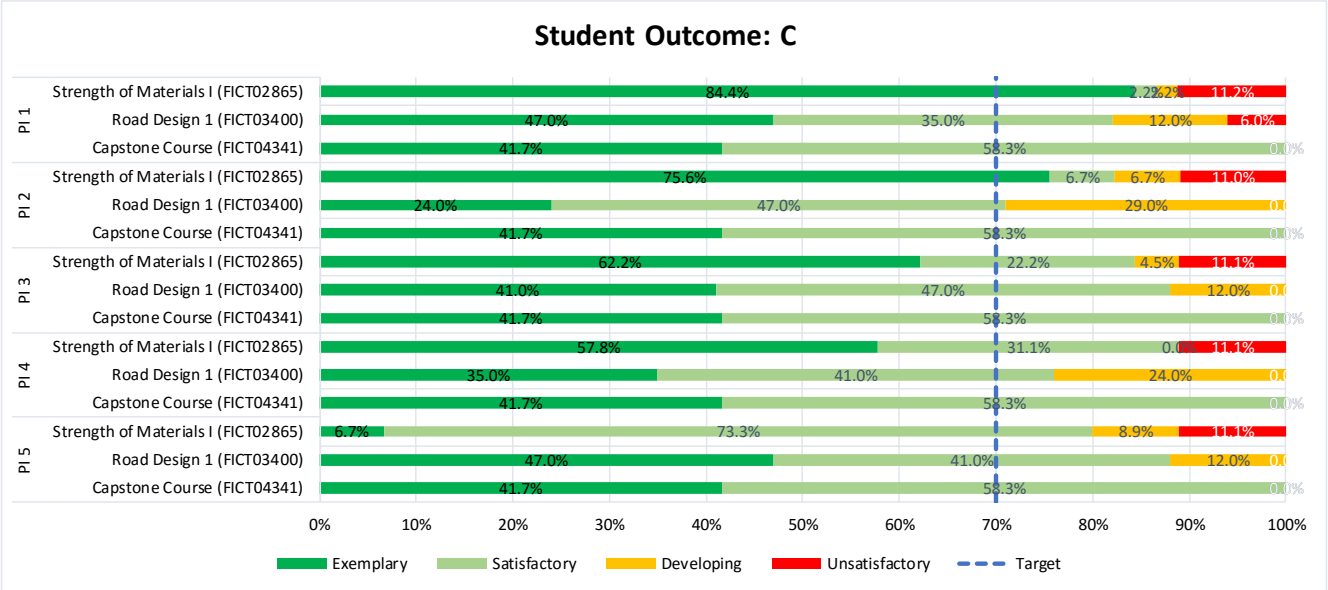
For the learning (formative) process:

* It is recommended to conduct more testing materials activities at the ESPOL laboratory facilities. New practical sessions are being planned in the Strength of Materials course (FICT02865), at the Mechanical Engineering College (FIMCP). In addtion, it has been suggested to increase the use of computer tools to analyze experimental results; hence, students can infer and relate with theory they have previously learned at the classroom. The newly opened Sanitary Engineering Lab, and the upcoming Hydraulics Lab will contribute greatly to the experimental learning process.

For the assessment tools:

*An agreement can be reached to conduct assessment of PI´s, among courses, with comparable activity (e.g. everyone with a project or a workshop). In addition, it is considered that it would be better to measure in any activity other than a final exam. (e.g. homeworks, projects, workshops), as the pressure to deliver the exam on time may divert the correct assessment of learning. It is recommended to review the SOs rubric .

SO_C: "An ability to design systems, components or processes related to civil engineering to meet desired needs within realistic constraints such as economic, environmentla, social, political, ethical, manufacturability and sustainability	**Performance Indicator**	**Strength of Materials I (FICT02865)**	**Road Design 1 (FICT03400)**	**Capstone Course (FICT04341)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1: Dimensions a system, component or element	**Project**	**Exam**	**Project**
Course 1 (Starting) **Strength of Materials I (FICT02865)**	2: Refines the dimensions of a system, component or element	**Project**	**Exam**	**Project**
Course 2 (Middle) **Road Design 1 (FICT03400)**	3: Justifies the selected option, compared to others, considering economic, ethical, moral, social and environmental issues.	**Project**	**Project**	**Project**
Course 3 (Advanced) **Capstone Course (FICT04341)**	4: Manages the selected option by looking for inputs to formalize the design.	**Project**	**Project**	**Project**
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	5. Designs the selected option	**Project**	**Workshop**	**Project**



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

*Students should manage better their workload schedule, in order to submit assignments on time. In this way, instructors can have time to process the collected assignments, and focus more to enhance the design learning process. This occurs usually at the beginning courses from CE curriculum.

*A positive aspect observed during the measurement of the Road Design 1 course (FICT03400), Hydraulics (FICT0915), Structural Design (FICT03269), among others, is the use of real data and constraints during the designing process.

Due to assessment tools:

* When students investigate about the availability of materials in Guayaquil, materials suppliers usually refuse to provide access to information, as identified in the Stregth of Materials I course (FICT02665). If this situation is not tackled properly, the PI 4 attainment may be hampered in the future. However, results reach the proposed target, leading to the conclusion that students solve the problem, despite the constraint.

* In the case of PI2, measured in the Road Design 1 course (FICT03400) with an exam question, this assessment tool perhaps caused a lower performance on the detailing process of the design, due to time constraints.

IV) Recommended improvement actions

For the learning (formative) process:

* The CE program should support instructors who assign real case problems usign project data, becoming a link with CE companies. Thus, these firms can provide all facilities for student development, and more importantly, assist in their design learning process.

For the assessment tools:

***The rubric of student outcomes should not be socialized with students, but applied directly. Socializing rubrics right before a SO assesment can cause result in potential bias.

*Especially in the Capstone Course, the evidence collection work should not be left to the last minute, but be elaborated during the semester.

* Exam questions should be utilized at most for one of the PI's, specially the ones measuring basic skills or abilites. In additon, two PIs should not be measured simultaneously during and examination or a quiz.

SO_D: "Ability to work as part of a multidisciplinary team"

According to the current academic flowchart, the following courses reported an assesment process of the SO:

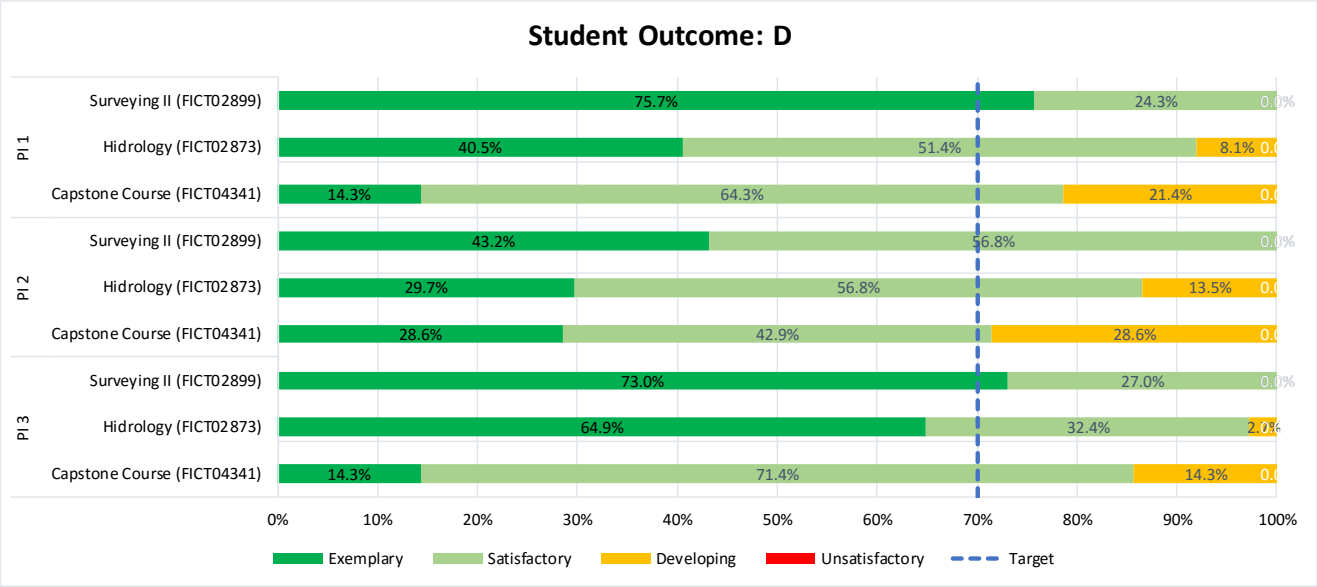
Course 1 (Starting) **Surveying II (FICT02899)**

Course 2 (Middle) **Hidrology (FICT02873)**

Course 3 (Advanced) **Capstone Course (FICT04341)**

Performance Indicator	Surveying II (FICT02899)	Hidrology (FICT02873)	Capstone Course (FICT04341)
1. Contributes effectively to the team goals.	Project	Workshop	Project
2. Comunicates effectively with the rest of the team.	Project	Workshop	Project
3. Respects other team members' opinions.	Project	Workshop	Project

I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

* There is a limited, although highly technological, number of equipments provided by the FICT College, which causes that sometimes the working groups are larger in number than the optimal, in order to accurately assess the performance of each student.
* There were external factors that prevented a better performance of students, such as the availabiliyt to set up meetings and communication between group members.

Due to assessment tools:

*Most groups were formed by member affinity and not by the instructor choice (Surveying II - FICT02899). The harmony and atmosphere in each group, influenced the outcome results.
*In the Capstone Course (FICT04341), perhaps a lack of constant monitoring could have influenced on the results. In additon, the number of group members (2) prevented more interaction, or a better assessment for this SO, given the multidisciplinary nature of Civil Engineering.

IV) Recommended improvement actions

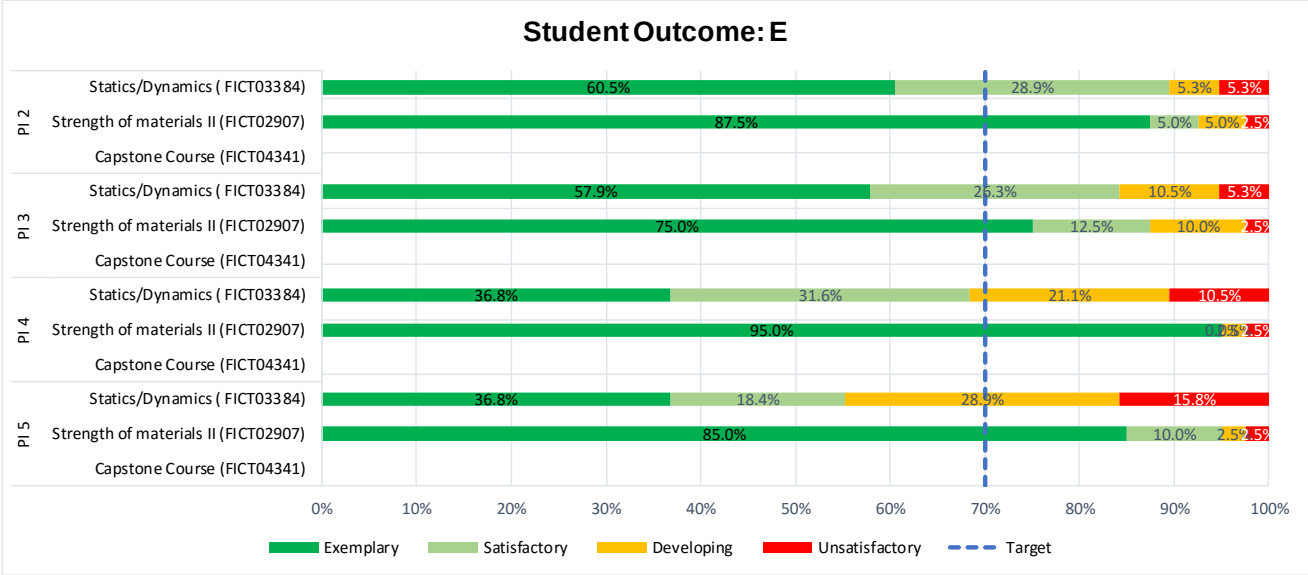
For the learning (formative) process:

*Is ideal for the working groups to write minutes of the meetings they held, where besides assistance, they shall register agreements, progress, tasks and purposes for the following meetings. This strategy will develop in students a responsibility sense to fulfill commitments with their work group. It is recommended that students use TICs as tools to hold meetings when meeting in person is not possible, for example videoconferences.

For the assessment tools:

*The suggested minutes will serve to monitor the activities development, being important also to hold meetings with the leaders of the groups to report the performance of each group member. This meetings should be on a weekly-basis to detect and record students who do not demonstrate commitment to the group. It would be interesting to evaluate a sample forming groups by the choice of the teacher; and not by the affinity that exists between students (simulating a real-life situation). Hence, students surely will leave their "comfort zone", and it will be able to compare improvement results against the previous ones. Indeed, this monitoring will demand more time from the instructor in charge, and should be included in his/her yearly planned workload. Another option is to use virtual meeting tools for the follow-up process.

RA_E (disciplinar): "Ability to identify, formulate and solve problems originating in different areas of civil "	Performance Indicator	Statics/Dynamics (FICT03384)	Strength of materials II (FICT02907)	Capstone Course (FICT04341)
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1. Identifies variables and parameters of the problem.	Quiz	Exam	
Course 1 (Starting) Statics/Dynamics (FICT03384)	2. Distinguishes restrictions or problem constraints.	Quiz	Exam	
Course 2 (Middle) Strength of materials II (FICT02907)	3. Selects a methodology.	Quiz	Exam	
Course 3 (Advanced) Capstone Course (FICT04341)	4. Solves the problem.	Quiz	Exam	
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	5. Evaluates the found solution.	Quiz	Exam	



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (lerning) process:

• In general, introductory courses in our curriculum, have been traditionally focused on finding a numerical solution, rather than explaining or evaluating a found solution. In this context, an important percentage of students can arrive well to find a solution (PI 1 to 4), but not all can comment / evaluate the found solution (PI5).

Due to assessment tools:

A decrease is observed in the percentages as we advance on the performance indicators, which effectively confirms that the measurement tool used may not be appropriate, in terms of time constraints. In the Strength of Materials II (FICT02907) course the unsatisfactory percentages is low; however, the assessment tool could have prevented from better results.

IV) Recommended improvement actions

For the learning (formative) process:

• It is necessary to socialize the rubric with students for formation purposes, continuously, during the whole academic term. Perhaps devoting several weeks to focus on each PI. Special attention should be addressed to the PI5 to educate students to properly evaluate a solution, and not just to arrive to a mere result. In this regard, new basic courses on Problem Solving (I and II) have been introduced at ESPOL, from 2016 onwards.

• It is required to increase the number of problem solving workshops or tutorials with the teaching assistant; also, during lectures.

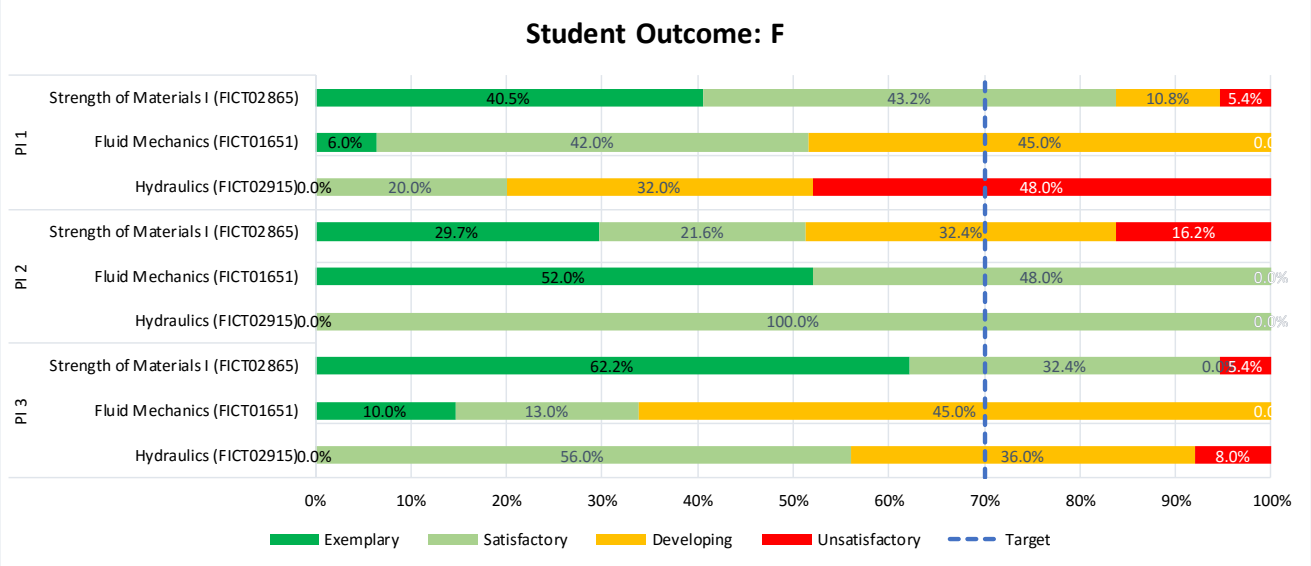
For the assessment tools:

• For assessment purposes, it is recommended not to share the rubric to students to prevent biases on the assessment.

• Exams or quizzes should be used carefully for assessment, perhaps for at most one PIs, and avoiding measuring 2 or more PIs simultaneously during one quiz or exam (due to time pressure). Projects should be preferred to assess some PIs; but not all, because sometimes group performance may mislead individual student performance.

SO_F: "Ability to comprehend ethical and professional responsability."	**Performance Indicator**	**Strength of Materials I (FICT02865)**	**Fluid Mechanics (FICT01651)**	**Hydraulics (FICT02915)**
According to the current academic flowchart, the following courses reported an assesment process of the SO: Course 1 (Starting) **Strength of Materials I (FICT02865)** Course 2 (Middle) **Fluid Mechanics (FICT01651)** Course 3 (Advanced) **Hydraulics (FICT02915)**	1. Recognizes ethical dilemmas and the involved parties	**Workshop**	**Forum participation / Lab report**	**Project**
	2. Demonstrates honesty and integrity in the academic context.	**Workshop**	**Forum participation / Lab report**	**Project**
	3. Shows ethical behavior in the professional context.	**Workshop**	**Forum participation / Lab report**	**Project**

I) Outcome results when measuring each performance e indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show, in average, that 64% of the students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

***** In in two cases it can be concluded that students undertake a partial analysis of ethic problems (Fluid Mechanics -FICT01651; and Hydraulics -FICT02951). While students recognize the ethical dilemma, they still do not distinguish the involved parts, either directly or indirectly. This was noted especially at higher levels of the program in disciplinary courses.

Due to assessment tools:

* In the Strength of Materiasl course (FICT02865), the SO rubric was shared with the student prior to the assessment. This could have strongly influenced the high student performance (for the 3 PIs).

IV) Recommended improvement actions

For the learning (formative) process:

*It is recommended to involve students in real cases related to the profession, evaluating several aspects, such as technical, social, environmental, etc.

*In order to foster future professional development and responsibility, students will be encourage to be part of young professional associations.

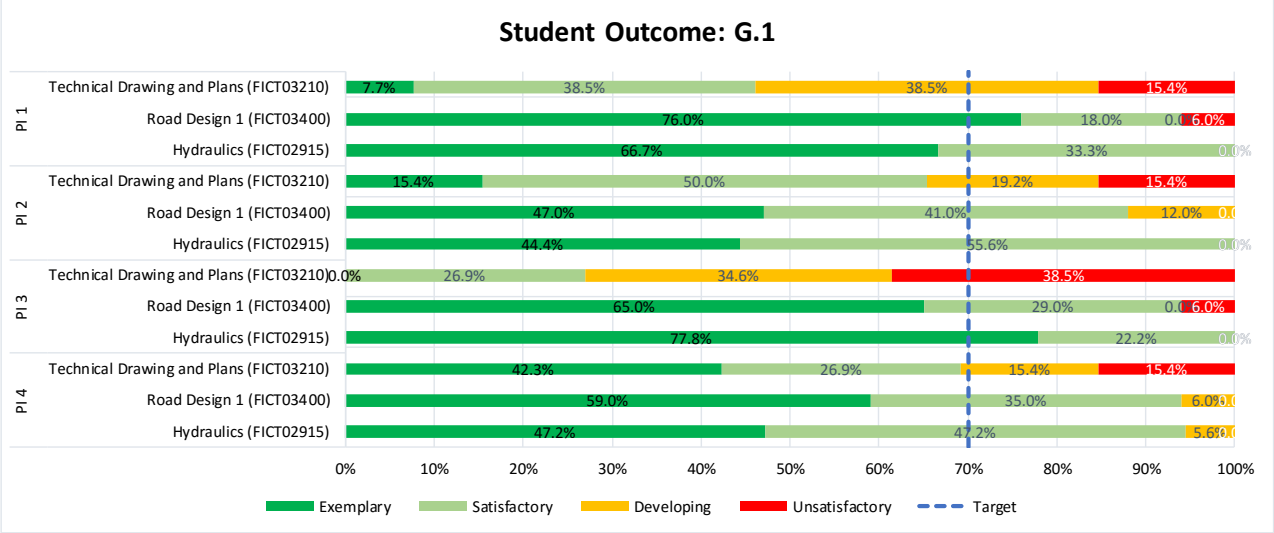
For the assessment tools:

*Given the nature of this SO, its assesment can be subjecto to perception or external bias so it is necessary an advice and consensus for the measurement tool prior to the implementation, between the instructor in charge.

*Specifically for assessment purposes, a good practice is to keep the SO rubric away from students, to avoid biases or confusion when checking potential failure causes.

SO_G.1: "Ability to communicate effectively in Spanish''	**Performance Indicator**	**Technical Drawing and Plans (FICT03210)**	**Road Design 1 (FICT03400)**	**Hydraulics (FICT02915)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1. Order: Develops ideas in order/Transitions between ideas/Plans the strcuture according to time and extension	**Research assigment**	**Research assigment**	**Project**
Course 1 (Starting) **Technical Drawing and Plans (FICT03210)**	2. Language: Language is appropiate for the audience. Appropriate and precise.	**Research assigment**	**Research assigment**	**Project**
Course 2 (Middle) **Road Design 1 (FICT03400)**	3. Argumentation: Supports ideas/Answers to questions thru evidence analysis. Uses verified and relevant sources.	**Research assigment**	**Research assigment**	**Project**
Course 3 (Advanced) **Hydraulics (FICT02915)**	4. Diction (Oral Communication): Pronuntiation. Volume / Intensity. Speed. Visual	**Research assigment**	**Research assigment**	**Project**

I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

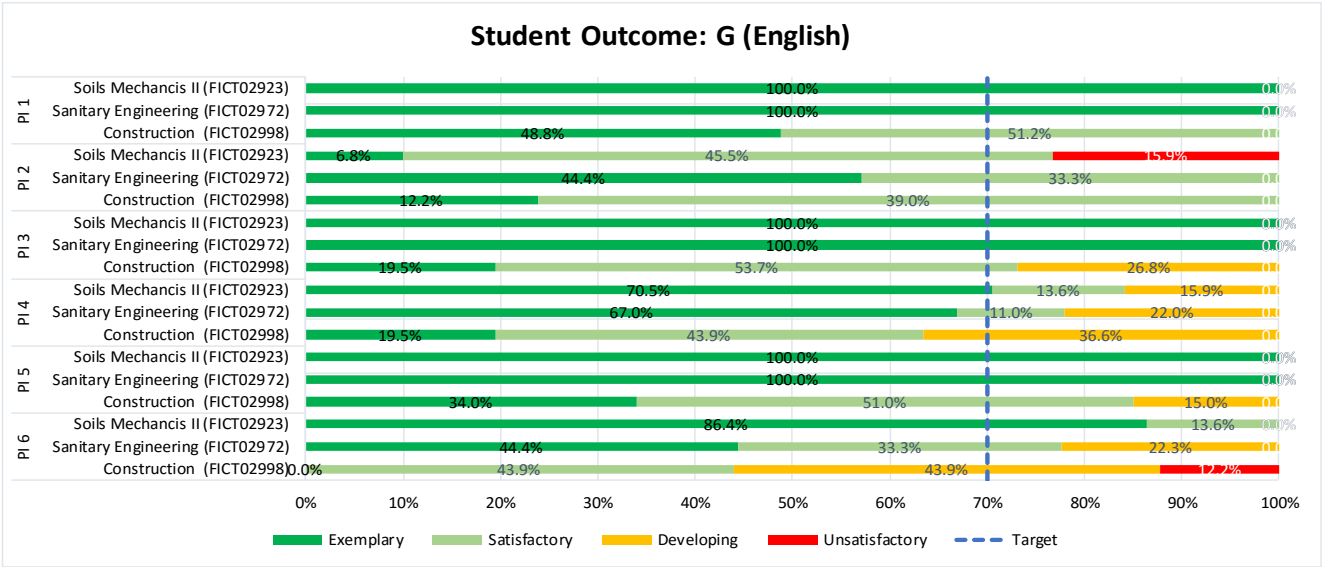
*One of the shortcomings found in the training process, specifically in the courses from the beginning of the CE curriculum, is that students have little prior experience in developing scientific writing skills, argumentation and references management including receiving feedback. According to the SO assessment, it is common that students use limited and repetitive vocabulary for the expression of ideas (cacophony), something commonly observed during th e Basic Sciences courses.
*Also, shortcomings are found in paraphrasing and using quotations and other various literature sources.
*Another problem observed lies in the non-periodic review of the written works to guide the drafting and information included; this failure occurred in 1 out of 3 assessed courses (Technical Drawing and Plans -FICT03210).
*In oral presentations, it is common sometimes to find insecurity and nervousness when delivering a speech in front of an audience.

Due to assessment tools:
N.A.

IV) Recommended improvement actions

For the learning (formative) process:
* To increase the elaboration of technical reports or articles to encourage the development of written communication skills. Clearly, the process of preparation of this work should be guided continuously.
*Oral presentations will be frequent during disciplinary courses. Thus, communication abilities and skills can be tracked (eg, diction, body language, interaction with the audience).
For the assessment tools:
N.A.

SO_G.2: "Ability to communicate in English"	Performance Indicator	Soils Mechancis II (FICT02923)	Sanitary Engineering (FICT02972)	Construction (FICT02998)
According to the current academic flowchart, the following courses reported an assesment process of the SO:	Criterion 1: Utilizes the rules / template, specified by the lecturer	Project	Project	Technical Paper Summary
Course 1 (Starting) **Soils Mechancis II (FICT02923)**	Criterion 2: Writes and speaks without grammar mistakes	Project	Project	Technical Paper Summary
Course 2 (Middle) **Sanitary Engineering (FICT02972)**	Criterion 3: Balances the document amongst text, imagery and tables	Project	Project	Technical Paper Summary
Course 3 (Advanced) **Construction (FICT02998)**	Criterion 4: Cites data sources and paraphrases relevant information	Project	Project	Technical Paper Summary
	Criterion 5: Develops the document with coherence and right sequence	Project	Project	Technical Paper Summary
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	Criterion 6: Synthesizes.	Project	Project	Technical Paper Summary



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:
Some students still lack of formal english writing skills. Their education backgrounds also show that although most of students have decent english communication skills, an important percentage can not elaborate properly in written or spoken English.

Due to assessment tools:
In the case of Soils Mechanics II (FICT02923) where students begin to write in English (and still taking basic English courses), it can be seen that student develop in general acceptably according to instructions given in class. In Sanitary Engineering II (FICT02972), it can be seen that students show difficulties in working in English, although they use citations, their writing style miss connectors and fluency, and limits to basic language sentences. In the Construction (FICT029998) corse it was identified that students meet basic crieteria but some fail in providing synthesis.

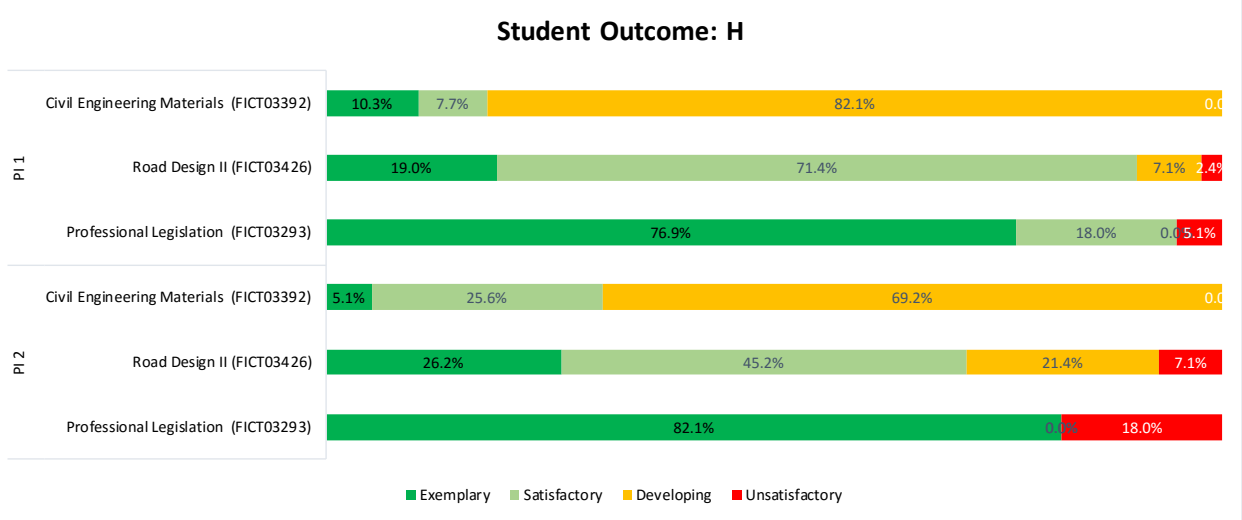
IV) Recommended improvement actions:

For the learning (formative) process:
It is recommended to assign more reading assignments in English in, hopefully, most of the professional courses. This is a good way to strengthen and develop gramatical skills. Thus, students will perceive the basic skills they learned are being used for CE applications. Some tools can be provided to students to enhance their gramatical skills, for example references for common grammar mistakes and databases of the most used verbs. Currently, the CELEX (Foreign Language Center at ESPOL) is providing continuous assistance to students.

For the assessment tools:
The rubric for this SO is being updated to match the g.1 SO (at institutional level).

SO_H: "Ability to understand the impact of Civil Engineering solutions, in a social, environmental, economic and social context"		**Performance Indicator**	**Civil Engineering Materials (FICT03392)**	**Road Design II (FICT03426)**	**Professional Legislation (FICT03293)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:		1. Identifies the impacts of civil engineering solution, under several contexts.	**Quiz**	**Project**	**Worshop**
Course 1 (Starting)	**Civil Engineering Materials (FICT03392)**	2. Analyses possible scenarios due to the application of the CE solution, under several contexts.	**Quiz**	**Project**	**Workshop**
Course 2 (Middle)	**Road Design II (FICT03426)**				
Course 3 (Advanced)	**Professional Legislation (FICT03293)**				

I) Outcome results when measuring each performance e indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show, in average, that 64.6% of the students are in the "Exemplary" and "Satisfactory" levels. However, it must be stated that, as students progress throughout the CE curriculum, they are improving their performance (in average, 79% are in the two best levels of performance in the Professional Legislation course - FICT03293, at the end of the CE academic flowchart).

III) Common problems found:

Due to the formative (lerning) process:

* The Civil Engineering Materials course (FICT03392) reports low performance, being at the beginning of the CE professional curriculum. The assessed target requires students with longer formative periods to acquire the necessary skills that are being evaluated.
* The Road Design II course (FICT03426) reports that students sometimes have problems using some computer tools for proper learning, raise awareness about impacts of design solutions, and thus help improving their engineering criteria.

Due to assessment tools:

IV) Recommended improvement actions

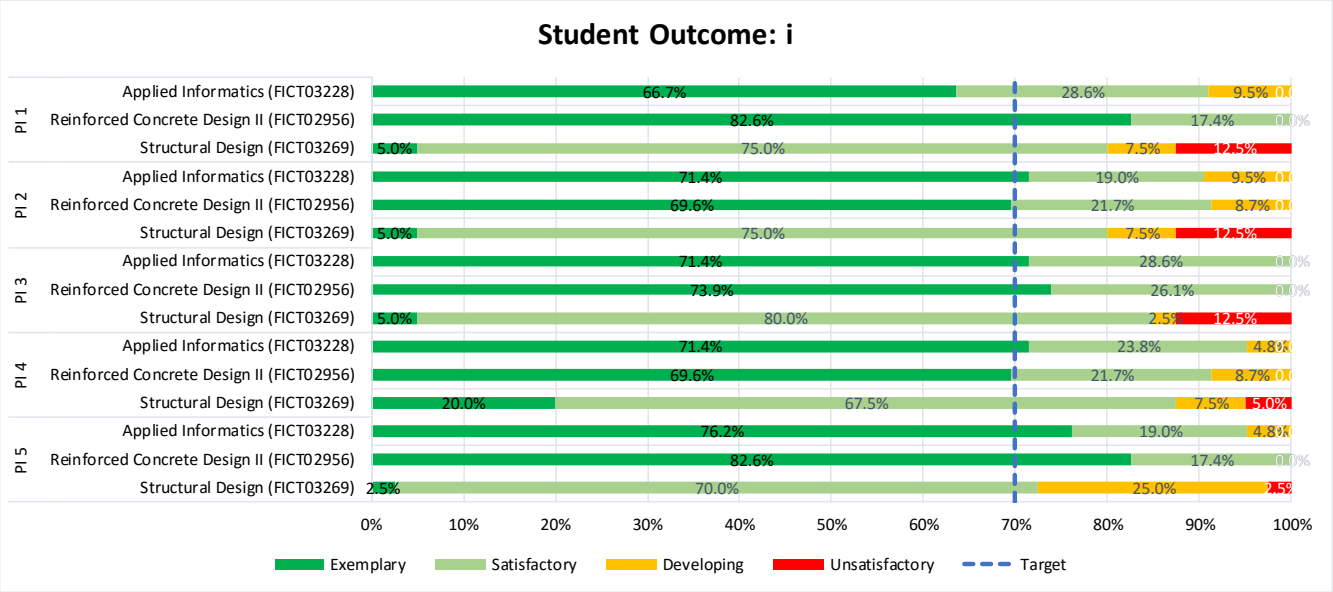
For the learning (formative) process:

* More comparative analyses will be raised in lectures (different courses) about the impact of engineering solutions. In this context, support form the CE program is required, to get acces to real data or (pre)feasibility studies about real-life situations, where different options, or scenarios take place.
* The use of computing tools will be promoted in several courses, for the students to get in touch with scenario analyses; but most importantly, how to interpret software results, in a proper engineering manner.

For the assessment tools:

* In order to improve the assessment process, a consensus will be reached among teachers of the courses which have been selected to measure this SO, with the aim of defining the most appropriate instruments and measurement tools (What kind of exam question?, What part of the project?, etc.). that will allow comparative analysis. The purpose is to remove subjectivities or external factors that could affect the assessment process.

SO_i: "A recognition of the need for, and and abiility to engage in life-long learning"	**Performance Indicator**	**Applied Informatics (FICT03228)**	**Reinforced Concrete Design II (FICT02956)**	**Structural Design (FICT03269)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1. Identifies what he/she needs to learn	Quiz	Project	Project
Course 1 (Starting) **Applied Informatics (FICT03228)**	2. Learns independently	Quiz	Project	Project
Course 2 (Middle) **Reinforced Concrete Design II (FICT02956)**	3. Uses various bibliographic sources and information technologies	Quiz	Project	Project
Course 3 (Advanced) **Structural Design (FICT03269)**	4. Analyzes the validity and reliability of the information gathered from consulted	Quiz	Project	Project
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	5. Evaluates how he/she has learned	Quiz	Project	Project



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

* In general, during courses at the beginning and the middle of the CE curriculum (eg. Applied Informatics-FICT03228, Reinforced Concrete Design II-FICT02956), students use tools already available, they usually do it independently, discriminating erroneous or incomplete information.
* In courses at the end of the CE curriculum program (eg. Structural Design - FICT03269), it can be seen a general enthusiasm towards research subjects beyond what is covered in class, whichs complements the learning process.
*An apparent "overload" work could have prevented students at the satisfactory to reach the exemplary level.

Due to assessment tools:

*In the Structural Design course (FICT03269) the rubric was shared with the students, which could have affected the SO assesment results (all the PIs exceeded the 70% set as the target, but the assement of this course was hardly higher more than the target, as it happened in the other two courses of the program).

IV) Recommended improvement actions

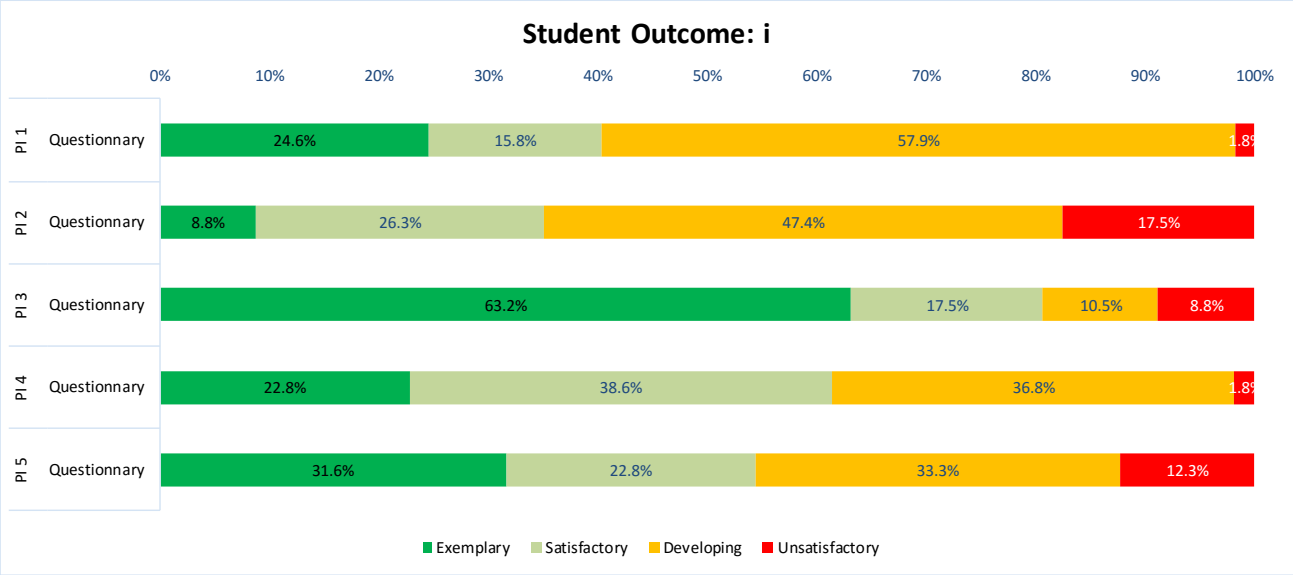
For the learning (formative) process:

*Plan more work with research-critical component, where students can work individually, in groups, and during lectures (eg. through oral presentations). It will be emphasized that information sources should not be only the library or the internet, but also expert judgment from professionals, interviews, and case studies. Students will be encouraged to organize their study, to prevent "overloads" in the last weeks close to the week examinations. Similarly, instructors must assign projects with sufficient time to be developed and monitored along the course (preferably on a weekly basis).

For the assessment tools:

* When measuring the SOs, avoid announcing the process or rubrics, to avoid skew the results, and thus ensure complete reliability on the assesment, and detect potential problems due to formative processes more clearly.

SO_i: "A recognition of the need for, and and abiility to engage in life-long learning"	**Performance Indicator**	**SO_i Senior Survey**
As an additional Assessment tool a Questionnary was sent to Senior students for performance evaluation of this Student Outcome. A sample of 57 students responded. Senior Survey (Advanced) **SO_i Senior Survey**	1. Identifies what him/her need to learn	**Questionnary**
	2. Learns independently	**Questionnary**
	3. Uses various bibliographic sources and information technologies	**Questionnary**
	4. Analyze validity and reliability of the information gatheres from the consulted	**Questionnary**
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	5. Evaluate themselves how they have learned	**Questionnary**



II) General Overview: According to what students chose on the survey in most of the Performance Indicators, in general, they are not attaining the desired performance goal. It has to be noted that the questionnary is an indirect way to assess this Student Outcome.

III) Common problems found:

Due to the formative (learning) process:

*Most students partially identify what they are required to know and what is useful for their knowledge (57.9%)

*Few (17.5%) have not taken continuous education courses within the last two years.

*Most of them use good references (80.7%) when they independently seek for education sources and made valuable conclussions (61.4%) about that information.

Due to assessment tools:

The questionnarie objective to assess attaintment of performance indicators perhaps was hindered by the opinion of the respondents (students).

IV) Recommended improvement actions

For the learning (formative) process:

*Students should be encouraged to educate themselves beyond traditional education within the curriculum on additional skills.

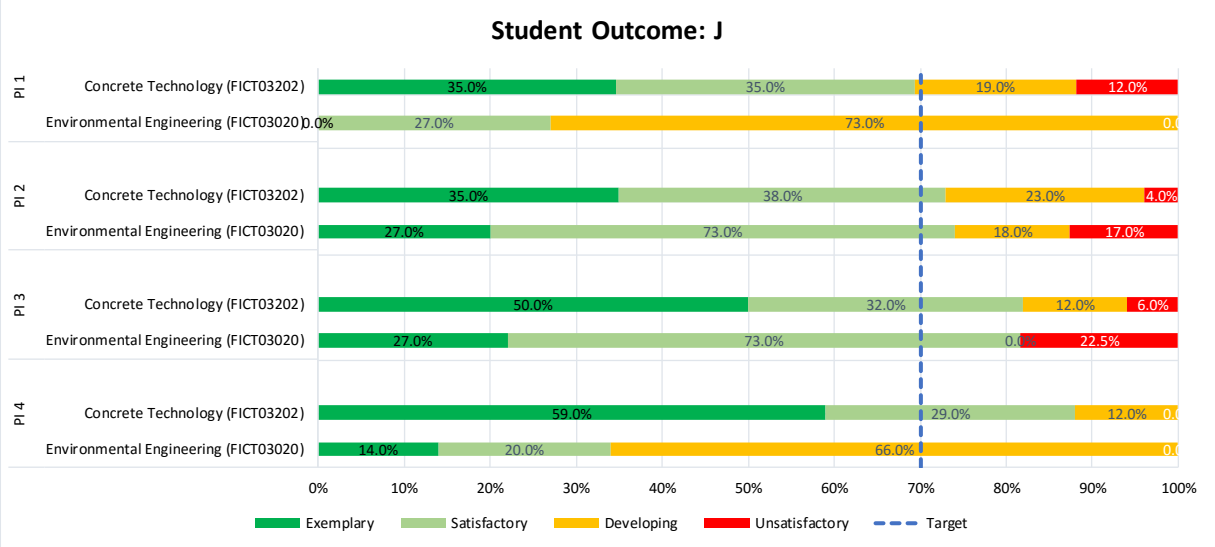
*Good examples pf this are certifications, continuous education and MOOC courses.

For the assessment tools:

*Further study of the reliability of the questionnaire results is required.

SO_J: "Knowledge of contemprary issues"		**Performance Indicator**	**Concrete Technology (FICT03202)**	**Environmental Engineering (FICT03020)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:		1. Shows interest in keeping up with relevant current events	**Homework**	**Research Report**
Course 1 (Starting)	**Concrete Technology (FICT03202)**	2. Interprets relevant current affairs	**Exam**	**Research Report**
Course 2 (Advanced)	**Environmental Engineering (FICT03020)**	3. Relates the current topic to his/her program	**Homework**	**Research Report**
		4. Evaluates the impact of a current event by analyzing scenarios in different time frames	**Exam**	**Research Report**

I) Outcome results when measuring each performance e indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (lerning) process:
In general terms, in the era of communications, students are in contact with numerous information and news sources. But usually they can not discriminate between useful contemporary information related to their field of study. Perhaps they are focused on unproductive or vain sources. This can be seen in the results from Criterion 1. Nevertheless, students show skills to intepret revelant current issues an relate them to theri field, once they are presented or identified. Finally, CE participants show poor performance on evaluating the impacts in the long term, focusing only on short term effects.

Due to assessment tools:
Assessment tools could be improved, specially during the early assessment course (Concrete Technology, FICT03202), avoiding when possible, time pressure tools such as exams.

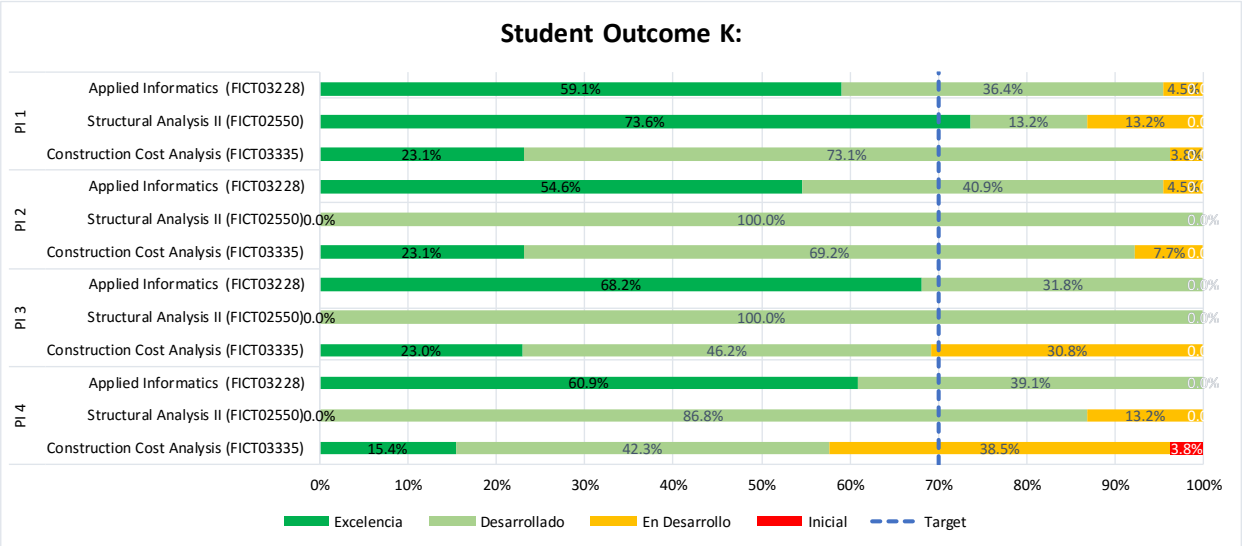
IV) Recommended improvement actions

For the learning (formative) process:
Present real case scenarios related to problems affecting the Civil Engineering profession and Construction Industry (i.e. Anthropogenic Environmental Disasters used in the Environmental Engineering course - FICT03020) is a suitable way to propel the knowledge of contemporary issues.
*Instruct the CE students to improve their time management, so they can handle the workload of projects, assignments and evaluations. instructors will remind students that assignments submitted at the last moment do not lead to the proper attainment, neither for contemporary issues, nor for other student outcomes.
Finally, students will be encouraged to read news, at least on a daily basis, to be in touch with what is going on in their local, regional environment, or worldwide.

For the assessment tools:
* If exams are to be used for criteria 2 and 4 (but not simultaneously), it is suggested that the contemporary issue had been previously defined.

SO_K: "An ability to use the techniques, skills, and modern engineering tools necessary for Civil Engineering practice"		**Performance Indicator**	**Applied Informatics (FICT03228)**	**Structural Analysis II (FICT02550)**	**Construction Cost Analysis (FICT03335)**
According to the current academic flowchart, the following courses reported an assesment process of the SO:		1. Identifies the input required for the application of techniques and tools to be used. (data / concepts / variables / units)	**Project**	**Project**	**Exam**
Course 1 (Starting)	**Applied Informatics (FICT03228)**	2. Applies techiques, methods or tools available to solve a specific design problem.	**Project**	**Project**	**Exam**
Course 2 (Middle)	**Structural Analysis II (FICT02550)**	3. Compares possible options for solving a problem, using the same or different techniques and tools.	**Project**	**Project**	**Exam**
Course 3 (Advanced)	**Construction Cost Analysis (FICT03335)**	4. Evaluates the results of the technique, applied method or tool.	**Project**	**Project**	**Exam**

I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):



II) General Overview: The results obtained in the process show that the initial proposed goal was reached, because in average, more than 70% of students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

* The Construction Cost Analysis course (FICT03335) reports problems when reaching students, because it is a course currently listed as a Free Eelective course from several programs other than the Civil Engineering program at ESPOL.

*It has further been found that students, when using a technique or a software, tend to solve a problem and finding a single solution, without comparing alternatives or evaluating results.

*The Applied Informatics (FICT03228) course reports that students are required to know "more GIS tools" for the proper learning.

Due to assessment tools:

*The PI 4 that measures the evaluation of results, there is evidence that Structural Analysis II course (FICT02550), and the Applied Informatics course (FICT03228) reached the target, while Construction Cost Analysis (FICT03335) course 38% of students reached the target. One cause may be that the assessment tool used, as developing an Analysis Unit Price, brings a unique solution that does not allow to easily compare alternatives or evaluate other options. Another reason for the high percentage in the first two courses is that the SO rubrics might have been shared with the students.

IV) Recommended improvement actions

For the learning (formative) process:

*In the teaching-learning process it is recommended to emphasize the comparison of alternatives (scenarios) and evaluate the results from the use of techniques and tools for the practice of Civil Engineering, not only the mere application of a software, for instance.

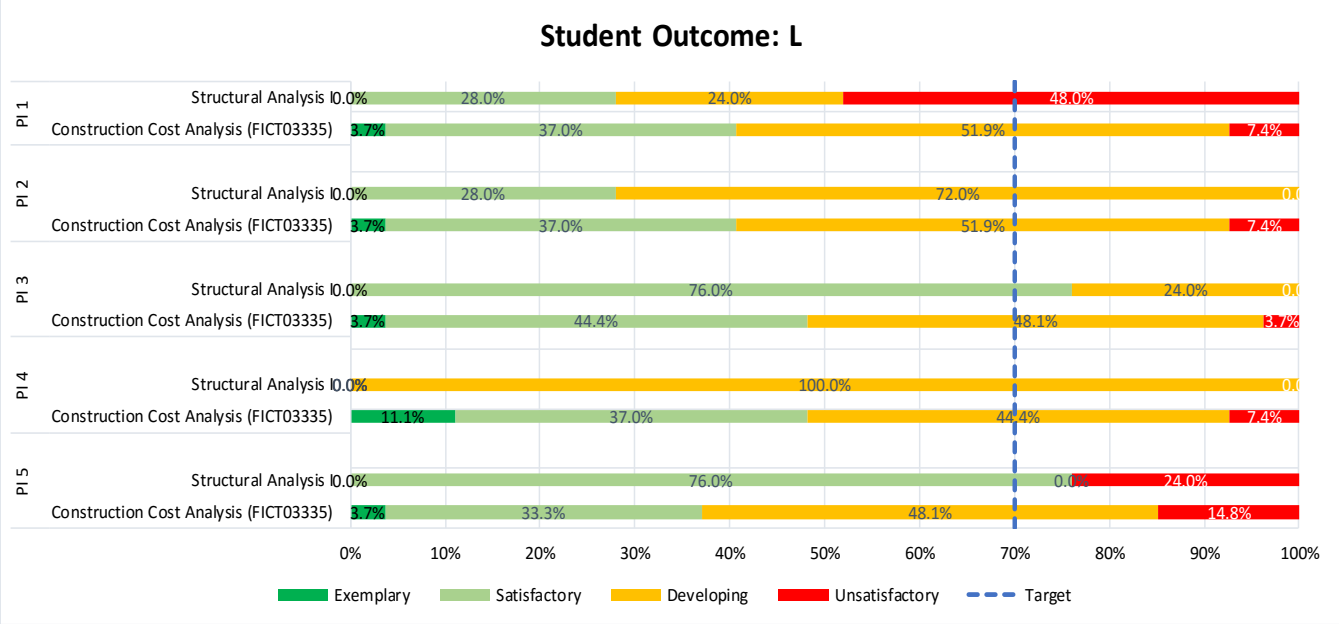
* It will not be possible in the future for students coming from other programs to be enrolled in CE Advanced Professional courses via free registration. Any application will be firstly approved by the CE Coordinator.

For the assessment tools:

* An improved perspective, including the analysis of scenarios will be included in assessment courses.

* It is recommended for courses assessing the same SO to define common assessment tools in order to make them comparable.

SO_L: "A recognition of the need for entrepreneurship and te abilities to become an entrepreneur"	Performance Indicator	Structural Analysis I (FICT02592)	Construction Cost Analysis (FICT03335)
According to the current academic flowchart, the following courses reported an assesment process of the SO:	1. Develops value proposals.	Project	Homework
Course 1 (Middle) **Structural Analysis I (FICT02592)**	2. Proposes added-value solutions.	Project	Homework
Course 2 (Advanced) **Construction Cost Analysis (FICT03335)**	3. Manages problems (during execution).	Project	Homework
	4. Develops contacts and networking	Project	Homework
I) Outcome results when measuring each performance indicator (PI), comparing to the target (70%):	5. Delivers products / services of high quality.	Project	Homework



II) General Overview: The results obtained in the process show, in average, that 42.3 % of the students are in the "Exemplary" and "Satisfactory" levels.

III) Common problems found:

Due to the formative (learning) process:

* This is probably the most challenging SO to conduct assessment for the CE students. Entrepreneruship skills are not among their best characteristics. It is hard for them to develop value propositions (PI 1). There is a resistance to leave their confort zone and propose value-added solutions (PI 2). Activities such as calling materials providers or interview experts pose a problem for students, which can not addequately develop network skills (PI4). In the other hand, PI3 related to conflict management shows better performance as well as PI 5, as students from our college are good and working with problems and delivering a final product.

Due to assessment tools:

* It has been emphasized that good assessment tools for this SO are those other than exams, in this case working with projects seems to be a good choice followed by homework assignments.

IV) Recommended improvement actions

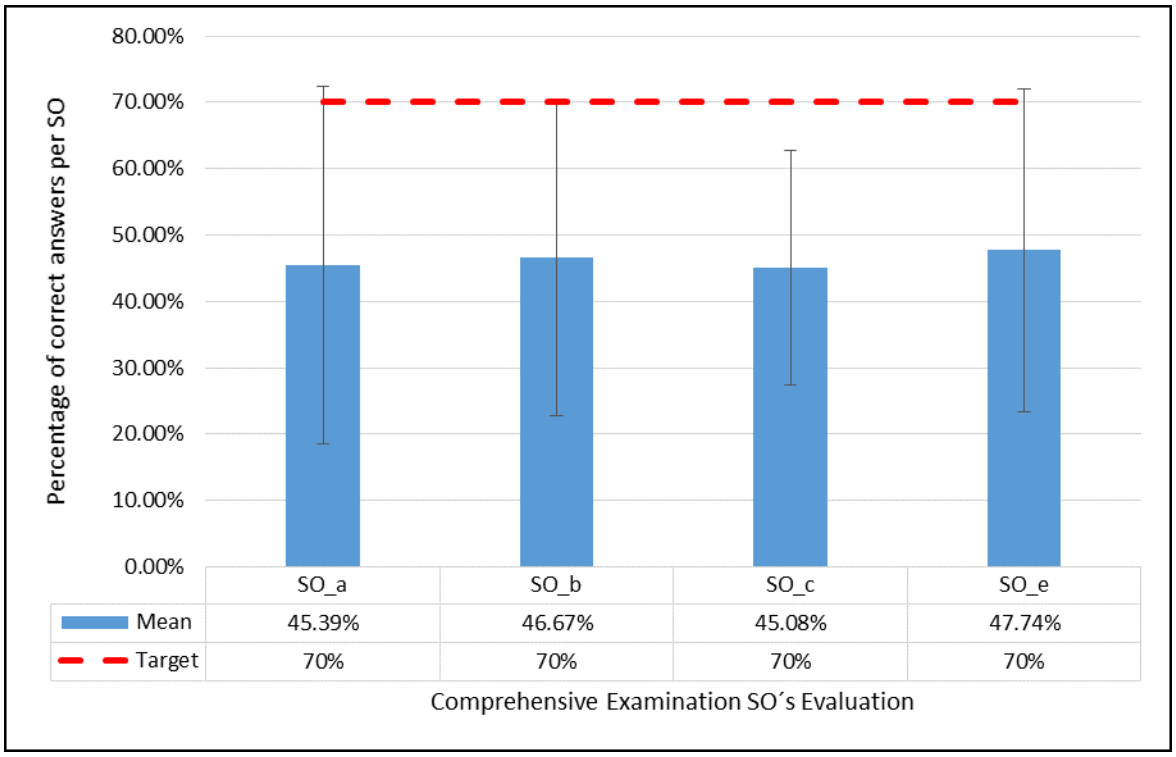
For the learning (formative) process:

* Students will be continously guided through the formative courses to develop entrepreneurship skills such as proactivity, creativity and persuasiveness, as well as conflict solving. Similarly, it will be emphasized with students the sense of the entrepreneruship spirit of their future profession and how the success of a project can depend on it. Beginning the following academic year at least two courses will support the formative process in entrepreneurship, proposed courses are Surveying I (FICT02725) and Soils Mechanics I (FICT02881), apart of the institutional course of Entrepreneurship and Technological Innovation (ICHE03541), which is taught at institutional level.

For the assessment tools:

* Working with team projects that requiere students meet all the PI will be continuously recommended as the best way for assessing this SO.
* A third course is being incorporated from 2016 onwards, for the assessment process (at the beginning stage of our professional curriculum).

COMPREHENSIVE EXAMINATION SO ASSESMENT



As mentioned before, a Comprehensive Examination was selected as a third Student Outcome Assesment tool. It has been recognized that written exam are not the most suitable tool for data collection in SO assessment, especially due to time constraints and the nature of the process which usually is focused on a grade evaluation. The fact that this pilot evaluation was not graded and did not impact students GPA, may have affected their performance. Although this Comprehensive Examination can provide an indirect measurement of SO attainment.

As a general average, 46.22% of students answered correctly to questions related to the student outcomes linked to the exam. Some students did achieve according to the goal defined as 70% in SO_a, SO_b and SO_e. None of the students reach the goal for SO_c, most likely due to time constraints.

There was wide variability among correct answers from each subject questions.

4.A.5. How the results are documented and maintained

The results of the attainment of the SOs are documented and maintained in portfolios organized by SO and course (display materials). These documents, as well as other assessment tool reports, and evaluation log files are stored at the ABET CE Coordinator's office, and will be available for evaluators.

B. Continuous Improvement

Despite the fact that this document has been prepared for initial accreditation candidacy to ABET accreditation, it is worth noting that, during 2014 and 2015, there have been several actions taken aimed at improving the attainment of each SO.

4.B.1 Improvement actions identified in the general evaluation process:

a) The generation of new Program Educational Objectives (PEOs) by faculty. These PEOs were evaluated by our Engineering Advisory Board (November 2014). In this meeting, updated SOs were also acknowledged and accepted by the board and formalized as such for assessment.
b) The elaboration of new syllabi, updating programs of study, and incorporating links to the updated SOs (2014).
c) The development and improvement of rubrics as a continuous process (2014 and 2015), taking into account feedback from students, faculty, and our Advisory Board. For instance, one of the main observations of the board was the CE students/alumni performance when writing technical reports or performing oral presentations (e.g. professional internships / professional life).
d) Implementation of new laboratories, and acquisition of new equipment (SO_b): sanitary engineering, hydraulics, strengthening the theoretical concepts learned in classrooms (2015 and 2016).
e) Procurement of textbooks, and software licenses, for several courses (SO_k), in progress.
f) A deep curriculum reform (currently under evaluation; the last major update took place 6 years ago), expect to become effective in May 2017 (Figure 4-1). This implies a new revision of the syllabi, rubrics and the formative/assessment processes (as seen earlier in this criterion). In this regard we point out:

   f.1) Since May 2015, the contents of the Construction Cost Analysis (FICT03335) and Construction (FICT0998) courses have been upgraded to incorporate leadership, business and management principles. Moreover, the contents of Professional Legislation course (FICT03293) were complemented to cover basic concepts of public policy, management, and to raise awareness of the importance of professional affiliations.
   f.1) Starting May 2016, ESPOL is implementing a pilot program of two basic courses of problem solving (SO_e), at the beginning of the CE flowchart. This will facilitate the respective formative activities in the professionalization courses.
   f.2) From May 2017, the Physics courses will be reorganized; ensuring basic Calculus tools are attained previously, i.e. as pre-requisites, no longer co-requisites. In addition, from next year a course on Advanced Mathematics (Prerequisite: Differential Equations) will be incorporated in the curriculum, to ensure students reinforce skills such as boundary and initial conditions and applied differential equations to engineering problems (SO_a), among others.
   f.3) Alongside the new curriculum, a new matrix of formative activities, and assessment plan are being established by the CE Faculty (Table 4-3).

4.B.2. Specific continuous Improvement actions derived from the 2014 assessment and evaluation process and implemented in 2015 or beyond:

SO_a: Ability to apply knowledge of Mathematics, Sciences, and Civil Engineering.

Learning process issue identified:
Few students lack of basic calculus or physics analysis skills.
Assessment tool issue identified:

Arrange projects assignment weeks ahead of examination period.

Improvement actions implemented:

The new curricular reform (with applicable effects from 2016 onwards, in basic science courses) strengthens our study plan ensuring students complete the basic sciences courses before going forward throughout the program flowchart.

During the CE plenary session (December 2015), it was stated that although projects are an adequate assessment tool, they have to be assigned with sufficient time ahead.

SO_b: Ability to design and conduct experiments, as well as to analyze and interpret data related to Civil Engineering.

Learning process issue identified:

Need to increase laboratory hours in related courses.

Assessment tool issue identified:

Select a suitable course for SO assessment.

Improvement actions implemented:

The acquisition of new laboratory equipment during 2015 and 2016 allow improvement on practical experimentation on laboratories.

Courses that require to conduct experiments and data acquisition were planned for 2015 assessment: Concrete Technology (FICT03202) and Road Design II (FICT03426)

SO_ c: Ability to design systems, components or processes related to Civil Engineering, in order to meet desired needs, with realistic constraints, such as economic, environmental, social, political, ethical, sustainability, and manufacture.

Learning process issue identified:

Some students have been identified to be focused on finding a single solution, merely theoretical.

Assessment tool issue identified:

N.A.

Improvement actions implemented:

The concept of design and its various stages, has been emphasized on students.

SO_ d: Ability to work as part of a multidisciplinary team.

Learning process issue identified:

Cross (peer) evaluation is suggested to identify group member’s attainment.

Assessment tool issue identified:

More courses should assess this SO.

Requires increased instructor´s monitoring.

Improvement actions implemented:

At least 3 courses assessed this SO in 2015.

SO_ e: Ability to identify, formulate and solve problems originated in different areas of Civil Engineering.

Learning process issue identified:

Students should emphasize in the discussion and analysis of found solutions.

Assessment tool issue identified:

N.A.

Improvement actions implemented:
Hydrology (FICT02873) and Hydraulics (FICT02915) courses contributed during 2015 to formative activities related to this SO. Strength of Materials II (FICT02907) assessed the specific performance indicators of discussion and alternative analysis of this SO during 2015.

SO_ f: Ability to comprehend ethical and professional responsibility.

Learning process issue identified:
Ethical problems should be analyzed frequently during courses.
Assessment tool issue identified:
Open debates should be preferred, rather than exam questions or quizzes, to improve the data collection.
Improvement actions implemented:
Hydraulics (FICT02915) as well as Fluid Mechanics courses used fora or projects to assess this SO.

SO_g.1: Ability to communicate effectively in Spanish.

Learning process issue identified:
Students required guidance in the elaboration of written reports or technical notes.
Assessment tool issue identified:
Attainment of this SO should be independent of students' grade on a specific assignment.
Improvement actions implemented:
It was explained to Faculty that they should not use the evaluation grade as a specific measure of SO attainment. Two different rubrics have been implemented: one for grade, one for the SO, in the assessment courses.

SO_g.2: Ability to communicate effectively in English.

Learning process issue identified:
Several misspellings have been detected, grammar and presentation flaws when they write and speak, respectively. In general, there is shyness amongst students for presenting in English (written and oral), also showing limited vocabulary.
During oral presentations, there is still imbalance between text and images. Some CE students still struggle for proper citation and paraphrasing.
Assessment tool issue identified:
Lecturers tend to confuse or merge academic scores with attainment of student outcomes.
Improvement actions implemented:
It was explained to Faculty that they must not use the evaluation grade as a specific measure or reference for SO attainment.

SO_h: Ability to understand the impact of Civil Engineering solutions, in a social, environmental, economic, and global context.
Learning process issue identified:
Freshmen students seem to perceive implications of CE solutions by media (mostly TV and internet), but still lack of feedback or professional experiences from Faculty.
Assessment tool issue identified:
N.A.
Improvement actions implemented:

Disciplinary courses have been selected to contribute thru formative activities in the attainment of this SO.

SO_i: A recognition of the need for, and an ability to engage in life-long learning.

Learning process issue identified:
Some students seem to be focused only to pass the course, and do not show interest in continuous learning; and even think less about the utility of these new concepts or knowledge.
Assessment tool issue identified:
Although there were ways to determine the use of TICs, and paraphrasing, it is still difficult to assess how students evaluate themselves in terms of acquiring and validity of new knowledge.
Improvement actions implemented:
A senior exit survey was implemented to assess this SO. When asked about their general self-performance regarding the willingness for continuous improvement, 88.9% considered it was either very high or high. In similar way, when consulted about their plans to pursue graduate studies, 88.9% showed an immediate interest (between 1 and 2 years after graduation).

SO_j: Knowledge of contemporary issues.

Learning process issue identified:
Among students, it has been observed a low interest regarding contemporary issues at various geographical scales.
Assessment tool issue identified:
Exam questions are not a suitable tool the measure this SO.
Improvement actions implemented:
The use of external or out-of the-class tools was proposed to measure this SO (e.g. collaborative platform-based fora -SIDWEB, debates).

SO_k: An ability to use the techniques, skills, and modern engineering tools necessary for Civil Engineering practice.

Learning process issue identified:
In general, the CE program has several courses that offer practical hours including state-of-the-art software and computational tools (in several areas). Nevertheless, some students apply these techniques "blindly", with poor criterion when interpreting results
Assessment tool issue identified:
Overlapping of project submissions with examinations has been detected. Perhaps this has been source of some noise on the assessment, and may lead to confusion about the real learning level of CE students.
Improvement actions implemented:
More attention is being paid on for the multiple choices for the application of a technique / software / methodology.
Project submissions are now assigned weeks ahead of examination periods.

SO_L: A recognition of the need for, and an ability to become an entrepreneur.

Learning process issue identified:

In general, it has been observed that there is low proactivity to propose innovative or creative solutions amongst students. In similar way, it is challenging to take students out of their "comfort zone", for instance, when performing networking or investigating a topic outside the institution.

Improvement actions implemented:

Progress monitoring is being performed at least twice a month, to check every criterion is attained at the end of those courses (formative activities). In addition, two courses have been assigned with measurement tasks.

- ✓ **General comment:** The summary results of the evaluation process from 2014 and 2015 (where re-assessment of the student outcomes was completed) show an overall improvement in the attainment of each SO.

4.B.3. General continuous Improvement actions derived from the 2014 assessment process and implemented in 2015 or beyond:

- Following a common recommendation for the assessment process reported in 2014, since May 2015 every SO has a Coordinator responsible for collecting assessment evidences; thus ensuring the assessment process of the same SO in different courses are consistent and comparable.
- All faculty members are being encouraged to participate actively in the development and improvement of rubrics, plenary sessions regarding evaluation of the attainment of the SOs, and curricular reform. This includes not just full-time faculty, but also those working part-time (During 2015).
- The attainment of SOs is not be limited to those courses with assessment duties. Actually, it must also cover those courses with formative tasks. Every professionalization course can contribute, in greater or lesser ways, to the attainment of the SOs.
- A wider spectrum of assessment tools are being considered for data collection; not only portfolios, such as:
    - Surveys (the alumni follow-up survey, as the Career Development Center, CEPROEM, collected during 2015),
    - The capstone course (students' performance),
    - Oral examinations,
    - Pre-professional internships (from 2016 onwards).
    - Program comprehensive examinations, (June 3rd, 2015); and,

4.b.4. Continuous Improvement actions, proposed from the 2015 evaluation

- SO Coordinators will meet, at least twice per term before midterm and finals, with the faculty members assigned to assess the same SO. These meetings will serve to define suitable assessment tools, help in the interpretation and implementation of rubrics.
- Institutionalized SO´s rubrics will be shared among faculty.
- At the end of the assessment period, SO´s Coordinator, together with the evaluating teachers will define in consensus common problems found and propose improvement actions.
- In the case of courses evaluating SO_d, team for group assignments and projects will be selected randomly to reflect the real-world scenario in which student interact with peers from different backgrounds and personalities.
- Due to the acquisition of new laboratory equipment for the Sanitary Engineering Lab, and the Soils Mechanics Lab, a greater use of the laboratories is being planned. A schedule of use of the laboratory sessions in courses will be required.

- Other improvement actions are being taken currently:

  1) Recruiting more full-time lecturers (2016);
  2) Strategic alliances with industry (by means of the pre-professional internships).

C. Additional Information

Copies of assessment instruments or materials referenced in this criterion will be available for review at the time of the visit as well as the minutes from the SO evaluation meetings.

Figure 4-1: New CE Curriculum flowchart (under construction; operational from 2017 onwards)

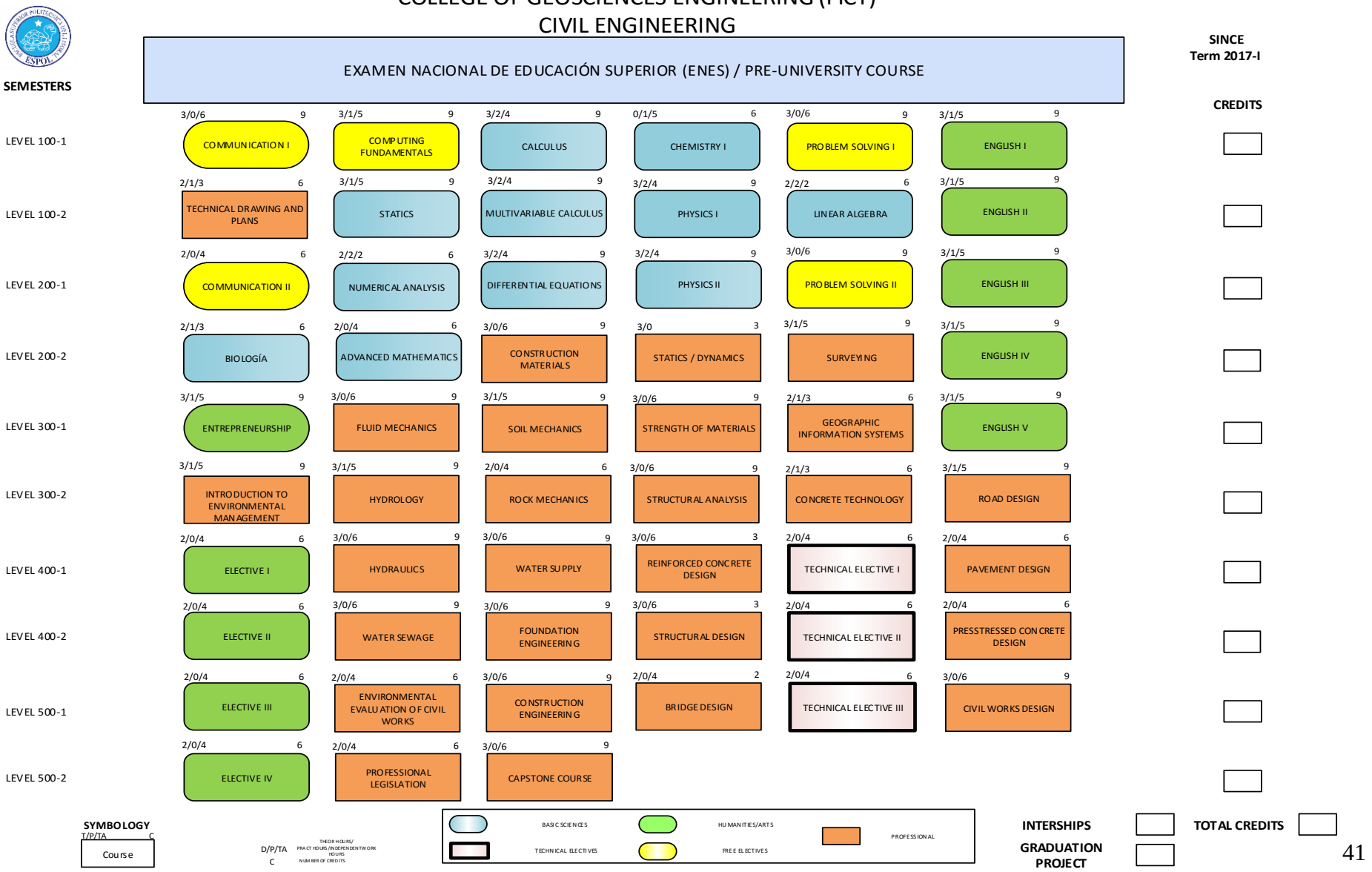


Table 4-3: New matrix of formative activities and assessment plan for the 2017 curriculum.

FICT - ESPOL - CIVIL ENGINEERING - FORMATIVES ACTIVITIES (X) AND ASSESSMENT PLAN (1) - CURRICULUM 2017				SO 1: Ethical Responsibility and professional	SO 2: Speaking and Writing in Spanish	SO 3: Communication in English	SO 4: Continuous Learning	SO 5: Contemporary Issues	SO 6: Work in Group	SO 7: Entrepreneurship	SO 8: Math, Science and Engineering Apply	SO 9: Laboratory and Data Control	SO 10: Design	SO 11: Solutions of Engineering Problems	SO 12: Understand the impact of Civil Engineering	SO 13: Techniques and modern tools for CE		
Equivalence Student Outcomes - ABET				f	g.1	g.2	i	j	d	l	a	b	c	e	h	k		
Course Name	Level	Faculty Name	Term														# Ases x course	# For x course
Technical Drawing and Plans	100-2		2017 2T	1			X									X	1	2
Construction Materials	200-2		2017 2T	X				X							1		1	2
Statics / Dynamics	200-2		2017 2T					1			X		1	X			2	2
Surveying	200-2		2017 1T						X	X						1	1	2
Fluid Mechanics	300-1		2017 1T						1		X	1			X		2	2
Soil Mechanics	300-1		2017 1T		X	1				1		X					2	2
Strength of Materials	300-1		2017 1T				X				1		X				1	2
Geographic Information Systems	300-1		2017 1T				1	X						1		X	2	2
Hydrology	300-2		2017 2T		X							X			1		1	2
Rock Mechanics	300-2		2017 2T		1						X				X		1	2
Structural Analysis	300-2		2017 2T					1	X					X			1	2
Concrete Technology	300-2		2017 2T				X					X				1	1	2
Road Design	300-2		2017 2T	X						X			1				1	2
Hydraulics	400-1		2017 1T		X	1					1				X		2	2
Water Supply	400-1		2017 1T			X			X			1		1			2	2
Reinforced Concrete Design	400-1		2017 1T				1		1			X	X				2	2
Technical Elective I	400-1		2017 1T					X			X						0	2
Pavement Design	400-1		2017 1T	X						1			X				1	2
Water Sewage	400-2		2017 2T	X		X										1	1	2
Foundation Engineering	400-2		2017 2T				X				X				1		1	2
Structural Design	400-2		2017 2T	1					X				X				1	2
Technical Elective II	400-2		2017 2T												X	X	0	2
Presstressed Concrete Design	400-2		2017 2T		1		X	1						X			2	2
Environmental evaluation of civil works	500-1		2017 1T			X						1			X		1	2
Construction Engineering	500-1		2017 1T		X	1	X			1							2	2
Bridge Design	500-1		2017 1T						X		1		X				1	2
Technical Elective III	500-1		2017 1T					X			X						0	2
Civil Works Management	500-1		2017 1T				1			X		X					1	2
Capstone Course	500-1		2017 1T						1					1	X		2	1
Professional Legislation	500-2		2017 2T	1				X							X		1	2
Capstone Course	500-2		2017 2T		1								1	X			2	1
Assessment Total for Student Outcome				3	3	3	3	3	3	3	3	3	3	3	3	3		
Formatives Total for Student Outcome				4	4	3	6	5	5	3	6	5	5	4	7	3		

CRITERION 5. CURRICULUM

A. Program Curriculum

1. Plan of Study Civil Engineering Program

Table 5-1 shows the curriculum of the Civil Engineering (CE) program. At ESPOL, study programs are organized yearly by two academic terms of 16 weeks each plus examination periods. The first term (1-Term) starts in mid-May and ends in mid-September; the second term (2-Term) starts in mid-October and ends in early March. ESPOL does not offers courses during the student vacation period (mid-March to early May). The CE curriculum is completed in 10 terms (5 academic years), and has 259 course credit hours.

According to the current academic flowchart, students have to take the following courses:

a) 20 courses in the basic sciences and related subjects (required). In ESPOL, the basic sciences core comprises of the first 3 semesters.
b) 34 professionalization courses (required).
c) 6 English courses.
d) 2 free elective courses (multiple choices).
e) 3 technical electives (12 options).

In total, the basic sciences core and the English courses account for 40% of the academic flowchart.

As for the professionalization courses, in our CE program there are 6 areas: transportation engineering, construction, sanitary and environmental engineering, geotechnical engineering, structural engineering, and hydraulics. In most of the cases, in order to take the professionalization courses, students must have passed a high percentage of the basic sciences courses.

Furthermore, students have to complete 40 credits worth of pre-professional internships prior to graduation, and have to fulfill 25 credits for the graduation phase by following any of the available options.

Table 5-1 Curriculum

Civil Engineering

Courses	Course is Required, Elective or a Selected Elective by an R, an E or an SE.[1]	*Subject Area (Credit Hours)*								Last Two Terms the Course was Offered:		Maximum Section Enrollment for the Last Two Terms the Course was Offered[2]
		Math & Basic Sciences		Engineering Topics Check if Contains Significant Design (√)		General Education		Other				
		T	P	T	P	T	P	T	P	School Year	Term	
FIEC06460, Digital Collaboration Tools	R	4	0							2015-2016	1	N/A
											2	N/A
ICM01941, Differential Calculus	R	5	0							2015-2016	1	N/A
											2	N/A
ICM01958, Integral Calculus	R	5	0							2015-2016	1	N/A
											2	N/A
ICM01966, Multivariable Calculus	R	5	0							2015-2016	1	N/A
											2	N/A
ICM01974, Differential Equations(2005)	R	5	0							2015-2016	1	N/A
											2	N/A
ICM00604, Linear Algebra	R	4	0							2015-2016	1	N/A
											2	N/A
ICM00166, Statistics	R	4	0							2015-2016	1	N/A
											2	N/A
ICM00158, Numerical Analysis	R	4	0							2015-2016	1	N/A
											2	N/A
ICM00794, Computing Fundamentals	R	4	0							2015-2016	1	N/A
											2	N/A
ICF01099, Physics A	R	4	0							2015-2016	1	N/A
											2	N/A

ICF01107, Laboratory of Physics A	R	0	2							2015-2016	1	N/A
											2	N/A
ICF01115, Physics B	R	4	0							2015-2016	1	N/A
											2	N/A
ICF01123, Laboratory of Physics B	R	0	2							2015-2016	1	N/A
											2	N/A
ICF01131, Physics C	R	4	0							2015-2016	1	N/A
											2	N/A
ICF01149, Laboratory of Physics C	R	0	2							2015-2016	1	N/A
											2	N/A
ICQ00018, General Chemistry I	R	3	2							2015-2016	1	N/A
											2	N/A
FMAR04093, Biology	R	3	0							2015-2016	1	N/A
											2	N/A
CELEX00067, Basic English A	R					6	0			2015-2016	1	N/A
											2	N/A
CELEX00075, Basic English B	R					6	0			2015-2016	1	N/A
											2	N/A
CELEX00083, Intermediate English A	R					6	0			2015-2016	1	N/A
											2	N/A
CELEX00091, Intermediate English B	R					6	0			2015-2016	1	N/A
											2	N/A
CELEX00109, Advanced English A	R					4	0			2015-2016	1	N/A
											2	N/A
CELEX00117, Advanced English B	R					4	0			2015-2016	1	N/A
											2	N/A
ICHE00877, Techniques of Speaking, Writing and Research	R					4	0			2015-2016	1	N/A
											2	N/A
ICQ01222, Ecology and Environmental Education	R					4	0			2015-2016	1	N/A
											2	N/A

ICHE03541, Entrepreneurship and Technological Innovation	R					4	0			2015-2016	1	N/A
											2	N/A
FICT03376, Introduction to Geotechnical Engineering	R			2	2					2015-2016	2	72
										2014 -2015	2	89
FICT03384, Statics / Dynamics	R			2	2					2015-2016	1	58
											2	86
FICT03392, Civil Engineering Materials	R			2	2					2015-2016	2	83
										2014 -2015	2	113
FICT02881, Soil Mechanics I	R			2	2					2015-2016	1	94
										2014 -2015	1	80
FICT03228, Applied Informatics	R							2	3	2015-2016	1	66
											2	24
FICT03210, Technical Drawing and Plans	R							2	3	2015-2016	1	91
											2	41
FICT02865, Strength of Materials I	R			2	2					2015-2016	1	81
											2	31
FICT02725, Surveying I	R			2	2					2015-2016	1	80
											2	28
FICT02923, Soil Mechanics II	R			2	2					2015-2016	2	86
										2014 -2015	2	72
FICT02899, Surveying II	R			2	2					2015-2016	2	74
										2014 -2015	2	69
FICT03202, Concrete Technology	R			2	2					2015-2016	1	37
											2	61
FICT02907, Strength of Materials II	R			2	2					2015-2016	2	71
										2014 -2015	2	72
FICT02931, Reinforced Concrete Design I	R			2	2					2015-2016	2	66
										2014 -2015	2	65
FICT01651, Fluid Mechanics	R			2	2					2015-2016	1	96
											2	97

FICT02972, Sanitary Engineering I	R			2	2					2015-2016	1	65
										2014 -2015	2	55
FICT01057, Rock Mechanics	R			2	2					2015-2016	1	80
										2014 -2015	2	91
FICT03400, Road Design I	R			2	2					2015-2016	1	57
										2014 -2015	2	74
FICT02592, Structural Analysis I	R			2	2					2015-2016	1	63
										2014 -2015	2	61
FICT02956, Reinforced Concrete Design II	R			2	2					2015-2016	1	60
										2014 -2015	2	57
FICT02873, Hydrology	R			2	2					2015-2016	1	14
											2	60
FICT03012, Sanitary Engineering II	R			2	2					2015-2016	2	62
										2014 -2015	2	69
FICT02295, Foundation Engineering	R			2	2					2015-2016	2	60
										2014 -2015	2	64
FICT03426, Road Design II	R			2	2					2015-2016	2	59
										2014 -2015	2	79
FICT02550, Structural Analysis II	R			2	2					2015-2016	2	64
										2014 -2015	2	58
FICT03004, Prestressed Concrete Design	R			2	2					2015-2016	2	60
										2014 -2015	2	64
FICT02915, Hydraulics	R			2	2					2015-2016	1	69
											2	17
FICT03335, Construction Cost Analysis	R			2	2					2015-2016	1	83
										2014 -2015	1	59
FICT03269, Structural Design	R			2	2					2015-2016	1	65
										2014 -2015	1	51
FICT03343, Structural Steel Design	R			2	2					2015-2016	1	67
										2014-2015	1	63

FICT03293, Professional Legislation	R			3	0					2015-2016	2	77
										2014 -2015	2	69
FICT03020, Environmental Engineering	R			2	2					2015-2016	2	44
										2014 -2015	2	43
FICT03244, Building Installation Systems	R			2	2					2015-2016	2	64
										2014 -2015	2	69
FICT02998, Construction	R			2	2					2015-2016	2	64
										2014 -2015	2	47
Free Elective I	E					2	0			2015-2016		
Free Elective II	E					2	0			2015-2016		
Technical Elective	SE			4	0					2015-2016		
Technical Elective	SE			4	0					2015-2016		
Technical Elective	SE			4	0					2015-2016		
Capstone Course	R									2015-2016	1-2	17-18
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		58	8	75	60	48	0	4	6			
OVERALL TOTAL CREDIT HOURS FOR COMPLETION OF THE PROGRAM	259											
PERCENT OF TOTAL		25.48%		52.12%		18.53%		3.86%				
Total must satisfy either credit hours or percentage	Minimum Semester Credit Hours	32 Hours		48 Hours								
	Minimum Percentage	25%		37.5 %								

1. **Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group.
2. **N/A (Not applicable) implies the course is not offered by CE, but are general education.**

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2. Alignment of the curriculum with the program educational objectives and student outcomes.

Courses in the curriculum, including the culminating design experience in the capstone course (FICT04341), and the pre-professional internship requirement, are aimed at preparing students to perform at an acceptable level in the CE program student outcomes (SOs). Such policy provides our graduates with the knowledge, abilities, and skills for them to attain the program educational objectives (PEOs), as shown in the links between ESPOL's CE program SOs and PEOs (Table 3.1). CE Courses such as Soil Mechanics II (FICT02923), Hydrology (FICT02873), Structural Design (FICT03269), and Construction Cost Analysis (FICT03335) provide insight into civil engineering problem-solving, considering several social, economic and environmental aspects (PEOs # 1,2). The faculty body decided that courses such as Applied Informatics (e.g. GIS system development and applications), Reinforced Concrete Design (e.g. new design methodologies), and sanitary engineering courses (e.g. innovative water treatment procedures) can contribute to the development of life-long learning and continuous improvement (PEO #3), whereas the Surveying and Entrepreneurship courses are aimed at improving multidisciplinary group work skills, and making students more proactive (PEO #4). Moreover, activities within the graduation process, such as the capstone and research projects, provide students further opportunity to show that they can work on the solution of engineering problems involving planning, design, analysis and/or research, which prepares them for their careers.

Table 5-2 shows the courses that significantly contribute to the ABET SOs (formative activities). Table 5-3 shows the total number of courses with such contributions (formative). By means of these tables, it is demonstrated how courses are linked with the attainment of the CE program SOs. The level ###-1 indicates that the course is taught during the first semester (May to September), whereas the ###-2 is during the second semester (October to March).

Table 5-2 Contribution of CE Program Courses to SOs (Formative activities)

Course Code	Course name	Level	a	b	c	d	e	f	g.1	g.2	h	i	j	k	l
FIEC06460	Digital Collaboration Tools	100-1	X			X	X	X	X						
ICM01941	Differential Calculus	100-1	X				X		X					X	
ICM01958	Integral Calculus	100-2	X				X		X					X	
ICM01966	Multivariable Calculus	200-1	X			X	X	X	X		X	X		X	
ICM03376	Differentials Equations	200-1	X		X		X				X		X	X	
ICM00604	Linear Algebra	100-2	X		X		X				X		X	X	
ICM00166	Statistics	200-2	X	X	X	X		X	X					X	
ICM00158	Numerical Analysis	200-1	X			X	X		X					X	
ICM00794	Computing Fundamentals	100-2			X	X			X			X			
ICF01099	Physics A	100-1	X			X		X							
ICF01107	Physics Laboratory A	100-1	X												
ICF01115	Physics B	100-2	X			X									

ICF01123	Physics Laboratory B	100-2	X	X		X									
ICF01131	Physics C	200-1	X						X						
ICF01149	Physics Laboratory C	200-1	X	X		X									
ICQ00018	General Chemistry I	100-1	X	X		X			X			X	X	X	X
FMAR04093	Biology	100-2	X										X		
CELEX00067	Basic English A	100-1								X					
CELEX00075	Basic English B	100-2								X					
CELEX00083	Intermediate English A	200-1								X					
CELEX00091	Intermediate English B	200-2								X					
CELEX00109	Advanced English A	300-1								X					
CELEX00117	Advanced English B	300-2								X					
ICHE00877	Techniques of Speaking, Writing and Research	100-1				X			X			X			
ICQ01222	Ecology and Environmental Education	200-2	X	X		X		X	X		X	X	X		X
ICHE03541	Entrepreneurship and Technological Innovation	500-1				X		X	X		X				X
FICT03376	Introduction to Geotechnical Engineering	200-2	X	X			X		X		X				
FICT03384	Statics / Dynamics	200-2	X	X			X								
FICT03392	Civil Engineering Materials	200-2	X	X							X		X		
FICT02881	Soil Mechanics I	300-1	X	X		X	X		X		X			X	
FICT03228	Applied Informatics	300-1	X	X	X	X	X		X		X	X		X	
FICT03210	Technical Drawing and Plans	300-1	X	X			X	X	X	X	X	X	X	X	
FICT02865	Strength of Materials I	300-1	X	X	X		X								
FICT02725	Surveying I	300-1	X	X		X	X	X	X			X	X	X	
FICT02923	Soil Mechanics II	300-2	X	X		X	X		X					X	
FICT02899	Surveying II	300-2	X	X		X	X		X			X	X	X	
FICT03202	Concrete Technology	300-2		X	X	X	X		X		X	X	X	X	
FICT02907	Strength of Materials II	300-2	X	X					X					X	
FICT02931	Reinforced Concrete Design I	300-2	X		X		X		X		X	X		X	

FICT01651	Fluid Mechanics	400-1	X	X			X		X		X		X	X	
FICT02972	Sanitary Engineering I	400-1	X	X	X	X	X	X	X			X	X	X	
FICT01057	Rock Mechanics	400-1	X				X				X			X	
FICT03400	Road Design I	400-1	X	X		X	X	X	X			X			
FICT02592	Structural Analysis I	400-1	X				X							X	
FICT02956	Reinforced Concrete Design II	400-1	X		X		X		X		X	X		X	
FICT02873	Hydrology	400-2	X	X		X	X	X	X	X	X	X	X	X	
FICT03012	Sanitary Engineering II	400-2	X	X	X	X	X	X			X	X	X	X	
FICT02295	Foundation Engineering	400-2	X	X	X	X	X		X					X	
FICT03426	Road Design II	400-2	X	X		X	X	X	X			X			
FICT02550	Structural Analysis II	400-2	X			X	X				X	X		X	
FICT03004	Prestressed Concrete Design	400-2			X		X		X		X	X	X	X	
FICT02915	Hydraulics	500-1	X	X	X	X	X		X	X	X	X		X	
FICT03335	Construction Cost Analysis	500-1	X			X	X	X			X		X		X
FICT03269	Structural Design	500-1	X		X	X		X	X		X	X	X	X	
FICT03343	Structural Steel Design	500-1	X		X	X		X	X		X	X	X	X	
FICT03293	Professional Legislation	500-2			X	X		X	X				X	X	
FICT03020	Environmental Engineering	500-2	X	X	X	X	X	X	X		X		X	X	
FICT03244	Building Installation Systems	500-2	X	X	X		X	X			X	X	X		
FICT02998	Construction	500-2	X	X	X	X		X	X		X	X	X	X	X
FICT04341	CE Capstone Course	500-2	X	X	X	X	X		X	X	X	X		X	

Table 5-3 Number of courses contributing to SOs (Formative activities).

	Student Outcomes (SOs)												
	a	**b**	**c**	**d**	**e**	**f**	**g.1**	**g.2**	**h**	**i**	**j**	**k**	**l**
Number of courses in the CE Program	48	29	21	34	35	20	37	10	27	25	21	34	5

As examples of formative contributions to SOs, it is seen in Table 5.2 that the courses FICT0165 (Fluid Mechanics), FICT02592 (Structural Analysis I), FICT02873 (Hydrology), FICT03426 (Road Design II), FICT02550 (Structural Analysis II) and FICT02915 (Hydraulics) have a high contribution to CE program SO "e" related to solving engineering problems (different topics and real-life situations). The SO "c" (design) is strongly developed throughout our program (with five performance criteria) in several courses such as FICT02865 (Strength of Materials I), FICT03202 (Concrete Technology), FICT03400 (Road Design 1), FICT02931 (Reinforced Concrete Design 2), FICT03269 (Structural Design), FICT03343 (Structural Steel Design), amongst others. The courses FICT02873 (Hydrology) and FICT02915

(Hydraulics) also contribute to the CE SO "g.1" related to effective oral and written communication (with written projects and oral presentations during the courses). The courses FICT02550 (Structural Analysis II), and FICT03228 (Applied Informatics)) contribute significantly to SO "k" related to state-of-the-art techniques and tools. The course Structural Analysis II includes workshops using SAP2000 and ETABS, whereas Applied Informatics uses ArcMap and other GIS-based applications (e.g. Google Earth and online apps).

In addition, the courses FICT02725 (Surveying 1), FICT03335 (Construction Cost Analysis), FICT03269 (Structural Design), FICT03343 (Structural Steel Design) and FICT03020 (Environmental Engineering) also have a high contribution to SO "d" related to group work (by means of workshops during lectures or as project assignments). Great importance is also placed on life-long learning ("i") by means of FICT03210 (Technical Drawing and Plans, e.g. new software skills), FICT02725 (Surveying I, e.g. state-of-the-art equipment for measurements), FICT03400 (Road Design 1, e.g. new methodologies for pavement design), and FICT03004 (Prestressed Concrete Design, e.g. new technologies for design and construction).

3. The Civil Engineering curriculum and its associated prerequisite structure support the attainment of the student outcomes.

This section uses the information provided in Figure 5.1 and Table 5.6 and the end of this section. Curriculum and the prerequisite structure aim to ensure that CE participants progress without difficulty throughout their study plan and that students meet all the knowledge requirements before they register for a course. Most of the mathematics and basic science courses are scheduled to be taken during the first four semesters. These classes are offered by the College of Natural Sciences and Mathematics of ESPOL (FCNM, acronym in Spanish), by means of its individual departments: Physical Sciences (ICF, acronym in Spanish), Mathematical Sciences (ICM, acronym in Spanish), and Chemistry and Environmental Sciences (ICQA, acronym in Spanish). The Biology course is offered by the Biology program at the College of Life Sciences (FCV, acronym in Spanish).

Engineering science and design, and professionalization courses are offered in the CE program by the program faculty members during the subsequent six academic terms. After the basic sciences courses, CE students have to take courses that develop their space visualization (Applied Informatics), sketching and drawing skills (Technical Drawing and Plans), engineering mechanics (Statics/Dynamics), and the fundamentals of CE engineering materials, as a collection of introductory topics to the program. Afterwards, students take (among others): Fluid Mechanics, Sanitary Engineering, Soil Mechanics, Surveying, Hydrology, Hydraulics, Road Design, Reinforced Concrete Design, Foundations, Rock Mechanics, Structural Design, Structural Steel Design, Building Installation Systems, Construction, and Environmental Engineering. Students have to take a minimum of three technical electives and two free elective courses (from other programs within the College of Geosciences Engineering, FICT, or anywhere in ESPOL). The course of Entrepreneurship is compulsory and can be taken only after the 6th semester (after completion of 50% of the total credits). As of semester 2015-I (May), CE students have to take the Capstone Course (FICT04341), before finishing their academic flowchart.

4. Flowchart or worksheet that illustrates the prerequisite structure of the program's required courses.

Figure 5.1 and Table 5.4 show a flowchart with the CE program of study, including the prerequisite (and co-requisite) structure of the courses. In light blue are the basic science, and the English courses; in orange, the engineering science and professionalization courses; in green those in the humanities area, in pink the technical electives, and in yellow the free electives.

5. Program compliance with requirements specifically addressed by either the general criteria or the program criteria.

The CE program is compliant with ABET's program criteria by means of several courses across our curriculum, as is shown in the namesake section (after criterion 8).

From Table 5.1, it can be seen that in the CE program, students have to study 66 credit hours of math and basic sciences, 145 of engineering topics (including technical electives), 44 relating to general education, and 4 relating to other areas (free electives). The total number of credits in the program is 259, out of which 25.48% correspond to math and basic sciences, and 55.98% to engineering topics. In this regard, ABET requirements are satisfied.

Math and Basic Science

CE students have to take courses in Differential and Integral Calculus, Linear Algebra, Multivariable Calculus (Calculus of Several Variables) and Differential Equations. Students also have to take three calculus-based physics courses, all of them with laboratory components (Physics A, B and C with their laboratory sessions). Students also take credits in chemistry (General Chemistry I) with laboratory hours, and a Biology course. In addition, students have to take one semester course in Statistics, Computing Fundamentals, and a Numerical Analysis course. These courses comply with the general requirements prescribed in the ABET Program Criteria for CE.

Engineering Topics

Most of the courses across the CE curriculum include engineering sciences and engineering design. Students take courses on Introduction to Geotechnical Engineering, Statics/Dynamics, and Civil Engineering Materials. CE participants also take courses such as Soil Mechanics, Strength of Materials, Surveying, Concrete Technology, Reinforced Concrete Design, Fluid Mechanics, Sanitary Engineering, Rock Mechanics, Foundation Engineering and Structural Analysis. They also take applied courses such as Hydrology, Prestressed Concrete Design, Road Design, Structural Steel Design, Professional Legislation, Environmental Engineering, Building Installation Systems, and Construction. Even before the new curriculum (set by 2017-I), CE students already have to pass the capstone course (FICT04341), where they are required to complete one major design project. Students have to take three technical elective courses; their choices include Rock and Soil Stabilization, Special Concretes, Introduction to Structural Dynamics, Introduction to Seismic Engineering, Applied Rock Mechanics, Hydraulic Works, Underground Works, Construction Planning & Scheduling, Bridge Design, Solid Waste Treatment, Water Treatment, and Air Treatment.

General Education

Students have to take the Ecology and Environmental Education course, an Entrepreneurship course and a Techniques of Speaking, Writing and Research course. Students also have to take 6 courses of English, or to pass an exam for each of the courses. Students also have to take 6 credits of free elective courses (e.g. sports such as soccer, chess, basketball, or kayaking; or a wide variety of other courses, for example, Art History, Photography, Enology, Welding Design, and Microeconomics).

Other courses

In addition to the aforementioned subjects, CE students strengthen their computational knowledge of Computer-Aided Design (CAD), and Geographic Information Systems (GIS), by means of the courses FICT03228 (Applied Informatics) and FICT03210 (Technical Drawing and Plans), respectively.

6. Civil Engineering program culminating design experience

The main goal of our capstone course (FICT04341) is to familiarize CE students with a significant multidisciplinary design experience and group-work tasks, preparing them for real-world situations, e.g. submitting pre-feasible studies, or defending their design proposals in front of a shareholder committee. Our capstone course lasts 16 weeks (1 academic term). It is expected that students apply the academic experience (abilities and knowledge) they have accumulated during previous semesters in courses such as Structural Design, Foundations, Hydraulics, Sanitary Engineering, Construction Cost Analysis, and Road Design. In this regard, CE participants show their expertise by proposing solutions to an engineering problem, involving constraints from two or more disciplinary areas at the pre-feasibility and feasibility stage.

At the end of the semester, each team (comprising of two CE students) is expected to submit the following deliverables:

a) Calculations report
b) Plans and drawings
c) Unit price analyses and budget
d) Scheduling
e) Technical specifications
f) Executive summary
g) Poster and oral presentation

Faculty members evaluate all these deliverables; members of the Advisory Board may be invited to evaluate the oral presentation. The CE program foresees possible agreements with public and private institutions to enhance the student design experience by offering them real world situations. Additionally, different data, constraints and initial specifications are assigned to each group to ensure originality in the results, conclusions and recommendations. Constraints comprise of the following items (when applicable):

a) Codes and standards
b) Time, funding, environmental restrictions, governmental regulations, and legal implications
c) The evaluation of engineering/financial alternatives to reach a compromise and select/justify the best possible solution(s)
d) Specific format for the final report (not a scientific paper)

Throughout this course, there is a continuous monitoring, feedback and follow-up process supervised by course leaders, and consulted through:

a) Scheduled appointments with every team (weekly basis)
b) Technical presentations from companies/consultants/public officials for sharing design/engineering experiences, and,
c) Periodic evaluations (commonly two, simulating a bidding process: proposal, and final pre-feasibility design) in accordance with a general schedule, established at the beginning of the academic term that ensures optimized progress and avoids burdensome revision stages at the end of the semester. By then, a summary of the best works are published on the program website, and further discussed with interested public/private institutions for potential feasibility stages.

Finally, potential examples of capstone projects for the following semesters may include the pre-feasibility design of a:

1) Water distribution and treatment systems.
2) Structural design of a building under different constraints.
3) Wastewater and Stormwater design of neighborhood developments.
4) Mid-rise building with deep foundations
5) Small dam
6) Dock with approaching road
7) Road (including a bridge)
8) Flyover

Figure 5-1 ESPOL Civil Engineering Curriculum

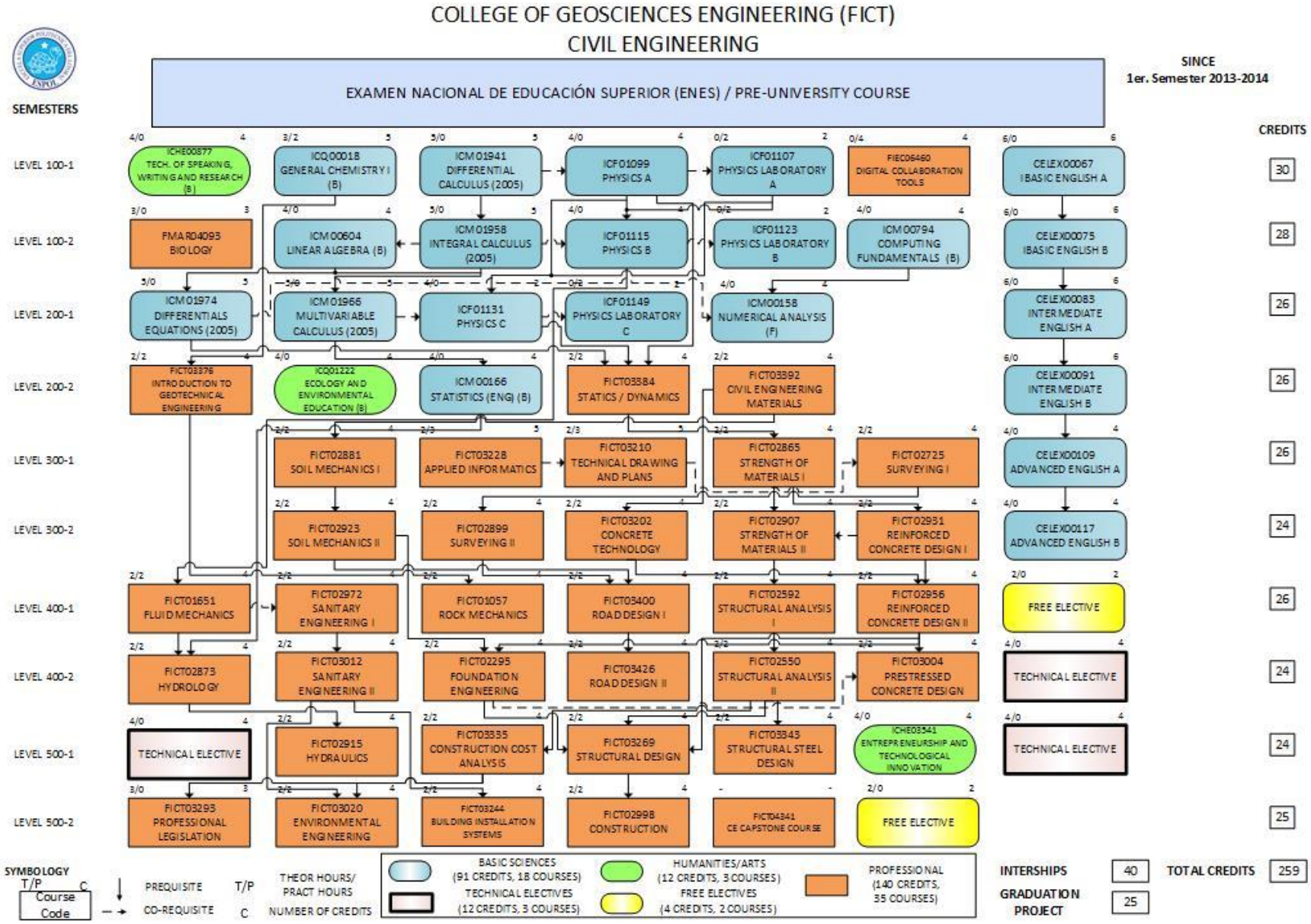

Table 5-4. CE Program course sequence

Code	Course	Prerequisite	Co-Requisite	Observations
LEVEL 100-1				
ICHE00877	Techniques of Speaking, Writing and Research	Preparation courses before admission to CE		
ICQ00018	General Chemistry I	Preparation courses before admission to CE		
ICM01941	Differential Calculus	Preparation courses before admission to CE		
ICF01099	Physics A	Preparation courses before admission to CE	Differential Calculus	
ICF01107	Physics Laboratory A	Preparation courses before admission to CE	Physics A	
FIEC06460	Digital Collaboration Tools	Preparation courses before admission to CE		
CELEX00067	Basic English A	Preparation courses before admission to CE		It can be passed by exam
LEVEL 100-2				
FMAR04093	Biology	Preparation courses before admission to CE		
ICM00604	Linear Algebra	Preparation courses before admission to CE	Integral Calculus	
ICM01958	Integral Calculus	Differential Calculus		
ICF01115	Physics B	Physics A and Physics Laboratory A	Integral Calculus	
ICF01123	Physics Laboratory B		Physics B	
ICM00794	Computing Fundamentals	Preparation courses before admission to CE		
CELEX00075	Basic English B	Basic English A		It can be passed by exam
LEVEL 200-1				
ICM03376	Differentials Equations	Linear Algebra and Integral Calculus		
ICM01966	Multivariable Calculus	Integral Calculus		
ICF01131	Physics C	Physics A and Physics Laboratory A	Multivariable Calculus	
ICF01149	Physics Laboratory C		Physics C	
ICM00158	Numerical Analysis	Computing Fundamentals	Differentials Equations	
CELEX00083	Intermediate English A	Basic English B		It can be passed by exam
LEVEL 200-2				
FICT03376	Introduction to Geotechnical Engineering	General Chemistry I		
ICQ01222	Ecology and Environmental Education			

ICM00166	Statistics	Multivariable Calculus		
FICT03384	Statics / Dynamics	Differentials Equations, Physics A and Physics C		
FICT03392	Civil Engineering Materials			
CELEX00091	Intermediate English B	Intermediate English A		It can be passed by exam
LEVEL 300-1				
FICT02881	Soil Mechanics I	Civil Engineering Materials		
FICT03228	Applied Informatics		Applied Informatics	
FICT03210	Technical Drawing and Plans		Applied Informatics	
FICT02865	Strength of Materials I	Statics / Dynamics		
FICT02725	Surveying I		Technical Drawing and Plans	
CELEX00109	Advanced English A	Intermediate English B		It can be passed by exam
LEVEL 300-2				
FICT02923	Soil Mechanics II	Soil Mechanics I		
FICT02899	Surveying II	Surveying I		
FICT03202	Concrete Technology	Civil Engineering Materials		
FICT02907	Strength of Materials II	Strength of Materials I	Reinforced Concrete Design I	
FICT02931	Reinforced Concrete Design I	Strength of Materials I		
CELEX00117	Advanced English B	Advanced English A		It can be passed by exam
LEVEL 400-1				
FICT01651	Fluid Mechanics	Physics B		
FICT02972	Sanitary Engineering I		Fluid Mechanics	
FICT01057	Rock Mechanics	Introduction to Geotechnical Engineering		
FICT03400	Road Design I	Soil Mechanics II and Surveying II		
FICT02592	Structural Analysis I	Strength of Materials II		
FICT02956	Reinforced Concrete Design II	Reinforced Concrete Design I and Concrete Technology		
	Free Elective I			

LEVEL 400-2				
FICT02873	Hydrology	Statistics and Fluid Mechanics		
FICT03012	Sanitary Engineering II	Sanitary Engineering I		
FICT02295	Foundation Engineering	Reinforced Concrete Design II and Soil Mechanics II		
FICT03426	Road Design II	Road Design I		
FICT02550	Structural Analysis II	Structural Analysis I		
FICT03004	Prestressed Concrete Design	Reinforced Concrete Design II	Foundation Engineering	
LEVEL 500-1				
FICT02915	Hydraulics	Hydrology		
FICT03335	Construction Cost Analysis	Structural Analysis II		
FICT03269	Structural Design	Foundation Engineering, Structural Analysis II and Reinforced Concrete Design II		
FICT03343	Structural Steel Design	Structural Analysis II		
ICHE03541	Entrepreneurship and Technological Innovation	Have completed at least 31 subjects		
LEVEL 500-2				
FICT03293	Professional Legislation	Construction Cost Analysis		
FICT03020	Environmental Engineering	Sanitary Engineering II		
FICT03244	Building Installation Systems	Sanitary Engineering II		
FICT02998	Construction	Structural Design		
FICT04341	Capstone Course	Have completed at least 62 subjects out of 64 subjects that conforms the CE program curriculum		
FICT02915	Hydraulic Works	Hydraulics		Technical Elective
FICT03038	Bridge Design	Structural Design Prestressed Concrete Design		Technical Elective
FICT03434	Introduction to Structural Dynamics	Structural Analysis II		Technical Elective
FICT03236	Special Concretes	Concrete Technology		Technical Elective
FICT01842	Applied Rock Mechanics	Rock Mechanics		Technical Elective

FICT02964	Stabilization of Soils and Rocks	Soil Mechanics II Rock Mechanics		Technical Elective
FICT03459	Introduction to Seismic Engineering	Introduction to Geotechnical Engineering Structural Analysis II		Technical Elective
FICT03467	Air Treatment	General Chemistry I Hydrology Environmental Engineering		Technical Elective
FICT03475	Water Treatment	Sanitary Engineering II		Technical Elective
FICT03483	Soil Waste Treatment	General Chemistry I Soil Mechanics I Sanitary Engineering II		Technical Elective
FICT02311	Underground Works	Rock Mechanics		Technical Elective
		Foundation Engineering		Technical Elective
		Road Design II		Technical Elective
FICT02311	Construction Scheduling	Construction Cost Analysis		Technical Elective
	Free Elective II			
FICT04341	Capstone Course			Pre-professional internships complete, Level 500-2 at least.

7. Cooperative education

Currently, our CE program does not support any cooperative education. However, our faculty members, as well as the Office of the Vice-rector, have considered using the pre-professional internships as a large pilot study. We have been using these to assess the attainment of the SOs by means of continuous observation (simulation) of the performance of students in real-life engineering situations.

8. Visual materials

During the visit, ABET evaluators will be able to check the following:

a) Course syllabi (belonging to the old and new curricula).
b) Textbooks, referred to by syllabi, or evidence of a subscription to a digital bibliography (if applicable).

c) Evidence of assignments, exams, quizzes, and student work in general. There will be one example per performance level: unsatisfactory, developing, satisfactory and exemplary.
d) Portfolios, organized by course, and SOs.
e) Posters and written reports from Capstone Course.
f) Other relevant evidence, such as computational systems in ESPOL: the advisory system, academic system, and SIDWEB platform.

B. Course Syllabi

See Appendix A for more details about the CE program syllabi.

CRITERION 6. FACULTY

A. Faculty Qualifications

The Civil Engineering (CE) program at the College of Geosciences (FICT, acronym in Spanish) encompasses six areas: geotechnical engineering, transportation engineering, hydraulics, structures, construction and sanitary engineering. In general, the college has an adequate mix of full-time, half-time and part-time faculty. During the 2015-2016 academic year, the CE program had a total of 31 faculty members including tenured, tenure-track and non-tenure track (lecturers). Updated information will be available at the time of visit.

Faculty members:

- Lourdes Aburto-Osnaya, MSc., joined FICT in 2015 as lecturer of the Building Installations Systems, and Technical Drawing and Plans courses. She is Architect from the Metropolitan Autonomous University of Mexico, and has three Master's degrees in Bioclimatic Urbanism, Urban Design, and Architecture Projects, obtained in Mexico. She has been lecturer in related issues in several Universities in both Ecuador and Mexico, since 1995. Ms. Aburto-Osnaya has work in several projects related to Development Planning, Urbanisms (Samanes Park in Guayaquil), and beach recovering (Salinas – Ecuador). She has been received several academic awards related to her field. Ms. Aburto-Osnaya is founding member of the Landscape Architect Society of Ecuador (SAPE).

- Julio Acosta-Vega, MSc., was hired by FICT in 2015 as a part-time lecturer of the course of Sanitary Engineering I and the course of Sanitary Engineering II. He is a civil engineer graduated from UNO – University of New Orleans, and he is a Master of Science in Civil and Environmental Engineering graduated at the same University. He is EIT certified.

- Alby Aguilar-Pesantes, MSc., joined FICT in 2006. She has been a lecturer for the Sanitary Engineering, Environmental Engineering, Water Treatment, Air Treatment, and Solid Disposal Treatment courses since 2006. She has been a thesis director for over 30 students in the CE Program at FICT. She has a Master's degree in CE (Environmental Engineering) from Arizona State University. She has worked in several construction and consultancy firms in Ecuador, such as Norberto Odebrecht and Efficacitas Ltd. At the present time she is a member of a research group at FICT that is investigating environmental problems at one of Ecuador's mining sites. She is currently pursuing a Doctorate in Environmental Engineering from the University of Oviedo (Spain). Since March 2015, she serves as the CE Program Coordinator.

- Mijail Arias-Hidalgo, PhD., was hired by FICT in 2013 as a researcher-lecturer in the hydraulics area: Fluid Mechanics, Hydrology, Hydraulics, and related courses in the new MSc Program on Water Resources Management (VLIR-ESPOL-EPN-UCuenca). He holds a Masters in Water Science and Engineering with a specialization in Hydro-Informatics (*cum laude*) from UNESCO-IHE, and a PhD. in Water Science and Engineering from Delft University of Technology, (both in The Netherlands). From May 2013 to March 2015 he served as the CE Program Coordinator. Dr. Arias-Hidalgo is also a private consultant in water engineering, and a member of ASCE, IAHR, AGU, IAHS, and the local Civil Engineering Association. He has published in both peer-reviewed scientific journals and at internationally recognized conferences, and is peer reviewer for the Hydrological Sciences Journal since 2013. In April 2015, he won a tenured position as an Associate Professor (full time) in Water Resources Engineering at FICT. In 2015, he coordinated activities for the CE program with regard to ABET accreditation candidacy. Since January 2016 he has been coordinating activities at institutional level for ABET accreditations candidacies.

- Claudia Basantes-Espinosa, C.E., was invited in 2014 to teach the course of Surveying I and the course of Surveying II. She is a part-time lecturer and a civil engineer graduated from ESPOL. She is a research assistant of the FICT College. She works on several projects related to her field of study, elaborating plans and doing the preparation of thematic maps, with the use of GIS. She is a member of the Association of Civil Engineers of Guayas Province (CICG – Acronym in Spanish).

- Arnaldo Bayona-Malo, MSc., was hired by FICT in 2015 as a part-time lecturer of the course of Statics/Dynamics. He is a civil engineer graduated from ESPOL. He holds a Master of Science in Civil Engineering in the Area of Construction Engineering and Management from the University of Michigan. He is currently Zone 5 Director for the Ministry of Transport and Public Works (MTOP- Acronym in Spanish).

- Davide Besenzon-Vanegas, MSc., is lecturer on geotechnical engineering since October 2015. He obtained his CE and MSc degree (geotechnical engineering) from the University of Padova (Italy). He has participated in several CE projects in various construction and consultancy firms, regarding interpretation and analysis of soil tests and foundation studies, construction inspection, piloting monitoring, slope stabilities, in Padova (Italy), Porto (Portugal), and Guayaquil (Ecuador).

- Jorge Cedeño-Cuellar, C.E., graduated from our CE Program in 2009. He was hired to teach the Technical Drawing and Plans, and Special Concretes courses. Amongst his experience working for the industry is his engineering assistant position at the Public Works Department of the Municipality of Guayaquil, his project engineer position in INTERAGUA (water supply company in Guayaquil), and his experience at the Ecuadorian Army Corp of Engineers and at CPR & Associates. Additionally, he has worked as a CE independent contractor since 2010 and has participated in conferences, congresses and international and national courses.

- Miguel Chávez-Moncayo, PhD., has been a full time lecturer (tenured) in FICT since 1977 (at that time in the Geological Engineering program) until 2014. Currently he is an Emeritus Professor. Since the CE program's inception (1990), he has been teaching most of the courses related to the geotechnical engineering branch: Rock Mechanics, Applied Rock Mechanics, Soils and Rocks Stabilization, Underground Works, Introduction to Geotechnical Engineering, and Foundations. He has been a private consultant in that area of study, working extensively in many projects across Ecuador. Dr. Chávez designed the two artificial lakes at the ESPOL Campus. Currently, he is an advisor for SENAGUA (Ministry of Water Resources) on issues related to dam design and geotechnical engineering.

- Hugo Egüez-Alava, MSc., has been a half-time lecturer (tenure track) in FICT since 1987. He has been working in the Concrete Technical Center (Holcim) since 1992, and he was in charge of the Concrete Technology and Special Concretes courses until 2012 when he went to the University of Ghent (Belgium) to pursue a PhD in Concrete Technology. He is expected to return in late 2016 to resume his tenured position in our program.

- Natividad García-Troncoso, MSc., graduated from our CE program. As a student, she developed her pre-professional internship and BSc thesis project at HOLCIM. Following her studies, this multinational company hired her as a Quality Management Supervisor. She has a Master's degree in Design, Management and Project Management from the University of León in Spain. In 2013, she was hired by ESPOL to teach the Concrete Technology course. She has taken several seminars and courses related to concrete technology. She is a certified ACI Concrete Field Testing Technician – Grade I. In addition, she is a member of ACI. Ms. García-Troncoso is expected to have started a PhD. in Concrete Technology at Imperial College, London (UK) by early 2016.

- Carola Gordillo-Vera, MSc., graduated as a civil engineer from ESPOL in 1997. She has a Master's degree in Road Management and Engineering from Birmingham University in the UK. In addition, Ms. Gordillo has a Graduate Course Diploma in Roads Engineering from Buenos Aires University in Argentina. In 2014, she was hired by FICT to teach the Road Design I and II courses. Over the years, she has gained experience in her study area, as she is also a well-known consultant in pavement and transportation engineering. Currently, Ms. Gordillo is an Advisor for the Ministry of Transport and Public Works.

- Francisco Grau-Sacoto, MSc., is a part-time lecturer in FICT. He was invited to teach the Soil Mechanics course in 2015. Mr. Grau graduated as a civil engineer in 2011. He obtained a Master's degree in Geotechnics from Louisiana State University (LSU, USA). Mr. Grau passed a course in Asphalt Mixtures Design in 2011 offered by the Ministry of Communications and Transport in Mexico. He has many years of experience in geotechnical engineering (since 2007). Francisco has published in Soils Mechanics Journals.

- Luis Jordá-Bordehore, PhD., was invited to teach the course of Rock Mechanics in 2015. He is a researcher with the PROMETEO program (sponsored by the Ecuadorian Government). Dr. Jordá holds a Master's in Tunnels and Underground Works from Universidad Politécnica de Madrid (UPM) and a PhD. in Mining Science and Engineering from the Mining Engineers Institute (with *Cum Laude*). He is a specialist in rock engineering, tunneling and geotechnics. From 2004 to 2008, Dr. Jordá was a manager at Rudnik Geo-Sciences (a consultancy firm). In 2012, he worked in Peru, as an advisor to a Spanish consulting firm, in aspects about geotechnical and tunnel engineering. He has carried out projects and fieldwork in Spain, Belgium, France, Norway, Japan, Malta, Peru, Colombia, Ecuador and Bolivia. Dr. Jordá has several years of experience in his field of study and investigation. In addition, he has taken several courses and seminars in his field of study. Dr. Jordá has contributed to several publications, book chapters and scientific articles.

- Erwin Larreta-Torres, G.E., was hired in 2015 to teach the courses Surveying I and II. Mr. Larreta has postgraduate studies in Risk and Disaster Management at the Technological Institute of Monterrey (Mexico), and is a geological engineer from ESPOL. He is also a lecturer at the University of Guayaquil. He has worked on several projects involving geographic information systems (GIS) for private and public institutions. Currently, Mr. Larreta is doing a MSc. in GIS at the University of San Francisco (Quito).

- Xavier Molina-Arce, MSc., was hired in 2014 to teach the Fluid Mechanics and Hydraulic Works courses. Mr. Molina has a Master's Degree in Hydraulic and Environmental Engineering, from the Polytechnic University of Valencia (Spain). He is a graduate from our CE program. He has taken several courses and seminars in his field of study. He is the director of the GIS and Water Resources Modeling Department at INTERAGUA .

- Isabel Montoya-Freire, MSc., has been a full-time lecturer at ESPOL since 2015. She graduated from our CE program. She has been recently hired to teach the Hydraulics and Hydrology courses. Ms. Montoya has two Master's Degrees, one in Hydraulics from the National Autonomous University of Mexico and the other in Hydrology and Water Resources Management from Alcala University in Spain. Until late 2014, she was a manager for Rival Plastics S.A., a PVC pipe production company. She has worked in many projects in different fields, including environmental impact studies. Ms. Montoya has been a design supervisor for the Daule-Pedro Carbo water transfer project, and for ACOTECNIC, an engineering association. In addition, she has been a private consultant for Quality Engineering Solutions. (a consulting firm in Guayaquil). She is a member of the International Association for Hydro-Environment Engineering and Research (IAHR).

- Guillermo Muñoz-Villa, C.E., was invited in 2014 to teach the course of Structural Analysis. He is a part-time lecturer and a civil engineer graduated from ESPOL. He works on several projects related to his field of study. He currently performs analyses and designs different structures as a private consultant. In addition, he works for a CE consulting company (GEOGIS Corp). Mr. Muñoz is currently pursuing a MSc. in Structures at the University of Chile in Santiago.

- Diana Navarrete-Aguirre, C.E., was hired by FICT in 2014 as a part-time lecturer of the course of Fluid Mechanics FICT01651 and the course of Technical Drawing and Plans. She is a civil engineer graduated from ESPOL. She currently works for INSTALASA GROUP that specialize in the design and construction of water and sewage facilities. She is a member of the Association of Civil Engineers of Guayas Province (CICG – Acronym in Spanish)

- Fabián Peñafiel-Torres, MBA., C.E., was hired in 2013 to teach the Professional Legislation, Civil Engineering Materials, and Construction Cost Analysis courses (after winning the respective public contest called by ESPOL). Mr. Peñafiel has a Master's in Project Management for Development from ESPAE (ESPOL). He owns a construction firm and therefore has participated in several CE projects as a contractor.

- Juan Carlos Pindo-Macas, M.E., is alumni of Mining Engineering and Mechanical Engineering, from ESPOL. He is currently enrolled in a Master's degree program in Mining Resources at the Universidad Politécnica de Catalunya (Spain). Mr. Pindo obtained a degree in Geographic Information Systems (GIS) from Santa Maria de la Rábida International University of Andalusia (Huelva, Spain) in 2005. Since 2007, Mr. Pindo has collaborated on various scientific publications involving mining engineering, early warning systems, mechanical engineering, topography, and GIS. He has been working on various consultancy projects for several years. Mr. Pindo is a member of the American Society of Mechanical Engineering (ASME) and the Society for Mining, Metallurgy and Exploration (SME).

- Richard Ramirez-Palma, MSc., was invited in 2015 to teach the course of Strength of Materials I and the course of Strength of Materials II. He is a part-time lecturer and a civil engineer graduated from ESPOL. He works on several projects related to his field of study, from elaborating plans and surveying to structural designs, sanitary design and construction. Nowadays he is an independent contractor with a wide area of specialization obtained by a good amount of years of experience.

- Carlos Rodríguez-Díaz, PhD., holds a Master of Science in Construction Engineering and Management and is a Doctor of Philosophy in Civil Engineering. Dr. Rodriguez, after graduating from ESPOL, worked at INTERAGUA. Afterwards, he studied for a Master's degree and Doctorate at the University of Florida (Gainesville, FL, USA). Dr. Rodriguez returned to ESPOL as a researcher-lecturer for the Construction, Technical Drawings and Plans, Construction Costs Analysis and Building Installation Systems courses, all of them belonging to the construction area, for which he currently serves as the leader. In addition, he has served as the mentor of the INECYC (Ecuadorian Institute for Cement and Concrete) Chapter at ESPOL and is the faculty advisor for the CESC (Civil Engineering Student's Club) currently working in the ASCE-ESPOL Student Chapter formation. He has several publications, and is the Research Coordinator for the FICT College. Dr. Rodríguez is an Associate Member of ASCE. Since January 2016, he has been coordinating activities for the CE program with regard to ABET accreditation candidacy.

- Pedro Rojas-Cruz, PhD., obtained his doctorate from Lehigh University (USA), and a Master's Degree from the State University of New York in Buffalo. He is specialized in structural steel engineering. He is a shareholder and staff member of CONSULTOLA, a reputed CE firm in Guayaquil (specializing in structural and earthquake engineering). He has participated in many projects in the city, including the Daule and Babahoyo bridges (2002 and 2008), and the design of several buildings (steel and concrete structures). He holds a diploma of specialist in welding inspection (from ESPOL). Currently, he is a faculty member of

the Catholic University of Guayaquil as well as ESPOL, where since 2005 he has been lecturing (part-time) for the Structural Design, Bridge Design, Structural Steel Design, and Strength of Materials courses. He is a member of the SEIS (Ecuadorian Society of Seismic Engineering).

- Alfonso Romero-Galarza, MSc., was hired in 2013 to teach the Applied Informatics course (GIS), after winning a public contest (called by ESPOL). Mr. Romero is a computer science and systems engineer. He has a Master's in Risk Management from the University of Guayaquil. Mr. Romero specialized in geographic information systems at the Universidad Distrital Francisco José de Caldas (Bogotá, Colombia). He is also a private consultant in the area of geomatics.

- Eduardo Santos-Baquerizo, MSc., has a CE degree from the University of Guayaquil, and a Master's in Higher Education from ESPOL (2004). He has been a lecturer in the following courses since 1994: Surveying (I and II), Road Design (I and II) and Construction. From 2006 to 2013 he was the CE program coordinator. He has extensive professional experience in transportation engineering and topography. Mr. Santos has been a CE consultant with several public and private contracts, as well as supervisor in some construction projects for ESPOL (within the campus). Currently, he is a part-time lecturer at ESPOL because he is serving as the Dean of the Civil Engineering College at the University of Guayaquil.

- David Stay-Coello, MSc., was invited in May 2015 to teach the Foundation Engineering and Soil Mechanic courses. He has a CE degree from the University of Guayaquil, where he also obtained a Diploma in Project Administration. He also has a Master's degree in Geotechnical Engineering, also from the University of Guayaquil. Mr. Stay is a member of the Ecuadorian Association of Consulting Companies (ACCE) and has been President of the Ecuadorian Chapter of ISSMGE since 2013 (International Society of Soil Mechanics and Geotechnical Engineering). He has taken numerous seminars, courses and conferences in different fields related to geotechnical engineering. Mr. Stay has participated as a consultant engineer in several design and construction projects with more than 25 years of experience in various areas of civil engineering.

- Daniel Toro-Castillo, C.E., graduated from our CE program in 2006. He was a teaching assistant (for several structural engineering courses) at ESPOL during his studies. In 2013, he was hired to teach Concrete Design, Strength of Materials and Civil Engineering Materials. Mr. Toro has participated in many related projects (bridges, tunnels, roads, buildings) in CONSULSÍSMICA, a well-known CE consulting firm in Guayaquil. He has attended seminars and taken courses in that field of study. In addition, he is a certified auditor of the ISO 9001-2008 Code, and is a member of the SEIS (Ecuadorian Society of Seismic Engineering).

- Luis Villavicencio-Cavero, C.E., was invited by ESPOL in 2013 to teach the Pre-stressed Concrete course, and again in 2014 the Concrete Technology course as well. In 2006, Mr. Villavicencio won the prize for the best graduation project for his work entitled "Use of the external pre-stressed elements for bridge design and construction" at the University of Guayaquil, where he served as a faculty member for several years. He works for a civil engineering firm, and is a private consultant in the design of pre-stressed concrete elements and bridges.

Table 6-1A. Faculty Qualifications (Full Time Faculty members)

Civil Engineering Program (ESPOL), 2015

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT, MT and PT [3]	Years of Experience			Professional Registration/ Certification[5]	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Ma. Lourdes Aburto-Osnaya	-Master in Bioclimatic urbanism, 2003. -Master in Urban Design, 2002. -Master in Architecture and Urbanism Projects, 2010.	I	NTT	FT	8 Govt./27 Ind.	20	1	SAPE	H	H	M
Julio Acosta-Vega	Master of Science in Civil Engineering, 2014	I	NTT	FT	0 Govt./6 Ind.	0	1	EIT	M	M	L
Alby Aguilar-Pesantes	Master of Science in Civil Engineering, 2004	I	NTT	FT	0 Govt./19 Ind.	9	9	CICG	M	H	L
Mijail Arias-Hidalgo	Ph.D. in Water Science and Engineering, 2012	ASC	TT	FT	1 Govt./10 Ind.	4	3	IAHR, IAHS, EGU, AGU,	H	H	M

								ASCE, CICG			
Davide Besenzon-Vanegas	Master in Civil Engineering, 2013	I	NTT	FT	0 Govt./4 Ind.	1	1	-------	L	M	M
Jorge Cedeño-Cuellar	Civil Engineer, 2009	I	NTT	FT	0 Govt./5 Ind.	1	1	-------	M	M	L
Natividad García-Troncoso	Master in Design, Management and Project Management, 2012	I	NTT	FT	0 Govt./5 Ind.	3	3	CICG, ACI	H	H	L
Ma. Isabel Montoya-Freire	-Master in Hydrology and Water Resources Management, 2010 -Master of Science in Civil Engineering specialization Hydraulics, 2013	I	NTT	FT	0 Govt./8 Ind.	1	1	CICG, IAHR	H	H	H
Juan C. Pindo-Macas	- Mining Engineer, 2007 - Mechanical Engineer, 2015	I	NTT	FT	0 Govt./8 Ind.	9	9	SME, ASME	H	H	H
Carlos Rodriguez-Diaz	Ph.D. in Civil Engineering, 2012	I	NTT	FT	0 Govt./4 Ind.	3	3	ASCE, LEED	H	M	H

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. At the institution
4. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.

Acronyms (Professional Associations):

AGU = American Geophysical Union.
ASCE = American Society of Civil Engineers.
ASME. American Society of Mechanical Engineering
CCG = Guayaquil Construction Association.
CICE = Civil Engineering Association of Ecuador.
CICG = Civil Engineering Association, of Guayas Province (Ecuador).
CIGMIPA = Geology, Mines and Petroleum Engineering Association of Guayas Province.
DIHK = German Ecuadorian Commerce Association
EGU = European Geosciences Union.
IAEE = International Association of Earthquake Engineering.
IAEG = International Association of Geological Engineering.
IAHR = International Association of Hydraulic Research.
IAHS = International Association of Hydrological Sciences.
ISRM = International Society of Rock Mechanics
LACCEI = Latin American and Caribbean Consortium of Engineering Institutions.
LEED = Leadership in Energy & Environmental Design.
SAPE = Landscape Architectural Society of Ecuador.
SEIS = Ecuadorian Earthquake Engineering Society.
SEMSIR = Ecuadorian Society of Soil Mechanics and Rocks.
SME. Society for Mining, Metallurgy and Exploration.
SIMSIG = International Society of Soil Mechanics and Foundation Engineering.
SNGRD = Regional Committee for Natural Disasters Management - Costa Rica.

Table 6-1B. Faculty Qualifications (Part Time Faculty Members)

Civil Engineering Program (ESPOL), 2015

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment [2] T, TT, NTT	FT, MT and PT [3]	Years of Experience			Professional Registration/ Certification [5]	Level of Activity [4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Hugo Egüez-Alava	Master of Science in Mineral Processing Engineering, 1987	ASC	TT	PT	0 Govt./25 Ind.	25	25	CICG	H	M	H
Miguel Chávez-Moncayo	Ph.D. in Technical Sciences, 2010	P	T (retiring)	PT	16 Govt./15 Ind.	39	38	CIGMIPA, CICE CCG, SEMSIR, SIMSIG, ISRM, IAEG, SEIS, IAEE, SNGRD, DIHK	H	H	H

Victor Fernandez-Soledispa	Master of Construction Management	I	NTT	PT	2 Govt./8 Ind.	1	1	------	M	H	H
Carola Gordillo-Vera	Master of Science (Road Management and Engineering), 2004	I	NTT	PT	4 Govt./11 Ind.	2	2	CICG	H	H	H
Francisco Grau-Sacoto	Master of Science in Civil Engineering specialization Geotechnics, 2014	I	NTT	PT	1 Govt./4 Ind.	1	1	------	H	H	L
Luis Jorda-Bordehore	Ph.D. of Science in Mines Engineering	I	NTT	PT	0 Govt./15 Ind.	4	2	SEDPGYM, COIMCE, IIMP, ISRM, AETOS, ACEBU	H	H	H
Erwin Larreta-Torres	Master in Risk and Disaster Management, 2010	I	NTT	PT	1 Govt./18 Ind.	5	1	------	M	H	H
Xavier Molina-Arce	Master of Science (Hydraulic and Environmental Engineering), 2014	I	NTT	PT	0 Govt./7 Ind.	1	1	IWA, AWWA	L	H	H
Guillermo Muñoz-Villa	Civil Engineer, 2004	I	NTT	PT	4 Govt./8 Ind.	1	2	CICG	M	M	H
Fabián Peñafiel-Torres	Master in Project Management for Development, 2009	I	NTT	PT	4 Govt./12 Ind.	1	2	CICG, CCG	H	H	H
Carlos Peña-Ochoa	Civil Engineer, 2009	I	NTT	PT	0 Gvt/. 8 Ind.	1	0	CICG	L	M	H

Pedro Rojas-Cruz	Ph.D. in Philosophy, 2003	ASC	TT	PT	0 Govt./20 Ind.	25	10	CICG SEIS ASCE ACI PCI CRSI	M	H	H
Alfonso Romero-Galarza	Master in Risk Management, 2012	I	NTT	PT	0 Govt./11 Ind.	3	3	------	M	M	H
Eduardo Santos-Baquerizo	Master in Teaching and Research for Education, 2004	ASC	TT	PT	14 Govt./32 Ind.	26	21	-------	H	M	H
David Stay-Coello	Master of Science in Geotechnical Engineering, 2015	I	NTT	PT	3 Govt./24 Ind.	1	1	CICG, ACCE	H	H	L
Daniel Toro-Castillo	Civil Engineer, 2006	I	NTT	PT	0 Govt./7 Ind.	3	3	SEIS	H	M	H
Luis Villavicencio-Cavero	Civil Engineer, 2005	I	NTT	PT	0 Govt./9 Ind.	7	2	CICG	M	H	H

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non Tenure Track
3. At the institution
4. The level of activity, high, medium or low, should reflect an average over the year prior to the visit plus the two previous years.

Acronyms (Professional Associations):

ACI = American Concrete Institute.
ACCE = Consulting Companies Association of Ecuador
ACEBU = Merchants and Entrepreneurs Association of Bustarviejo
AETOS = Spanish Association of Tunnels and Underground Works
ASCE = American Society of Civil Engineers.
AWWA = American Water Works Association.
CCG = Guayaquil Construction Association.
CICE = Civil Engineering Association of Ecuador.
CICG = Civil Engineering Association, of Guayas Province (Ecuador).
COIMCE = Mines Official School of Center Spain
CRSI = Concrete Reinforcing Steel Institute.
IIMP = Mining Engineers Institute of Peru
ISRM = International Society of Rock Mechanics
IWA = International Water Association.
PCI = Precast Concrete Institute.

SEDPGYM = Spanish Society for the Defense of the Geological and Mining Heritage
SEIS = Ecuadorian Earthquake Engineering Society.

Retiring Faculty

Due to the national regulations of the Higher Education Law (LOES), recently approved, faculty members aged 70 or above must retire. During 2014, Dr. Ottón Lara-Montiel (professor for the structural engineering area), Dr. Miguel Chávez-Moncayo and Dr. Carmen Terreros (both from the geotechnical engineering area) reached retirement age. The Higher Education Law in Ecuador (LOES, acronym in Spanish) states that professors reaching retirement age can finish the academic term that they are teaching. This means that for the first academic term of 2014, the CE program lost three faculty members. However, one of them, Prof. Chávez-Moncayo, has been re-hired under special contract conditions to teach three courses, and the capstone course. This option seems to continue to be open until suitable replacements for him are found.

Faculty Searches

The CE program is conducting open faculty searches for positions in geotechnics, construction materials and surveying. It is expected that these processes will be completed by late 2015.

Plan for recruiting new faculty

At the time of writing, the College is contacting potential candidates (including alumni) to replace the retiring faculty and to enhance the academic level of the faculty to move the CE department in the direction of graduate programs. Alternatively, several alumni (Table 6.2) are now pursuing MSc and PhD programs, with institutional support in different fields of civil engineering. Most of them have professional experience in CE fields and have shown deep interest in becoming full-time faculty once they complete their graduate studies. Simultaneously, seven (7) highly qualified recently graduated students have participated in the *Walter Valdano Raffo* scholarships program, an initiative of the Vice-rectorate to promote graduate studies thru financial assistant and graduate scholarships applications counseling. Most of these alumni participating in the program have obtained external scholarship and have been admitted to graduate programs. It is expected that these alumni (recently graduated) will return in the next 2 to 4 years to enlarge our faculty staff.

Table 6-2. Alumni pursuing graduate studies with institutional support.

LAST NAME, NAME	DEGREE PURSUING	FIELD	UNIVERSITY	EXPECTED GRADUATION
ACOSTA VERA ANDRES ANTONIO	Ph.D.	Structural Engineering	Stanford, USA	December 2020
EGUEZ ALAVA HUGO ERNESTO	Ph.D.	Materials / Concrete Technology	Ghent, Belgium	November 2016
GARCIA TRONCOSO NATIVIDAD LEONOR	Ph.D.	Structural Engineering	Imperial College, UK	2020
VELASTEGUI MONTOYA ANDRES DANILO	Ph.D.	Environmental Sciences	Federal University of Pará, Brazil	2020
MUÑOZ VILLA GUILLERMO	M.Sc.	Structural Engineering	Pontificia Universidad Católica, Chile	2017

Our College Dean has also prepared a Plan Generational Takeover for the next 15 years. This plan suggests to incorporate at least 5 fulltime tenured faculty. One in each of the following areas: Geotechnics/Soils Mechanics, Environmental/Sanitary Engineering, Construction Engineering, Road Design, and Structural Engineering.

B. Faculty Workload

Table 6.3 shows the faculty workload summary for the first academic term 2015 (as an example). The expected teaching workload is 2 to 3 courses per semester for full-time faculty, 2 courses per semester for half-time faculty, and one course per semester for part-time faculty (10 hours a week). However, there are exceptions. For instance, the CE coordinator teaches a maximum of two courses, given his/her large administrative workload (20 hours per week). All full-time and half-time lecturers have 4 hours per week for student academic advising. Other faculty members have research loads, depending on their availability (usually 10 hours per week).

C. Faculty Size

Currently, the faculty size is adequate (31) to teach the different courses of the curriculum as well as for student advising and counseling. The CE program faculty dedicates some time to service inside the university. In addition, some lecturers work for consulting firms or are owners/shareholders of civil engineering firms (construction/consultancy), which in turn employ alumni and provide opportunities for pre-professional internships. Other faculty members are taking MSc degrees in various areas of civil engineering. Despite the current adequacy of faculty size, new faculty members are still needed to provide assistance to existing faculty and to promote future CE graduate programs in areas such as construction management and structural engineering, among others.

D. Professional Development

ESPOL covers the registration expenses for courses/seminars offered locally or internationally to faculty members, depending on the budget. Activities such as meetings of the Ecuadorian CE programs are financed (air transportation and accommodation when applicable). Table 6-1C shows the courses that faculty members have taken with institutional support. A further description of institutional support for professional development is detailed in Criterion 8, Section E.

Table 6-1C Professional Development.

Name	Capacity	Topic	Destination	Date/Duration	
Carlos Rodriguez-Diaz	Conference	ASCE Global Engineering Conference	New York, USA	From	11-Oct-15
				To	14-Oct-15
Mijail Arias-Hidalgo	Seminar	ABET-IDEAL Accreditation Course	Baltimore, USA	From	2-Aug-14
				To	8-Aug-14
Mijail Arias-Hidalgo	Conference	Latin-American IAHR Conference. Program of Faculty Members' Training.	Santiago de Chile, Chile	From	24-Aug-14
				To	1-Sep-14
Alby Aguilar-Pesantes	Course	Water-Treatment Plant Assessment	City of Mexico, Mexico	From	20-Oct-14
				To	24-Oct-14

Carlos Peña-Ochoa	Summer school	Continuous training, postgraduates studies, curricula, technology, professional orientation	Santiago de Chile, Chile	From	11-Jan-15
				To	18-Jan-15
Fabián Peñafiel-Torres	Summer school	Continuous training, postgraduates studies, curricula, technology, professional orientation	Santiago de Chile, Chile	From	11-Jan-15
				To	18-Jan-15
Carola Gordillo-Vera	Conference	Conservation and recycling of pavements	Paris, France	From	21-Feb-15
				To	26-Feb-15
Mijail Arias-Hidalgo	Symposium	ABET – 2015	Atlanta, USA	From	21-April-15
				To	25-April-15
Mijail Arias-Hidalgo	Conference	V Congreso Internacional de Potamología "José Antonio Maza"	Querétaro, México	From	22-Jul-15
				To	24-Jul-15
Pedro Rojas-Cruz	Conference	STESSA 2015 – Steel Structures in Seismic Areas	Shanghai, China	From	1-July-15
				To	4-July-15

E. Authority and Responsibility of Faculty

The Dean of FICT is responsible for the development and implementation process for the evaluation, assessment, and continuing improvement of the program. The Dean provides the support to carry out the assessment processes. The Dean also carries out negotiations with the Rector[1] regarding the funding required for CE program development, in terms of faculty and infrastructure. The Associate Dean is responsible for presenting the Annual Academic Planning (divided by academic terms) to the FICT Council. This plan details the allocated workload per faculty member, including activities such as teaching, advising, outreach, research and administrative duties. The Associate Dean and the CE Program Coordinator are responsible for the assessment of student outcomes (SOs), as well as for revising the selected course portfolios with evidence (prepared by the corresponding faculty).

CE faculty members are in charge of performing the assessment and evaluation of the attainment of the course outcomes and for the assessment of the SOs as requested by the Program Coordinator. Moreover, faculty members are responsible for recommending improvements, implementing them, measuring their effectiveness and reporting the results of the implementation of the measures. In this regard, firstly, each (appointed) faculty member has to prepare a course portfolio for each (selected) course he/she teaches, including a reflection on the assessment results (analysis section of the portfolio). Instructors then propose the changes they deem necessary in the courses they teach, including changes to content, pre-requisites and assessment tools, during faculty meetings. In the case that modifications to the academic curriculum, SOs or program educational objectives (PEOs) are needed, faculty members are the first to justify and approve such changes. The final document is then submitted to the FICT College Council for consideration and approval. Finally, these modifications or the improvement activity plan are confirmed by the Academic Council and Governing Board of ESPOL.

[1] [1] The position of Rector is similar to the President in the US university system.

Table 6-3. Faculty Workload Summary

Civil Engineering, 2015-2016

Faculty Member (name)	FT or PT[1]	Classes Taught (Course No. /Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	
Ma. De Lourdes Aburto-Osnaya	FT	2015-2 : FICT03210/8, FICT03244/4	82	0	82	100
Julio Alejandro Acosta-Vega	FT	2015-2 : FICT03392/4 ,FICT03012/4	41	0	59	100
Alby Aguilar-Pesantes	FT	2015-1: FICT02972/8, FICT03475/4 2015-2: FICT03012/4, FICT03020/4,	31	15	54	100
Mijal Arias-Hidalgo	FT	2015-1: FICT02915/4 2015-2: FICT02873/4	19	12	69	100
Claudia Basantes-Espinoza	FT	2015-1: FICT02725/4, FICT03210/5	35	20	45	100
Arnaldo Bayona-Malo	PT	2015-2: FICT02998/4	100	0	0	25
Davide Besenzon-Vanegas	FT	2015-2: FICT03376/8, FICT02964/4	100	0	0	100
Jorge Cedeño-Cuellar	FT	2015-1: FICT03210/5, FICT03236/4 2015-2: FICT03392/4	23	0	77	100
Miguel Chávez-Moncayo	PT	2015-1: FICT04341/6 2015-2: FICT04341/6, FICT02964/4	80	0	20	50
Hugo Egüez-Alava	PT	Currently abroad pursuing a PhD in Belgium	-	-	-	-
Víctor Fernández-Soledispa	PT	2015-2: FICT02865/8, FICT03244/4	44	0	56	50
Natividad García-Troncoso	PT	2015-1: FICT03202/8, FICT03236/4 2015-2: FICT03202/8	86	0	14	50
Carola Gordillo-Vera	PT	2015-1: FICT03400/4 2015-2: FICT03426/4	74	0	26	25
Francisco Grau-Sacoto	PT	2015-1: FICT02881/8 2015-2: FICT02295/4, FICT02923/4	83	0	17	25
Luis Jordá-Bordehore	PT	2015-1: FICT01057/4	74	0	26	50
Erwin Larreta-Torres	PT	2015-1: FICT02725/4 2015-2: FICT02725/4, FICT02899/8	74	0	26	25

Xavier Molina-Arce	PT	2015-1: FICT01651/8 2015-2: FICT01651/8	83	0	17	100
Ma. Isabel Montoya-Freire	FT	2015-1: FICT02873/4, FICT02915/4 2015-2: FICT02873/4, FICT02915/4	29	0	71	25
Guillermo Muñoz-Villa	PT	2015-1: FICT02592/8 2015-2: FICT02550/8	85	0	15	50
Diana Navarrete-Aguirre	PT	2015-1: FICT01651/4, FICT03210/5	85	0	15	25
Carlos Peña-Ochoa	PT	2015-1: FICT02865/8, FICT03384/4	89	0	11	25
Fabián Peñafiel-Torres	PT	2015-1: FICT03285/4, FICT03335/4, FICT04341/3 2015-2: FICT03293/6, FICT03285/4	88	0	12	50
J. Carlos Pindo-Macas	FT	2015-1: FICT3384/4 2015-2: FICT03384/8	44	40	16	100
Richard Ramirez-Palma	PT	2015-2: FICT02907/4, FICT02865/4	100	0	0	25
Carlos Rodríguez-Díaz	FT	2015-1: FICT03335/4, FICT03210/5 2015-2: FICT02998/4, FICT03244/4	34	47	19	100
Pedro Rojas-Cruz	PT	2015-1: FICT03269/4, FICT03343/4 2015-2: FICT03038/4	58	0	42	50
Alfonso Romero-Galarza	PT	2015-1: FICT03228/15 2015-2: FICT03228/10	88	0	12	50
Eduardo Santos-Baquerizo	PT	2015-1: FICT03400/4 2015-2: FICT03426/4	73	0	27	25
David Stay-Coello	PT	2015-1: FICT01057/4, FICT02881/4 2015-2: FICT02923/4, FICT02295/4	87	0	13	25
Daniel Toro-Castillo	PT	2015-1: FICT02956/8, FICT03459/4 2015-2: FICT02907/4, FICT02931/4	87	0	13	25
Luis Villavicencio-Cavero	FT	2015-1: FICT03269/4, FICT03343/4 2015-2: FICT03004/8	45	0	55	50

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the Self-Study Report is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution

CRITERION 7. FACILITIES[2]

A. Offices, Classrooms and Laboratories

Each full-time Civil Engineering (CE) faculty member has an assigned office equipped with air conditioner, a desk, a computer, peripherals and wired or wireless internet access. Part-time lecturers do not have private offices.

Additionally, the program facilities include:

- Two classroom buildings; each classroom is equipped with a projector and a computer.
- An auditorium (capacity 60 people) equipped with a projector. The auditorium is mainly used for conferences, seminars and workshops.
- A conference hall used for College meetings and graduation project defenses.
- A library (an extension of the ESPOL Central Library) with worktables for students and a computer with access to research databases; administrative staff are in charge to monitor the book loans, and ensure an appropriate environment within the library facilities.

The main laboratory of the CE program is the Soils Mechanics Laboratory. It is used for the courses: FICT02881 (Soils Mechanics I), FICT02923 (Soils Mechanics II), FICT03202 (Concrete Technology), FICT03400 (Road Design I) and FICT03426 (Road Design II). Appendix C shows a detailed inventory of this facility.

The Sanitary Engineering Laboratory has been recently equipped and furnished, it serves for the laboratory and experimental sessions of the courses FICT02972 (Sanitary Engineering I), and FICT03012 (Sanitary Engineering II).

Moreover, the CE program also uses the Thermo-fluids laboratory at the College of Mechanical Engineering and Production Sciences (FIMCP, acronym in Spanish), for the course FICT01651 (Fluid Mechanics). Its inventory is in Appendix C.

As for the FICT02915 course (Hydraulics), the CE program request the cooperation of the Hydraulics facility at the Mathematics and Physics College of the University of Guayaquil. At the moment of preparation of the present document, the procurement activities for acquiring a channel for the Hydraulics laboratory at ESPOL are undergoing.

The LEMAT (acronym in Spanish for Materials Testing Laboratory) at the College of Mechanical Engineering and Production Sciences brings support to Strength of Materials I (FICT02865) and Strength of Materials II (FICT02907) by providing the facilities to use a Universal Testing Machine to better understand tensile characteristics of materials and to more effectively demonstrate characteristics of bending.

B. Computing Resources

The CE program has one computing facility at the College of Geosciences (FICT, acronym in Spanish) to be used by courses that require computing practice sessions. These include FICT03210 (Technical Drawing and Plans), FICT03228 (Applied Informatics) and FICT03426 (Road Design 2). Additionally, students can also have access to the lab upon request and

[2]Includes information regarding facilities at all sites where program courses are delivered.

approval of the Dean. The computing site has a capacity to accommodate 20 students (desktop computers), and includes a projector for lectures. Every computer has wired internet access and the software used by several courses, such as Microsoft Office, Matlab and educational versions of Autocad and ArcMap. The computing sites at FICT are open only during the official academic terms (May to September and October to March). In order to do their course assignments or study, CE students also use the Library and Information Center (CIB, acronym in Spanish) facilities (also known as the Central Library, whose features are detailed in section 8.E).

In general, the entire ESPOL campus has access to the internet via a wireless connection, which requires an ESPOL virtual account (user and password). Every student, faculty member and administrative staff member has an ESPOL account. There are also temporary accounts for guests. Several CE students have personal laptops and other electronic devices (tablets, smartphones) to navigate the web.

At CIB (www.cib.espol.edu.ec) there are five computer sites available, all of them equipped with computers and software to aid students in the completion of homework and projects; this also includes access to some online databases. The time of loan of the equipment and the type of information students are able to access are managed by an in-house developed software (SMALC). Additionally, these labs are often booked for practical sessions of some CE courses, for instance, Road Design II (FICT03426).

The Center for Informatics Services (CSI, acronym in Spanish; www.csi.espol.edu.ec) is in charge of arranging all acquisition and maintenance of software licenses required for institutional use.

ESPOL uses an online platform (SIDWEB, www.sidweb.espol.edu.ec) to support academic interactions between faculty and students, especially enabling lecturers to organize their course activities. SIDWEB also allows faculty to upload grades - although the official website for managing grades is the Student Academic Information System (SAAC, acronym in Spanish: www.profesor.espol.edu.ec) - organize group work, publish announcements, manage course content, post syllabi and administer online quizzes, amongst other things.

C. Guidance

When beginning a study program at ESPOL, students are required to go through several guidance sessions, both at university level and at college level. In each one of these sessions, students receive key information about the services the institution offers, for example, places where they can eat, in-campus transportation regulations, online services, and other issues pertaining to their academic life.

Overall safety guidance is taught in the Basic Workshop class, and students typically receive an induction on this topic when they first go into a lab (technical or computing). Lecturers, teaching assistants and/or lab staff are in charge of giving students instructions on how to use the equipment and on safety rules when students have to use new equipment and instrumentation.

At the FICT College, there is a general regulation regarding equipment loans. Copies of this regulation can be found in several locations/noticeboards across the college (for example, in classrooms, the college secretariat, laboratories and the college custodian office). Every request must be approved by the Dean or his/her representative. Users are fully responsible for the proper use, adjustment and functioning of all equipment in their custody. Those needing equipment for course practices take precedence.

D. Maintenance and Upgrading of Facilities

Annually, ESPOL requests that every academic program prepare a list of laboratory equipment required to ensure that laboratories and libraries remain fully equipped and up-to-date. Such demands (after revision and approval by the Rector) are included in the FICT annual operating plan (POA, acronym in Spanish) and the annual procurement plan (PAC, acronym in Spanish). Every need is met depending on the availability of funds, considering both ESPOL resources and the possibility of external funding (e.g. from SENESCYT or foreign programs). For instance in Ecuador, for public universities classified as "Category A" (meaning "excellency", as currently is the case of ESPOL) there is a special budget from the National Secretariat for Higher Education, Science, Technology and Innovation (SENESCYT, acronym in Spanish) aimed at the improvement of laboratory facilities.

Regarding the maintenance and operation of equipment and computing resources, the CE program has an annual plan for the Soil Mechanics laboratory and Sanitary Engineering Laboratory. In those plans, periodic maintenance, replacement of parts, calibration procedures, and repair recommendations for the main equipment are detailed. Maintenance to the most expensive equipment is prioritized.

E. Library Services

The ESPOL library system is comprised of the CIB (the Central Library) and its associated libraries in each academic unit (e.g. colleges, institutes, schools and Office of Undergraduate Admissions). Facilities provided by the Central Library include:

- Virtual and video library
- Auditorium for multiple use with a 250-person capacity.
- Journal library (with subscriptions to 34 journals).
- Rooms (4) for audiovisual projection with a capacity of up to 5 people.
- Twenty study cubicles, equipped with computers with internet access for study meanings and homeworks.

Students are able to check the available bibliography through CIB terminals located in every library.

In 2013, ESPOL purchased access to online databases related to the fields of the programs offered at the institution. Currently, both students and faculty can order scientific publications belonging to the IEEE, SpringerBook, ProQuest, Science Direct (Elsevier), EBL, COSPivot and JSTOR academic databases for free. These subscriptions are available only within the Campus facilities (through wired or wireless modes).

In order to purchase new books, College Deans must submit a list of the books needed by every program to the CIB. The list is then submitted to the Rector, who in turn approves the purchase depending on budgetary availability. The FICT college library covers every area of the CE program (currently, there are 183 purchased and 915 donated books) as well as basic sciences, engineering, and other books related to our program. In total, the existing library collection available at ESPOL is adequate for the number of students (currently more than 500 in CE) and the taught courses. However, as an opportunity for continuous improvement, and as part of the curricula reform (2016), our library collection will be updated in accordance with the new program syllabi.

F. Overall Comments on Facilities

In general, CE facilities are adequate for the normal operation of the program, and will soon be enlarged or upgraded to improve the current situation. The classrooms are sufficient in number as are the computer labs (at FICT and CIB-ESPOL). Additionally, in order to ensure their proper use and safety during every lab session, the CE program has issued general usage and safety guidelines. These norms are published at several locations inside and outside a lab, as follows:

a) At the entrance to the lab facilities.
b) To perform a lab session (students are reminded before every session)
c) To close the lab facilities
d) Safety rules (students reminded before every lab session). Funds for safety gear have been requested by the FICT Dean from the central authorities of ESPOL.
e) Equipment loans and general use of lab facilities.

These regulations apply to the computing site as well. In any case, the Dean authorizes the use of facilities (when not referring to a standard course), and informs the laboratory assistant to proceed. Opening hours for the use of laboratories are published outside each facility. Finally, students can request laptops on loan, only at the CIB facilities, upon availability by filling in a registration form.

Recent renovations and acquisition of equipment

CE Soil Mechanics Laboratory

The Soil Mechanics lab underwent a major upgrade in equipment in early 2015 for a total amount of $ 108,515.24 (See Appendix C for more details of its current inventory). In addition, new equipment (the budget is over US$ 17,000.00) arrived by late 2015.

CE Surveying equipment

Several equipment to conduct practices in the Surveying courses are being incorporated by the FICT College, and are expected by late 2016 coming from Consultancy projects in which the college was involved.

CE Sanitary Engineering Laboratory

Several pieces of equipment have been requested from ESPOL to develop a pilot Sanitary Engineering Laboratory, the main components of which are listed in Appendix C, arrived in several parts during 2015, and accounting for a total budget of US$ 43,733.11.

CE Hydraulics Laboratory

Regarding equipment for a new Hydraulics Lab, the items (Appendix C) have been formally requested from ESPOL authorities, the approved budget for the acquisition of this equipment is $163,621.32. Procurement of the equipment is at this moment following the purchasing procedures required for public institutions at Ecuador. It is expected to be implemented by late 2016.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

The CE Program Coordinator leads all academic and administrative affairs and informs FICT's highest organism (the College Council) of any issues on those matters. This Coordinator is a full- time faculty member, appointed by the Dean. The CE Coordinator's responsibilities include annual academic planning, budgeting, leading faculty meetings, handling student applications for curriculum completion certificates, and program shifting. Additionally, the ABET Coordinator collaborates with the CE Coordinator to plan program assessment and evaluation tasks. The CE Coordinator is the point of contact for the program and is the main person responsible for supervising the status of decisions taken during faculty meetings about the future of the program.

B. Program Budget and Financial Support

Like other Ecuadorian public universities, ESPOL relies on government funding as the most important component of its annual budget. Additionally, as a "Category A" accredited university, ESPOL receives special financial support from the Ecuadorian Government.

Governmental regulations mandate that all public universities submit their budgets for governmental approval. ESPOL's budget preparation process involves the consideration of each College's budget. For this matter, the FICT Dean requires all program coordinators to create a list of the needs for the incoming year in terms of maintenance costs, and the expansion of laboratories and other facilities. The Dean compiles these needs and submits a College budget to the Rector, who approves it according to the availability of annual governmental funds. In ESPOL, the Rector is the chief administrative officer and decides on the financial affairs as well.

Although the CE Program is highly dependent on ESPOL's support, it does receive other revenue from research grants and contracts for consultancy activities (both public and private).

The CE program budget for the fiscal years of 2013, 2014, and its projection for 2015, is presented Table 8-1:

Table 8-1 Budget of the CE Program (in US Dollars)

	Items	2014	2015	Projection (2016)
Operation	Professional development	9,356.38	10,045.85	10,548.14
	Maintenance and small spare parts	23,864.13	5,781.70	12,994.42
	General office supplies	7,377.49	1,077.56	6,600.00
	Travel costs for conferences & meet.	1,297.75	4,174.62	4,383.35
	Scholarships of excellence	20,760.00	20,760.00	54,115.00
	Utilities, internet and security	283,583.45	77,957.32	81,855.19
	Technical visits transport	2,350.00	2,594.64	2,724.37
	ABET Evaluation Visit			10,256.41
	Total operation (US Dollars)	*348,589.20*	*122,391.69*	*183,476.89*
Investment	Buildings	0	0	108,807.00
	Equipment and tools	64,192.15	119,720.90	213,778.86
	Computing (hardware and software)	2,800.39	8,042.00	0
	Books	0	0	29957
	Total investment (US Dollars)	*66,992.54*	*13,152.06*	*352,542.86*
	TOTAL (US Dollars)	*415,581.74*	*135,543.76*	536,019.75
	Staff Budget			
		2014	**2015**	**2016**
	Faculty	496,866.72	750,942.57	853,900.92
	Administrative staff	75,163.03	78,465.51	78,465.51
	Teaching assistants	16,742.96	41,098.66	43,153.59
	Total (US Dollars)	***1,004,354.44***	***1,120,661.35***	***1,511,539.77***

ESPOL's Center for Educational Research and Services (CISE, acronym in Spanish) offers several courses to support the faculty's ongoing professional development. Some of the topics covered in these courses include "Learning methodologies for higher education", "The use of new technologies for pedagogy", "Ethics", "Research-based learning", and "Entrepreneurship". Although these courses are open to all faculty, attendance is mandatory for lecturers that have scored below 70% in the Student Evaluation of Teaching survey for two consecutive semesters.

Teaching and laboratory assistants (TAs) are available for several courses. The number of assistantships available is based on the characteristics of the courses that require TAs. Some criteria used to allocate assistantships are: the failure rate of the course, its complexity, and the number of practical sessions. The total number of teaching-assistant hours and laboratory assistants assigned to the faculty also depends on the annual budget. Courses with laboratory or practical credits take priority in the allocation of TAs. Program coordinators analyze the needs for assistantships and present them to the Vice Dean.

Regarding teaching and laboratory assistantships, FICT's Vice Dean coordinates the calling and selection of the applicants at the beginning of each semester. TAs are selected considering their grade point average and final grade in the specific course he/she is applying for. The TAs

duties include problem-solving sessions for students, assisting them during office hours, and collaborating with faculty during lab/computing practices. In the term 2015-1, there were 11 part-time teaching assistants, 2 administrative part-time assistants, and 1 part-time laboratory assistant, resulting in 105 hours per week of assistantships.

As described earlier, depending on the life-time of equipment and specifications, the CE Program must declare its needs regarding the regular, periodic, or emergency maintenance, restoration or reconstruction of equipment parts. The Dean compiles the needs of all the programs and submits it to the Rector, who approves it depending on financial availability. Following the approval of the Rector, the CE program and the FICT College authorities elaborate both the operative and purchase annual plans (POA & PAC, acronyms in Spanish). Budget execution, infrastructure upgrades, and equipment acquisition are carried out by the Administrative Management Department, the Physical Infrastructure and Planning Management Department (PIPM), and the Acquisition Unit (AU) respectively, according to the specific requirements of the CE PAC.

There is a plan to increase the number of teaching laboratories, facilities, and equipment of the CE Program. The implementation of this plan should lead to improved results for the attainment of the following Student Outcomes (SO): SO_a (for instance, classrooms), SO_b (Soil Mechanics & Concrete Lab, Holcim Concrete Lab facilities, Sanitary Engineering equipment), SO_c (Holcim Concrete Lab facilities), SO_d (Surveying equipment), SO_h (Technical visits), SO_k (CIB facilities & Computing lab), among others.

More details about the current and expected lists of equipment can be found in Appendix C.

C. Staffing

Administrative support for our program is provided by the FICT staff (Appendix D, Table D.2) which is comprised of two secretaries, two administrative assistants, one logistic support officer, three janitors, and two laboratory assistants. The staff is adequate in both number and training for the moment. However, given a noticeable increasing number of students, it is necessary to enlarge the number of Faculty as well. Additionally, the annual operative plan includes a set of activities for their ongoing professional development.

In order to process documentation, and carry out several administrative tasks in our College, and also ensure that students will be able to access computing sites (beyond lecture times), it will be necessary to increase the number of administrative staff (such as secretaries and assistants). Currently, the FICT Dean is requesting support from the ESPOL authorities with respect to this.

D. Faculty Hiring and Retention

The following laws regulate the recruitment process of faculty (lecturers/researchers): the LOES (the Organic Law of Higher Education in Ecuador), its Faculty Promotion statute, and the Statute of Career and Promotion of Faculty at ESPOL (4311). Additionally, these legal codes specify the requirements for faculty to achieve tenure, higher academic levels and professorship.

The process of recruitment of tenure-track faculty starts within the program. The Program Coordinator, in consultation with faculty members, requests the hiring of faculty either as a request for a particular position or as a part of a plan for filling a number of positions for the upcoming academic year. In this context, a yearly academic plan is proposed by the Program Coordinator to FICT's authorities, who submit it for the consideration of the College Board. The College Board then submits the request to the Academic Board for its analysis. Given

financial availability, the Polytechnic Council (Governing Board) makes a public call for academic hiring. The coordination of this process is the responsibility of an evaluation committee comprising of three full-time professors from ESPOL (appointed by the Rector, Vice Rector, and the Geosciences College Board, respectively) and two external professors from other Ecuadorian universities. After the evaluation committee conducts an exhaustive evaluation of each candidate's academic merits and reports the results to the Polytechnic Council, the latter announces the winner and grants appointment.

Regarding faculty retention strategies, ESPOL encourages participation in academic events where faculty members present the results of their academic work, and covers the expenses associated with such participation. ESPOL also encourages the involvement of their faculty in high level consulting work within the industry. Under this scheme, faculty members are not only able to augment their income, but also able to gain industrial exposure. In turn, this may lead to better research opportunities for the involved faculty, and hence could lead to scientific or technical publications, a key requirement for career advancement. In this regard, ESPOL is continuously searching for opportunities to ensure our faculty properly progress towards tenure status, and thereby attain salaries at the top of the pay scale.

Moreover, ESPOL grants temporary leave to faculty invited by the central or local government to collaborate in ministries or other types of public positions. In this way, the institution seeks to encourage faculty members to gain professional experience and connections within the engineering world.

E. Support of Faculty Professional Development

The Director of Foreign Relations (RELEX, acronym in Spanish) is in constant communication with academic staff regarding funding opportunities, international degree offerings, and workshops, seminars, internships and congresses that will enhance the academic progress of faculty members. Furthermore, faculty members seeking connections with peers have the support of a network of prior contacts built up by RELEX.

As a complement to what was described earlier in Criterion 6 of this report, ESPOL's faculty also receive institutional financial support for travel to participate in technical events and conferences, local seminars and professional development activities as well as for sabbatical leave. According to ESPOL's regulations, sabbatical leave is only for tenured faculty. Every tenured faculty member may apply for a sabbatical of up to one year after six years of uninterrupted work at the university. The institution provides financial support to cover travel and living expenses during that period. Usually, due to budget limitations, the university grants this leave to one member of the whole College (FICT) at a time. Finally, SENESCYT offers special scholarships for faculty to pursue post-graduate studies (MSc, and PhD degrees). To complement this, ESPOL sponsors these faculty members by means of a monthly wage while studying abroad.

PROGRAM CRITERIA

The following table shows how all ABET CE program criteria are fulfilled by our courses. More detail about the content of each course is provided in the appendix A (syllabi). In appendix B, there are more information about qualifications of Faculty who teach courses that are primarily design.

	Program Criteria	Course Code	Course name
Curriculum	Differential equations	ICM01941	Differential Calculus
		ICM01958	Integral Calculus
		ICM03376	Differential Equations
	Applied Mathematics	ICM00604	Linear Algebra
		ICM00166	Statistics
		ICM01966	Multivariable Calculus
		ICM00158	Numerical Analysis
		ICM00794	Computing Fundamentals
	Calculus-based physics	ICF01099	Physics A
		ICF01107	Laboratory of Physics A
		ICF01115	Physics B
		ICF01123	Laboratory of Physics B
		ICF01131	Physics C
		ICF01149	Laboratory of Physics C
	Chemistry	ICQ00018	General Chemistry I
	One Additional Area of basic Science:	FMAR04093	Biology
	Area of Civil Engineering: Geotechnical Engineering	FICT03376	Introduction to Geotechnical Engineering
		FICT02881	Soil Mechanics I
		FICT02923	Soil Mechanics II
		FICT01057	Rock Mechanics
		FICT02295	Foundation Engineering
	Area of Civil Engineering: Hydraulics	FICT03228	Applied Informatics
		FICT01651	Fluid Mechanics
		FICT02873	Hydrology
		FICT02915	Hydraulics
	Area of Civil Engineering: Structural Engineering	FICT03384	Statics / Dynamics
		FICT02865	Strength of Materials I
		FICT02907	Strength of Materials II
		FICT02931	Reinforced Concrete Design I
		FICT02956	Reinforced Concrete Design II
		FICT02592	Structural Analysis I
		FICT02550	Structural Analysis II
		FICT03004	Prestressed Concrete Design
		FICT03269	Structural Design
		FICT03343	Structural Steel Design
		FICT03392	Civil Engineering Materials

	Area of Civil Engineering: Construction	FICT03210	Technical Drawing and Plans
		FICT03202	Concrete Technology
		FICT03335	Construction Cost Analysis
		FICT03293	Professional Legislation
		FICT03244	Building Installation Systems
		FICT02998	Construction
	Area of Civil Engineering: Sanitary-Environmental	FICT02972	Sanitary Engineering I
		FICT03012	Sanitary Engineering II
		FICT03020	Environmental Engineering
	Area of Civil Engineering: Transportation Engineering	FICT02725	Surveying I
		FICT02899	Surveying II
		FICT03400	Road Design I
		FICT03426	Road Design II
	Conduct civil engineering experiments and analyze and interpret the resulting data (Student Outcome: B)	ICM00166	Statistics
		ICF01107	Laboratory of Physics A
		ICF01123	Laboratory of Physics B
		ICF01149	Laboratory of Physics C
		ICQ00018	General Chemistry I
		ICQ01222	Ecology and Environmental Education
		FICT03376	Introduction to Geotechnical Engineering
		FICT03392	Civil Engineering Materials
		FICT02881	Soil Mechanics I
		FICT03228	Applied Informatics
		FICT03210	Technical Drawing and Plans
		FICT02865	Strength of Materials I
		FICT02725	Surveying I
		FICT02923	Soil Mechanics II
		FICT02899	Surveying II
		FICT03202	Concrete Technology
		FICT02907	Strength of Materials II
		FICT01651	Fluid Mechanics
		FICT02972	Sanitary Engineering I
		FICT03400	Road Design I
		FICT02873	Hydrology
		FICT03012	Sanitary Engineering II
		FICT02295	Foundation Engineering
		FICT03426	Road Design II
		FICT02915	Hydraulics
		FICT03020	Environmental Engineering
		FICT03244	Building Installation Systems
		FICT02998	Construction
	Design a system, component, or process in more than one civil	FICT02865	Strength of Materials I
		FICT02931	Reinforced Concrete Design I

	engineering context (Student Outcome: C)	FICT02972	Sanitary Engineering I
		FICT02956	Reinforced Concrete Design II
		FICT03012	Sanitary Engineering II
		FICT02295	Foundation Engineering
		FICT03004	Prestressed Concrete Design
		FICT02915	Hydraulics
		FICT03269	Structural Design
		FICT03343	Structural Steel Design
		FICT03293	Professional Legislation
		FICT03020	Environmental Engineering
		FICT03244	Building Installation Systems
		FICT02998	Construction
	Basic concepts in Management, business, public policy, and leadership;	ICHE03541	Entrepreneurship and Technological Innovation
		FICT03293	Professional Legislation
		FICT03335	Construction Cost Analysis
		FICT02998	Construction
	Explain importance of professional licensure	FICT03293	Professional Legislation
Faculty	Courses that are primarily design	FICT02295	Foundation Engineering
		FICT02931	Reinforced Concrete Design I
		FICT02956	Reinforced Concrete Design II
		FICT03004	Prestressed Concrete Design
		FICT03269	Structural Design
		FICT03343	Structural Steel Design
		FICT03244	Building Installation Systems
		FICT02972	Sanitary Engineering I
		FICT03012	Sanitary Engineering II
		FICT03038	Bridge Design
		FICT04341	CE Capstone course

Signature Attesting to Compliance

By signing below, I attest to the following:

That **Civil Engineering Program** has conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's *Criteria for Accrediting Engineering Programs* to include the General Criteria and any applicable Program Criteria, and the ABET *Accreditation Policy and Procedure Manual.*

David Matamoros-Camposano, Ph.D.

ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL
FACULTAD DE INGENIERÍA EN CIENCIAS DE LA TIERRA

David Matamoros C., Ph.D.
DECANO

Signature **June 30th, 2016**