

CURRICULUM PROPOSAL FORM 2001-2002

NEW PROGRAMS, MAJOR PROGRAM REVISIONS, AND PROGRAM NAME CHANGES PROCESS C

\*DEADLINES: Deadline dates for 2001/2002 submissions: Regular proposals: October 19, 2001 to be implemented in Fall 2002; Short-Term proposals: December 7, 2001 to be implemented in Fall, 2002; Regular proposals February 15, 2002 to be implemented in Spring, 2003; March 22, 2002 for short-term courses to be implemented in Spring 2003.

**PROPOSAL TITLE:** Changes to Civil and Environmental Engineering Degree Requirements

**SPONSOR(S):** Jess Everett, Ralph Dusseau, Kauser Jahan, Beena Sukumaran, Douglas Cleary, Joseph Orlins, Yusuf Mehta

**DEPARTMENT:** Civil and Environmental Engineering

**COLLEGE:**  
 IF LAS CHECK ONE:  History/Humanities  Math/Sciences  Social/Behavioral Sciences

Check One:  Undergraduate  Graduate

The attached *NEW PROGRAM/MAJOR PROGRAM REVISION/PROGRAM NAME CHANGE* proposal is best described by the item(s) checked.

New degree program

New Certificate of Graduate Study Program

New major

New minor

New concentration, specialization, or track

Major changes to degree requirements, major, minor, or certificate program.

Changes to name of college, school, department or degree

Quasi Curricular

**DEPARTMENT**  
 (Signature indicates approval)

Dept. Curriculum Chair / Date Douglas B. Cleary 4/24/02

Dept. Chairperson / Date \_\_\_\_\_

**ACADEMIC DEAN (& Graduate Dean, for New Graduate Programs Only)**

Approved  Not Approved \_\_\_\_\_ Comments: *No increase in resource requirements*  
Academic Dean's Signature/Date *Waiame Roland 4/23/02*  
Graduate Dean's Signature/Date \_\_\_\_\_

**COLLEGE CURRICULUM COMMITTEE**

Approved  Not Approved \_\_\_\_\_  
Comments: \_\_\_\_\_  
Signature of College Chair/Date: *Kevin O'Doherty*

**UNIVERSITY CURRICULUM COMMITTEE**

Date of Open Hearing (if necessary) \_\_\_\_\_ Approved \_\_\_\_\_ Not Approved \_\_\_\_\_  
Comments: \_\_\_\_\_  
Curriculum Chair Signature/Date *Phillip A. Lewis*  
Date voted upon at Senate (if necessary) *5/14/02* Approved  Not Approved \_\_\_\_\_

**EXECUTIVE VICE PRESIDENT/PROVOST**

Approved  Not Approved \_\_\_\_\_ If no, reasons are as follows: \_\_\_\_\_  
Student Credit Hours \_\_\_\_\_ Faculty Load Hours \_\_\_\_\_ Equalized Credit Hours \_\_\_\_\_  
Official Copy & Approval Sheet Filed (Date): \_\_\_\_\_ Executive VP/Provost Signature/Date *[Signature] 11/7/02*

**REGISTRAR**

Date Approved Course Description Received \_\_\_\_\_ Hegis Taxonomy & Course Number Assigned \_\_\_\_\_  
Registrar Signature/Date *[Signature] 11/20/02*

**NOTIFICATION FORWARD**

Senate Curriculum Committee Chairperson  Academic Dean(s) *C.P. [Signature] 11-22-02*  
 Department Chairpersons  Registrar \_\_\_\_\_ Sponsor(s) \_\_\_\_\_

## Civil Engineering Degree Modification

### 1. Abstract

This document is used to propose major changes to the existing proposal is sponsored by Jess W. Everett. The changes describe concerns raised by ABET (the engineering accreditation organization) and by unbalance in enrollments in the two tracks currently offered. The Engineering degree is offered by the Civil and Environmental Engineering tracks at the College of Engineering. The proposed changes will collapse the civil and environmental tracks into one civil engineering degree track.

The primary changes proposed are: (1) replace Introduction to Civil Engineering with Introduction to Engineering Science; (2) replace science elective with Statistics I; and (3) require all students to take at least two structural and two environmental courses. Formerly, infrastructure track students were not required to take Environmental Engineering I and II, while environmental students were not required to take Structural Analysis and Design. Surveying, currently required in both tracks, is replaced by Surveying & Engineering Graphics. All students are required to take Geotechnical, Water Resources, and Transportation Engineering. Formerly, environmental track students were not required to take Transportation Engineering. All students are required to take 4 civil engineering electives. Formerly, environmental track students took 5 civil engineering electives. Accreditation rules require students to demonstrate proficiency in 4 areas of civil engineering. To achieve this in the proposed curriculum, students must use two of their civil engineering electives to complete courses in two of the following areas: geotechnical, water resources, and transportation.

No new courses are required for the proposed curriculum, but a number of course titles, numbers, and descriptions are changed. The new curriculum will be implemented starting in Fall 2002; note, it involves no freshman year class changes. In the 2003-4 academic year, sophomore year classes will reflect the new curriculum. In 2004-5, sophomore and junior classes will follow the new curriculum. Complete conversion to the new curriculum will be achieved in 2005-6. No new resources (staff or space) are required by the proposed changes. While the proposed curriculum is 131 semester-hours, 3 more than the current curriculum, efficiencies resulting from the collapse of two tracks into one result in the same number of courses and only a 1 workload-hour increase for Civil and Environmental Engineering faculty. It results in a 1 semester-hour and 2 workload-hour reduction for faculty in other units.

Major revision  
01-02-426

See

2. 11/1/01  
11/1/01

Change showing change =  
is attached

## **2. Details**

### *a. Title of Proposal:*

Civil Engineering Degree Modification

### *b. Sponsor:*

Jess W. Everett

### *c. Scope and Size of Program:*

No change: proposal concerns changes to existing degree

### *d. Need for Program:*

No change: proposal concerns changes to existing degree

### *e. Requirements for Admission and Graduation:*

No change for admission, graduation requirements are increased by 3 semester-hours.

### *f. Suggested Time and Scale:*

New curriculum should be applied to Freshman class starting in Fall 02. Complete conversion to the new curriculum will be achieved in 2005.

### *g. Resource Requirements:*

No new resources required.

### *h. Recommended Library Resources:*

Existing resources are sufficient.

### *i. Staffing:*

Existing staffing is sufficient.

### 3. Rationale

The changes described here are a necessary response to concerns raised by ABET (the engineering accreditation organization), industry stakeholders, and by recurring imbalances in enrollments in the two tracks currently offered by the program.

*ABET:* The Civil Engineering Degree was accredited for six years starting Fall 01. The final statement, transmitted to the President of Rowan University in a letter dated August 16, 2001 includes an evaluation of program weaknesses, concerns, and observations. Two are addressed through the proposed curricular modification, and are discussed here. First, ABET identified a weakness concerning probability and statistics, which in the current curriculum, is introduced to students primarily in Freshman Clinic I (0901.101) and Civil Engineering Systems (0908.305). While we were able to respond to this weakness (by showing that probability and statistics concepts were reinforced in other courses), it remains an officially stated ABET concern. The new curriculum addresses this concern by replacing a science elective (4 credits) with Statistics I (3 credits). According to the Course Catalogue, in Statistics I (1702.260)

[s]tudents learn to use frequency distributions, histograms, bar and line graphs, and measures of location and variability to describe data. The course considers elementary probability, and uses the binomial, normal, chi-square and t-distributions in estimation and hypotheses testing. It includes sampling techniques and the calculation procedure for linear regression and correlation. Use of graphics calculator is required; computer software may be used. Students are expected to have completed an equivalent of College Algebra.

Civil Engineering Systems will cover engineering aspects of probability and statistics as well other topics required by ABET, including engineering economics and scheduling. The courses typically taken as the science elective (Geology I, Organic Chemistry I, and Physics II) can still be taken as a technical elective.

Second, ABET observed that “[r]ecent efforts to integrate more computer-aided design and drafting into the civil engineering curriculum are commendable and are highly encouraged.” This has been done by designing homework assignments that require students to use computer-aided design and drafting software. However, through regular review of the program, faculty in Civil and Environmental Engineering have determined that further improvement of student skills is needed, and will be best accomplished by devoting some class time to specific instruction on AutoCad, one of the major computer-aided design and drafting software programs used by Civil and Environmental Engineers. This will be done by replacing Surveying (2 semester-hours) with Surveying & Engineering Graphics (3 semester-hours).

*Industrial Stakeholders:* As part of the process of preparing for ABET accreditation, Civil and Environmental faculty met with industrial stakeholders to discuss the Civil Engineering Degree. One concern raised by industrial stakeholders was the absence of dynamics in the curriculum. Dynamics is offered in most undergraduate civil engineering curriculums. According to the course catalogue, Dynamics (0901.291) is the

[s]tudy of kinematics and kinetics of a particle, including work-energy and impulse-momentum methods. Systems of particles are considered.

Kinematics and kinetics of plane motion of rigid bodies are introduced with respect to absolute and relative motions in various reference frames.

Concept of mass moment of inertia is introduced.

This concern is addressed by replacing Introduction to Environmental Engineering (2 credits) with Dynamics (2 credits). Introduction to Environmental Engineering is no longer needed, because the two-degree tracks are to be collapsed into one, justified below.

*Recurring imbalances in enrollments in the two tracks currently offered by the program:* Table 1 is used to present student enrollment by track.

Table 1: Student enrollment by track

Class of	Infrastructure	Environmental
2000	10	8
2001	7	1
2002	11	9
2003	15	4
2004	22	0

While the classes of 2000 and 2002 are balanced, the others are not. Collapsing the two tracks into one will better meet student interests and allow us to deliver our curriculum more efficiently and flexibly.

A number of changes were introduced in this section. The resulting curriculum provides are more broad-based and complete civil engineering degree.

## 4. Essence of the Program

### a. Major goals of the Program

The major goals of the program remain unchanged. They are repeated below, as presented in accreditation documents.

The Academic Department of Civil & Environmental Engineering (henceforth referred to as the Department of Civil and Environmental Engineering) strives to give civil engineering students the ability to understand and apply the core science, mathematics, and engineering principles that form the basis of civil engineering. This program aims to have students work individually and in multidisciplinary teams to identify and solve engineering problems using their accumulated knowledge and experience along with advanced technology such as computers and laboratory equipment. We will enforce the importance of ethics and professionalism, and the importance of global and societal issues in engineering practice. The Civil & Environmental Engineering Program strives to give students the ability to communicate effectively in preparation for both engineering practice and for graduate studies. We prepare students for professional careers by providing a broad based civil engineering education. This program will prepare civil engineering students for the pursuit of graduate degrees. Students will be exposed to a range of hands-on, standards-based, civil engineering laboratory experiences. Finally, we aim to give civil engineering students both individual and team-based design experiences taught by a diverse civil engineering faculty with professional engineering licenses and/or with appropriate education and design experience.

### b. Specific objectives of the Program

The major goals of the program remain unchanged. They are repeated below, as presented in accreditation documents.

Rowan Civil & Environmental Engineering graduates will be:

1. Knowledgeable, and able to remain current during their professional careers;
2. Problem-solvers, able to obtain needed information and identify, formulate, and solve problems;
3. Well rounded, understanding professional, ethical, and global/social issues and able to work in multidisciplinary and diverse groups; and
4. Communicators, able to disseminate information to professional and lay audiences.

c. Structure of Program

i. Identification of courses with brief description and credit hours for each.

Table 2 contains a list of the courses in the current and proposed curriculums.

Table 2: Current and proposed curriculums

Current Curriculum (infrastructure track)	Proposed Curriculum
<p>I. General Education 46 s.h.</p> <p>Communications 3 s.h.</p> <p>College Composition I (<i>College Composition II and Public Speaking have been approved for inclusion in the Sophomore Engineering Clinics</i>)</p> <p>Science and Mathematics 8 s.h.</p> <p>Calculus I (4 s.h.)</p> <p>Adv. College Chemistry I (4 s.h.)</p> <p>History, Humanities &amp; Languages 6 s.h.</p> <p>Social &amp; Behavioral Sciences 6 s.h.</p> <p>Microeconomics (3 s.h.)</p> <p>Arts 3 s.h.</p> <p>General Education Electives 20 s.h.</p> <p>Calculus II (4 s.h.)</p> <p>Physics I (4 s.h.)</p> <p>Computer Science and Programming (4 s.h.)</p> <p>Adv. College Chemistry II (4 s.h.)</p> <p>Science Elective (4 s.h.)</p> <p>II. Major Requirements 46 s.h. (Infrastructure track)</p> <p>Structural Engineering I (3 s.h.)</p> <p>Structural Engineering II (3 s.h.)</p> <p>Structural Engineering III (3 s.h.)</p> <p><b>Introduction to Environmental Engineering (2 s.h.)</b></p> <p>Civil Engineering Materials (2 s.h.)</p> <p>Water Resources Engineering (3 s.h.)</p> <p>Geotechnical Engineering (3 s.h.)</p> <p>Civil Engineering Systems (2 s.h.)</p> <p>Transportation Engineering (3 s.h.)</p> <p>Surveying (2 s.h.)</p> <p>Civil Engineering Electives (4) (3 s.h. each)</p> <p>Technical Elective (3 s.h.)</p> <p>Civil Engineering Design Project I and II (2 s.h. each)</p> <p>Civil Engineering Practice (1 s.h.)</p> <p>III. Other Engineering Courses 36 s.h.</p> <p>Math for Engineering Analysis I and II (4 s.h. each)</p> <p>Freshman Engineering Clinics I and II (2 s.h. each)</p> <p>Sophomore Engineering Clinics I and II (4 s.h. each)</p> <p>Junior Engineering Clinics I and II (2 s.h. each)</p> <p>Senior Engineering Clinics I and II (2 s.h. each)</p> <p>Statics (2 s.h.)</p> <p>Solid Mechanics (2 s.h.)</p> <p>Fluid Mechanics I (2 s.h.)</p> <p>Material Science (2 s.h.)</p> <p>IV. Total Credits in Program 128 s.h.</p>	<p>I. General Education 45 s.h.</p> <p>Communications 3 s.h.</p> <p>College Composition I (<i>College Composition II and Public Speaking have been approved for inclusion in the Sophomore Engineering Clinics</i>)</p> <p>Science and Mathematics 8 s.h.</p> <p>Calculus I (4 s.h.)</p> <p>Adv. College Chemistry I (4 s.h.)</p> <p>History, Humanities &amp; Languages 6 s.h.</p> <p>Social &amp; Behavioral Sciences 6 s.h.</p> <p>Microeconomics (3 s.h.)</p> <p>Arts 3 s.h.</p> <p>General Education Electives 19 s.h.</p> <p>Calculus II (4 s.h.)</p> <p>Physics I (4 s.h.)</p> <p>Computer Science and Programming (4 s.h.)</p> <p>Adv. College Chemistry II (4 s.h.)</p> <p>Statistics I (3 s.h.)</p> <p>II. Major Requirements 48 s.h.</p> <p>Structural Analysis and Design (3 s.h.)</p> <p>Analysis and Design of Steel Frames (3 s.h.)</p> <p>Environmental Engineering I (3 s.h.)</p> <p>Environmental Engineering II (3 s.h.)</p> <p>Civil Engineering Materials (2 s.h.)</p> <p>Water Resources Engineering (3 s.h.)</p> <p>Geotechnical Engineering (3 s.h.)</p> <p>Civil Engineering Systems (2 s.h.)</p> <p>Transportation Engineering (3 s.h.)</p> <p><b>Surveying &amp; Engineering Graphics (3 s.h.)</b></p> <p>Civil Engineering Electives (4) (3 s.h. each)</p> <p>Technical Elective (3 s.h.)</p> <p>Civil Engineering Design Project I and II (2 s.h. each)</p> <p>Civil Engineering Practice (1 s.h.)</p> <p>III. Other Engineering Courses 38 s.h.</p> <p>Math for Engineering Analysis I and II (4 s.h. each)</p> <p>Freshman Engineering Clinics I and II (2 s.h. each)</p> <p>Sophomore Engineering Clinics I and II (4 s.h. each)</p> <p>Junior Engineering Clinics I and II (2 s.h. each)</p> <p>Senior Engineering Clinics I and II (2 s.h. each)</p> <p>Statics (2 s.h.)</p> <p>Solid Mechanics (2 s.h.)</p> <p>Fluid Mechanics I (2 s.h.)</p> <p>Material Science (2 s.h.)</p> <p><b>Dynamics (2 s.h.)</b></p> <p>IV. Total Credits in Program 131 s.h.</p>

All of the courses in the proposed curriculum are current Rowan University courses. Descriptions are in the Undergraduate Catalogue. Minor changes are made to some Civil and Environmental Engineering courses, as described in Table 3. The only change to courses outside Civil and Environmental Engineering involves replacing the science elective (Geology I, Organic Chemistry I, and Physics II) with Statistic I. Science elective courses can still be taken as a technical elective.

Table 3: Minor changes to Civil and Environmental Engineering Courses

Current Course	Changes	Description*
<b>(a) Required Courses</b>		
Surveying & Planning (0908-402)	Change course description, number (to 0908-203) and title (to Surveying and Engineering Graphics)	Measurement and presentation of existing and man-made land profiles, drainage areas, distance measurements, angle measurements, elevation measurements, closing traverses, topographic surveys, and highway alignments.
Structural Engineering I <sup>†</sup> (0908-281)	Change course description, number (0908-481) and title (to Reinforced Concrete Design)	The design of reinforced concrete beams and introduces concrete framing systems.
Structural Engineering II (0908-382)	Change course description (0908-382) and title (to Structural Analysis and Design)	Methods of calculating deflections, moment area and conjugate beam methods, virtual work, and the force method of truss analysis, design of steel tension and compression members.
Structural Engineering III <sup>**</sup> (0908-383)	Change course description (0908-383) and title (to Analysis and Design of Steel Frames)	The stiffness method for analysis of frames and the design of steel flexural members and systems.
Environmental Engineering I (0908-311)	Change course description.	Ecosystems, Reactors, Water Quality and Treatment, Wastewater Quality and Treatment
Environmental Engineering II (0908-421)	Change course description and number (0908-312, because it will be taught in junior year).	Solid and Hazardous Waste and Air Pollution
<b>(b) Civil Engineering Electives</b>		
Physicochemical Processes for Seniors (0908-412)	Change course description and title (to Environmental Treatment Process Principles)	Advanced Physical, Chemical, and Biological Processes of interest to Environmental Engineers
Advanced Environmental Engineering for Seniors (0908-422)	Change course description, number (0908-434) and title (to Site Remediation Principles)	Site Planning, Characterization, and Remediation.
Groundwater/Soil Remediation (0908-432)	Change course description and title (to Pollutant Fate and Transport Principles)	Fate and Transport of Pollutants in the Environment.
Advanced Transportation Engineering for Seniors (0908-462)	Change course description and title (to Pavement Analysis and Evaluation)	The engineering study of pavement response.
Transportation Planning and Demand Analysis (0908-463)	Change course description and title (to Principles of Highway and Traffic Design, and Transportation Planning)	Advanced topics in highway design and analysis, signalized and un-signalized intersection design, and transportation planning.

\*Complete descriptions are given in course modification proposals.

<sup>†</sup>Currently required, becomes an elective.

<sup>\*\*</sup>Currently an elective, becomes required.

ii. Sequence of course work with description of major and general education requirements. Include an example of courses that would typically be taken term by term, pointing out any course prerequisites.

The sequence of course work is given in Table 3. Course prerequisites are included only where they are different from current prerequisites, as listed in the course catalogue.

Table 3: The sequence of course work

Fall	Spring
<b>FIRST YEAR</b>	
Freshman Engineering Clinic I	Freshman Engineering Clinic II
Calculus I	Calculus II
Advanced College Chemistry I	Physics I
Composition I	Computer Science and Programming
General Education Course	General Education Course
<b>SECOND YEAR</b>	
Sophomore Engineering Clinic I	Sophomore Engineering Clinic II
Math for Engineering Analysis I	Math for Engineering Analysis II
Advanced College Chemistry II	Statistics I
Statics	Dynamics
Solid Mechanics	Surveying & Engineering Graphics
<b>THIRD YEAR</b>	
Junior Engineering Clinic I	Junior Engineering Clinic II
Structural Analysis and Design ( <i>prereq – Statics and Solid Mechanics</i> )	Analysis and Design of Steel Frames ( <i>prereq – Structural Analysis and Design</i> )
Environmental Engineering I ( <i>prereq – Advanced College Chemistry II</i> )	Environmental Engineering II
Fluid Mechanics I	Water Resources Engineering
Civil Engineering Materials	Civil Engineering Systems ( <i>prereq – Statistics</i> )
Material Science	Civil Engineering Elective
Geotechnical Engineering	
<b>FOURTH YEAR</b>	
Senior Engineering Clinic I	Senior Engineering Clinic II
Civil Engineering Design Project I	Civil Engineering Design Project II
Civil Engineering Elective	Civil Engineering Elective
Transportation Engineering	Microeconomics
Civil Engineering Elective	Technical Elective
General Education Course	General Education Course
	Civil Engineering Practice

iii. Describe to what extent courses from other units in the institution will be used and include evidence of agreement from those units to provide such services.

The proposed curriculum includes only one change that affects other units at the institution. Currently, Civil and Environmental Engineering students take a science elective chosen from Physic II, Organic Chemistry I, or Geology I (4 credit hours, 5 workload hours). The science elective is replaced by Statistics I (3 credit hours, 3 workload hours) in the proposed curriculum; thus, there is a net decrease in workload for the College of Liberal Arts and Sciences of 1 credit hour and 2 workload hours. Some students may take one of the science elective courses as an elective. Mathematics has agreed to teach an extra section of Statistics I, a letter of support is included in section 5c.

d. Compare and contrast the program with similar programs of high quality.

The primary changes proposed are: (1) replace Introduction to Engineering with Dynamics; (2) replace a science elective with Statistics I; and (3) require all students to take at least two structural and two environmental courses. These changes bring the curriculum closer to what is typical. The results of a survey of excellent civil engineering programs at primarily undergraduate institutions are presented in Table 4. The proposed curriculum has 131 credit hours, well within the range exhibited in the table.

Table 4: Curriculum Hours for Peer Civil Engineering Curriculums

<b>Institution</b>	<b>Curriculum Credit Hours</b>
Rowan Univ.	131
Bucknell Univ.	136
Lafayette Coll.	38 courses
Rose Hulman	131
Cooper Union	135
US Military Ac.	155
Cal Poly-Obispo	203 quarter units
Virginia Military Inst.	138
US AF Acad.	154
Norwich Univ.	129
US Naval Acad.	NR
Villanova Univ.	133
Rutgers Univ - New Brunswick	128
Lehigh Univ.	NR
Univ. of Dayton	NR
Howard Univ.	NR
Northeastern Univ.	NR
Univ. of Mass - Dartmouth	NR
Widener Univ.	133
Manhattan Coll.	NR

NR = No Response. These institutions were chosen because: (a) they are primarily undergraduate institutions with excellent civil engineering department, or (b) they are a peer or aspirant institution of Rowan University with a civil engineering department. No attempt was made to survey all civil engineering programs. Responses were obtained by email from chairs. The compiler cannot guarantee the accuracy of the information presented above.

*e. Administration (describe the administrative organization of the program with details of the specific role of each group and/or department)*

No change in administrative organization is required by the proposed curriculum.

*f. Program Evaluation: Procedures that will be used to assess the success of the program in meeting its goals and objectives.*

No change in administrative organization is required by the proposed curriculum. Evaluation procedures are ABET approved.

#### *5. Results of Consultation*

*a. Letters of consultation with all departments that have similar programs, courses, or course titles **MUST** be included.*

The modifications described here are to an existing curriculum and existing courses; however, consultations have been made with Mathematics, because the modification adds Statistics I to the curriculum, and the other Engineering programs.

*b. List the names of persons from department and/or disciplines consulted. Attach a statement about the results (pro and con).*

Consultations with the following persons were made: Ronald Czochor (Chair Mathematics); Stewart Slater (Chair, Chemical Engineering); John Schmalzel (Chair, Electrical and Computer Engineering); and T.R. Chandrupatla (Chair, Mechanical Engineering). In all cases, feedback regarding the curriculum modifications was positive. A letter of support is included from Ronald Czochor in section 5c.

*c. Attach copies of any written consultations.*

**A letter of support from Ronald Czochor (Chair Mathematics) is included on the next page.**



Mathematics Department  
MEMO

**TO:** Jess Everett  
Civil Engineering Department

**FROM:** Ron Czocho, Chair *RJC*  
Mathematics Dept

**DATE:** June 4, 2002

**RE:** Consultation on proposed changes to Civil Engineering major

Thank you for the opportunity to review the changes you have proposed in the Civil Engineering B.S. degree. I have carefully studied your proposal and although I support the new requirement for Statistics I, I have philosophical differences about specifying General Education Electives. Although it is completely legitimate to specify these courses under our General Education model since you need them for accreditation purposes, I cannot in general support the notion. Nevertheless, I support your proposal.

I agree that engineers should have training in applied statistical analysis and until a calculus based data analysis class is developed, Statistics I is the best choice for your students. This change in your curriculum will add an additional burden on the Mathematics Department in terms of staffing. It will mean an additional section of the course once every academic year and along with the additional demand placed on this course from the business, biology, environmental studies, and liberal studies math/science majors; it demonstrates an obvious need for another statistics faculty member in the Mathematics Department. I support the requirement for the course as I have for the other majors I have cited, I only want to emphasize the need for an additional line to staff the extra courses.

*6. New Courses:*

*a. Include proposals for new courses needed for the program. The program cannot be fully approved if New Course Proposals are not included.*

No new courses are required by the proposed curriculum. Proposed changes to existing courses are attached.



Mathematics Department  
MEMO

**TO:** Jess Everett  
Civil Engineering Department

**FROM:** Ron Czochor, Chair *RJC*  
Mathematics Dept

**DATE:** April 24, 2002

**RE:** Consultation on proposed changes to Civil Engineering major

Thank you for the opportunity to review the changes you have proposed in the Civil Engineering B.S. degree. I have carefully studied your proposal and although I support the new requirement for Statistics I, I have philosophical differences about specifying General Education Electives. Although it is completely legitimate to specify these courses under our General Education model since you need them for accreditation purposes, I cannot in general support the notion. Nevertheless, I support your proposal.

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SCC#01-02-426

**From:** "Cleary, Douglas B." <cleary@groupwise.rowan.edu>  
**To:** <reevesl@groupwise.rowan.edu>  
**Date:** 5/14/02 2:35PM  
**Subject:** Civil engineering curriculum

Attached is an update to the Civil engineering curriculum proposal. I have fixed the table in question so that the courses in the existing and new curriculum are aligned to show equivalence. The courses added or dropped that have an effect on credit hours have been bolded. We also had shown the current intro to environmental engineering course as 3 hours although it is really 2. The totals for each course grouping however were correct.

Douglas B. Cleary, Ph.D., P.E.  
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I added  
mat'l to SCC#01-02-  
426  
8/1/02

## Civil Engineering Degree Modification

### 1. Abstract

This document is used to propose major changes to the existing Civil Engineering Degree. The proposal is sponsored by Jess W. Everett. The changes described here are a necessary response to concerns raised by ABET (the engineering accreditation organization), industry stakeholders, and by unbalance in enrollments in the two tracks currently offered by the program. The Civil Engineering degree is offered by the Civil and Environmental Engineering Program, residing in the College of Engineering. The proposed changes will collapse the infrastructure and environmental tracks into one civil engineering degree track.

The primary changes proposed are: (1) replace Introduction to Engineering with Dynamics; (2) replace science elective with Statistics I; and (3) require all students to take at least two structural and two environmental courses. Formerly, infrastructure track students were not required to take Environmental Engineering I and II, while environmental students were not required to take Structural Analysis and Design. Surveying, currently required in both tracks, is replaced by Surveying & Engineering Graphics. All students are required to take Geotechnical, Water Resources, and Transportation Engineering. Formerly, environmental track students were not required to take Transportation Engineering. All students are required to take 4 civil engineering electives. Formerly, environmental track students took 5 civil engineering electives.

Accreditation rules require students to demonstrate proficiency in 4 areas of civil engineering. To achieve this in the proposed curriculum, students must use two of their civil engineering electives to complete courses in two of the following areas: geotechnical, water resources, and transportation.

No new courses are required for the proposed curriculum, but a number of course titles, numbers, and descriptions are changed. The new curriculum will be implemented starting in Fall 2002; note, it involves no freshman year class changes. In the 2003-4 academic year, sophomore year classes will reflect the new curriculum. In 2004-5, sophomore and junior classes will follow the new curriculum. Complete conversion to the new curriculum will be achieved in 2005-6. No new resources (staff or space) are required by the proposed changes. While the proposed curriculum is 131 semester-hours, 3 more than the current curriculum, efficiencies resulting from the collapse of two tracks into one result in the same number of courses and only a 1 workload-hour increase for Civil and Environmental Engineering faculty. It results in a 1 semester-hour and 2 workload-hour reduction for faculty in other units.

## **2. Details**

### *a. Title of Proposal:*

Civil Engineering Degree Modification

### *b. Sponsor:*

Jess W. Everett

### *c. Scope and Size of Program:*

No change: proposal concerns changes to existing degree

### *d. Need for Program:*

No change: proposal concerns changes to existing degree

### *e. Requirements for Admission and Graduation:*

No change for admission, graduation requirements are increased by 3 semester-hours.

### *f. Suggested Time and Scale:*

New curriculum should be applied to Freshman class starting in Fall 02. Complete conversion to the new curriculum will be achieved in 2005.

### *g. Resource Requirements:*

No new resources required.

### *h. Recommended Library Resources:*

Existing resources are sufficient.

### *i. Staffing:*

Existing staffing is sufficient.

### 3. Rationale

The changes described here are a necessary response to concerns raised by ABET (the engineering accreditation organization), industry stakeholders, and by recurring imbalances in enrollments in the two tracks currently offered by the program.

*ABET:* The Civil Engineering Degree was accredited for six years starting Fall 01. The final statement, transmitted to the President of Rowan University in a letter dated August 16, 2001 includes an evaluation of program weaknesses, concerns, and observations. Two are addressed through the proposed curricular modification, and are discussed here. First, ABET identified a weakness concerning probability and statistics, which in the current curriculum, is introduced to students primarily in Freshman Clinic I (0901.101) and Civil Engineering Systems (0908.305). While we were able to respond to this weakness (by showing that probability and statistics concepts were reinforced in other courses), it remains an officially stated ABET concern. The new curriculum addresses this concern by replacing a science elective (4 credits) with Statistics I (3 credits). According to the Course Catalogue, in Statistics I (1702.260)

[s]tudents learn to use frequency distributions, histograms, bar and line graphs, and measures of location and variability to describe data. The course considers elementary probability, and uses the binomial, normal, chi-square and t-distributions in estimation and hypotheses testing. It includes sampling techniques and the calculation procedure for linear regression and correlation. Use of graphics calculator is required; computer software may be used. Students are expected to have completed an equivalent of College Algebra.

Civil Engineering Systems will cover engineering aspects of probability and statistics as well other topics required by ABET, including engineering economics and scheduling. The courses typically taken as the science elective (Geology I, Organic Chemistry I, and Physics II) can still be taken as a technical elective.

Second, ABET observed that “[r]ecent efforts to integrate more computer-aided design and drafting into the civil engineering curriculum are commendable and are highly encouraged.” This has been done by designing homework assignments that require students to use computer-aided design and drafting software. However, through regular review of the program, faculty in Civil and Environmental Engineering have determined that further improvement of student skills is needed, and will be best accomplished by devoting some class time to specific instruction on AutoCad, one of the major computer-aided design and drafting software programs used by Civil and Environmental Engineers. This will be done by replacing Surveying (2 semester-hours) with Surveying & Engineering Graphics (3 semester-hours).

*Industrial Stakeholders:* As part of the process of preparing for ABET accreditation, Civil and Environmental faculty met with industrial stakeholders to discuss the Civil Engineering Degree. One concern raised by industrial stakeholders was the absence of dynamics in the curriculum. Dynamics is offered in most undergraduate civil engineering curriculums. According to the course catalogue, Dynamics (0901.291) is the

[s]tudy of kinematics and kinetics of a particle, including work-energy and impulse-momentum methods. Systems of particles are considered.

Kinematics and kinetics of plane motion of rigid bodies are introduced with respect to absolute and relative motions in various reference frames.

Concept of mass moment of inertia is introduced.

This concern is addressed by replacing Introduction to Environmental Engineering (2 credits) with Dynamics (2 credits). Introduction to Environmental Engineering is no longer needed, because the two-degree tracks are to be collapsed into one, justified below.

*Recurring imbalances in enrollments in the two tracks currently offered by the program:* Table 1 is used to present student enrollment by track.

Table 1: Student enrollment by track

Class of	Infrastructure	Environmental
2000	10	8
2001	7	1
2002	11	9
2003	15	4
2004	22	0

While the classes of 2000 and 2002 are balanced, the others are not. Collapsing the two tracks into one will better meet student interests and allow us to deliver our curriculum more efficiently and flexibly.

A number of changes were introduced in this section. The resulting curriculum provides are more broad-based and complete civil engineering degree.

#### 4. Essence of the Program

##### *a. Major goals of the Program*

The major goals of the program remain unchanged. They are repeated below, as presented in accreditation documents.

The Academic Department of Civil & Environmental Engineering (henceforth referred to as the Department of Civil and Environmental Engineering) strives to give civil engineering students the ability to understand and apply the core science, mathematics, and engineering principles that form the basis of civil engineering. This program aims to have students work individually and in multidisciplinary teams to identify and solve engineering problems using their accumulated knowledge and experience along with advanced technology such as computers and laboratory equipment. We will enforce the importance of ethics and professionalism, and the importance of global and societal issues in engineering practice. The Civil & Environmental Engineering Program strives to give students the ability to communicate effectively in preparation for both engineering practice and for graduate studies. We prepare students for professional careers by providing a broad based civil engineering education. This program will prepare civil engineering students for the pursuit of graduate degrees. Students will be exposed to a range of hands-on, standards-based, civil engineering laboratory experiences. Finally, we aim to give civil engineering students both individual and team-based design experiences taught by a diverse civil engineering faculty with professional engineering licenses and/or with appropriate education and design experience.

##### *b. Specific objectives of the Program*

The major goals of the program remain unchanged. They are repeated below, as presented in accreditation documents.

Rowan Civil & Environmental Engineering graduates will be:

1. Knowledgeable, and able to remain current during their professional careers;
2. Problem-solvers, able to obtain needed information and identify, formulate, and solve problems;
3. Well rounded, understanding professional, ethical, and global/social issues and able to work in multidisciplinary and diverse groups; and
4. Communicators, able to disseminate information to professional and lay audiences.

c. Structure of Program

i. Identification of courses with brief description and credit hours for each.

Table 2 contains a list of the courses in the current and proposed curriculums.

Table 2: Current and proposed curriculums

Current Curriculum (infrastructure track)	Proposed Curriculum
<p>I. General Education 46 s.h.            Communications 3 s.h.                College Composition I (<i>College Composition II and Public Speaking have been approved for inclusion in the Sophomore Engineering Clinics</i>)            Science and Mathematics 8 s.h.                Calculus I (4 s.h.)                Adv. College Chemistry I (4 s.h.)            History, Humanities &amp; Languages 6 s.h.            Social &amp; Behavioral Sciences 6 s.h.                Microeconomics (3 s.h.)            Arts 3 s.h.            General Education Electives 20 s.h.                Calculus II (4 s.h.)                Physics I (4 s.h.)                Computer Science and Programming (4 s.h.)                Adv. College Chemistry II (4 s.h.)                Science Elective (4 s.h.)</p> <p>II. Major Requirements 46 s.h. (Infrastructure track)            Structural Engineering I (3 s.h.)            Structural Engineering II (3 s.h.)            Structural Engineering III (3 s.h.)  <b>Introduction to Environmental Engineering (2 s.h.)</b>            Civil Engineering Materials (2 s.h.)            Water Resources Engineering (3 s.h.)            Geotechnical Engineering (3 s.h.)            Civil Engineering Systems (2 s.h.)            Transportation Engineering (3 s.h.)            Surveying (2 s.h.)            Civil Engineering Electives (4) (3 s.h. each)            Technical Elective (3 s.h.)            Civil Engineering Design Project I and II (2 s.h. each)            Civil Engineering Practice (1 s.h.)</p> <p>III. Other Engineering Courses 36 s.h.            Math for Engineering Analysis I and II (4 s.h. each)            Freshman Engineering Clinics I and II (2 s.h. each)            Sophomore Engineering Clinics I and II (4 s.h. each)            Junior Engineering Clinics I and II (2 s.h. each)            Senior Engineering Clinics I and II (2 s.h. each)            Statics (2 s.h.)            Solid Mechanics (2 s.h.)            Fluid Mechanics I (2 s.h.)            Material Science (2 s.h.)</p> <p>IV. Total Credits in Program                      128 s.h.</p>	<p>I. General Education 45 s.h.            Communications 3 s.h.                College Composition I (<i>College Composition II and Public Speaking have been approved for inclusion in the Sophomore Engineering Clinics</i>)            Science and Mathematics 8 s.h.                Calculus I (4 s.h.)                Adv. College Chemistry I (4 s.h.)            History, Humanities &amp; Languages 6 s.h.            Social &amp; Behavioral Sciences 6 s.h.                Microeconomics (3 s.h.)            Arts 3 s.h.            General Education Electives 19 s.h.                Calculus II (4 s.h.)                Physics I (4 s.h.)                Computer Science and Programming (4 s.h.)                Adv. College Chemistry II (4 s.h.)                Statistics I (3 s.h.)</p> <p>II. Major Requirements 48 s.h.              Structural Analysis and Design (3 s.h.)            Analysis and Design of Steel Frames (3 s.h.)            Environmental Engineering I (3 s.h.)            Environmental Engineering II (3 s.h.)            Civil Engineering Materials (2 s.h.)            Water Resources Engineering (3 s.h.)            Geotechnical Engineering (3 s.h.)            Civil Engineering Systems (2 s.h.)            Transportation Engineering (3 s.h.)  <b>Surveying &amp; Engineering Graphics (3 s.h.)</b>            Civil Engineering Electives (4) (3 s.h. each)            Technical Elective (3 s.h.)            Civil Engineering Design Project I and II (2 s.h. each)            Civil Engineering Practice (1 s.h.)</p> <p>III. Other Engineering Courses 38 s.h.            Math for Engineering Analysis I and II (4 s.h. each)            Freshman Engineering Clinics I and II (2 s.h. each)            Sophomore Engineering Clinics I and II (4 s.h. each)            Junior Engineering Clinics I and II (2 s.h. each)            Senior Engineering Clinics I and II (2 s.h. each)            Statics (2 s.h.)            Solid Mechanics (2 s.h.)            Fluid Mechanics I (2 s.h.)            Material Science (2 s.h.)  <b>Dynamics (2 s.h.)</b></p> <p>IV. Total Credits in Program                      131 s.h.</p>

All of the courses in the proposed curriculum are current Rowan University courses. Descriptions are in the Undergraduate Catalogue. Minor changes are made to some Civil and Environmental Engineering courses, as described in Table 3. The only change to courses outside Civil and Environmental Engineering involves replacing the science elective (Geology I, Organic Chemistry I, and Physics II) with Statistic I. Science elective courses can still be taken as a technical elective.

Table 3: Minor changes to Civil and Environmental Engineering Courses

Current Course	Changes	Description*
<b>(a) Required Courses</b>		
Surveying & Planning (0908-402)	Change course description, number (to 0908-203) and title (to Surveying and Engineering Graphics)	Measurement and presentation of existing and man-made land profiles, drainage areas, distance measurements, angle measurements, elevation measurements, closing traverses, topographic surveys, and highway alignments.
Structural Engineering I <sup>†</sup> (0908-281)	Change course description, number (0908-481) and title (to Reinforced Concrete Design)	The design of reinforced concrete beams and introduces concrete framing systems.
Structural Engineering II (0908-382)	Change course description (0908-382) and title (to Structural Analysis and Design)	Methods of calculating deflections, moment area and conjugate beam methods, virtual work, and the force method of truss analysis, design of steel tension and compression members.
Structural Engineering III <sup>††</sup> (0908-383)	Change course description (0908-383) and title (to Analysis and Design of Steel Frames)	The stiffness method for analysis of frames and the design of steel flexural members and systems.
Environmental Engineering I (0908-311)	Change course description.	Ecosystems, Reactors, Water Quality and Treatment, Wastewater Quality and Treatment
Environmental Engineering II (0908-421)	Change course description and number (0908-312, because it will be taught in junior year).	Solid and Hazardous Waste and Air Pollution
<b>(b) Civil Engineering Electives</b>		
Physicochemical Processes for Seniors (0908-412)	Change course description and title (to Environmental Treatment Process Principles)	Advanced Physical, Chemical, and Biological Processes of interest to Environmental Engineers
Advanced Environmental Engineering for Seniors (0908-422)	Change course description, number (0908-434) and title (to Site Remediation Principles)	Site Planning, Characterization, and Remediation.
Groundwater/Soil Remediation (0908-432)	Change course description and title (to Pollutant Fate and Transport Principles)	Fate and Transport of Pollutants in the Environment.
Advanced Transportation Engineering for Seniors (0908-462)	Change course description and title (to Pavement Analysis and Evaluation)	The engineering study of pavement response.
Transportation Planning and Demand Analysis (0908-463)	Change course description and title (to Principles of Highway and Traffic Design, and Transportation Planning)	Advanced topics in highway design and analysis, signalized and un-signalized intersection design, and transportation planning.

\*Complete descriptions are given in course modification proposals.

<sup>†</sup>Currently required, becomes an elective.

<sup>††</sup>Currently an elective, becomes required.

ii. Sequence of course work with description of major and general education requirements. Include an example of courses that would typically be taken term by term, pointing out any course prerequisites.

The sequence of course work is given in Table 3. Course prerequisites are included only where they are different from current prerequisites, as listed in the course catalogue.

Table 3: The sequence of course work

Fall	Spring
<b>FIRST YEAR</b>	
Freshman Engineering Clinic I	Freshman Engineering Clinic II
Calculus I	Calculus II
Advanced College Chemistry I	Physics I
Composition I	Computer Science and Programming
General Education Course	General Education Course
<b>SECOND YEAR</b>	
Sophomore Engineering Clinic I	Sophomore Engineering Clinic II
Math for Engineering Analysis I	Math for Engineering Analysis II
Advanced College Chemistry II	Statistics I
Statics	Dynamics
Solid Mechanics	Surveying & Engineering Graphics
<b>THIRD YEAR</b>	
Junior Engineering Clinic I	Junior Engineering Clinic II
Structural Analysis and Design ( <i>prereq – Statics and Solid Mechanics</i> )	Analysis and Design of Steel Frames ( <i>prereq – Structural Analysis and Design</i> )
Environmental Engineering I ( <i>prereq – Advanced College Chemistry II</i> )	Environmental Engineering II
Fluid Mechanics I	Water Resources Engineering
Civil Engineering Materials	Civil Engineering Systems ( <i>prereq – Statistics</i> )
Material Science	Civil Engineering Elective
Geotechnical Engineering	
<b>FOURTH YEAR</b>	
Senior Engineering Clinic I	Senior Engineering Clinic II
Civil Engineering Design Project I	Civil Engineering Design Project II
Civil Engineering Elective	Civil Engineering Elective
Transportation Engineering	Microeconomics
Civil Engineering Elective	Technical Elective
General Education Course	General Education Course
	Civil Engineering Practice

iii. Describe to what extent courses from other units in the institution will be used and include evidence of agreement from those units to provide such services.

The proposed curriculum includes only one change that affects other units at the institution. Currently, Civil and Environmental Engineering students take a science elective chosen from Physic II, Organic Chemistry I, or Geology I (4 credit hours, 5 workload hours). The science elective is replaced by Statistics I (3 credit hours, 3 workload hours) in the proposed curriculum; thus, there is a net decrease in workload for the College of Liberal Arts and Sciences of 1 credit hour and 2 workload hours. Some students may take one of the science elective courses as an elective. Mathematics has agreed to teach an extra section of Statistics I, a letter of support is included in section 5c.

d. Compare and contrast the program with similar programs of high quality.

The primary changes proposed are: (1) replace Introduction to Engineering with Dynamics; (2) replace a science elective with Statistics I; and (3) require all students to take at least two structural and two environmental courses. These changes bring the curriculum closer to what is typical. The results of a survey of excellent civil engineering programs at primarily undergraduate institutions are presented in Table 4. The proposed curriculum has 131 credit hours, well within the range exhibited in the table.

Table 4: Curriculum Hours for Peer Civil Engineering Curriculums

Institution	Curriculum Credit Hours
Rowan Univ.	131
Bucknell Univ.	136
Lafayette Coll.	38 courses
Rose Hulman	131
Cooper Union	135
US Military Ac.	155
Cal Poly-Obispo	203 quarter units
Virginia Military Inst.	138
US AF Acad.	154
Norwich Univ.	129
US Naval Acad.	NR
Villanova Univ.	133
Rutgers Univ - New Brunswick	128
Lehigh Univ.	NR
Univ. of Dayton	NR
Howard Univ.	NR
Northeastern Univ.	NR
Univ. of Mass - Dartmouth	NR
Widener Univ.	133
Manhattan Coll.	NR

NR = No Response. These institutions were chosen because: (a) they are primarily undergraduate institutions with excellent civil engineering department, or (b) they are a peer or aspirant institution of Rowan University with a civil engineering department. No attempt was made to survey all civil engineering programs. Responses were obtained by email from chairs. The compiler cannot guarantee the accuracy of the information presented above.

*e. Administration (describe the administrative organization of the program with details of the specific role of each group and/or department)*

No change in administrative organization is required by the proposed curriculum.

*f. Program Evaluation: Procedures that will be used to assess the success of the program in meeting its goals and objectives.*

No change in administrative organization is required by the proposed curriculum. Evaluation procedures are ABET approved.

#### *5. Results of Consultation*

*a. Letters of consultation with all departments that have similar programs, courses, or course titles **MUST** be included.*

The modifications described here are to an existing curriculum and existing courses; however, consultations have been made with Mathematics, because the modification adds Statistics I to the curriculum, and the other Engineering programs.

*b. List the names of persons from department and/or disciplines consulted. Attach a statement about the results (pro and con).*

Consultations with the following persons were made: Ronald Czocho (Chair Mathematics); Stewart Slater (Chair, Chemical Engineering); John Schmalzel (Chair, Electrical and Computer Engineering); and T.R. Chandrupatla (Chair, Mechanical Engineering). In all cases, feedback regarding the curriculum modifications was positive. A letter of support is included from Ronald Czocho in section 5c.

*c. Attach copies of any written consultations.*

**A letter of support from Ronald Czocho (Chair Mathematics) is included on the next page.**



Mathematics Department  
MEMO

**TO:** Jess Everett  
Civil Engineering Department

**FROM:** Ron Czochor, Chair **RJC**  
Mathematics Dept

**DATE:** July 25, 2002

**RE:** Consultation on proposed changes to Civil Engineering major

Thank you for the opportunity to review the changes you have proposed in the Civil Engineering B.S. degree. I have carefully studied your proposal and although I support the new requirement for Statistics I, I have philosophical differences about specifying General Education Electives. Although it is completely legitimate to specify these courses under our General Education model since you need them for accreditation purposes, I cannot in general support the notion. Nevertheless, I support your proposal.

I agree that engineers should have training in applied statistical analysis and until a calculus based data analysis class is developed, Statistics I is the best choice for your students. This change in your curriculum will add an additional burden on the Mathematics Department in terms of staffing. It will mean an additional section of the course once every academic year and along with the additional demand placed on this course from the business, biology, environmental studies, and liberal studies math/science majors; it demonstrates an obvious need for another statistics faculty member in the Mathematics Department. I support the requirement for the course as I have for the other majors I have cited, I only want to emphasize the need for an additional line to staff the extra courses.

6. *New Courses:*

a. *Include proposals for new courses needed for the program. The program cannot be fully approved if New Course Proposals are not included.*

No new courses are required by the proposed curriculum. Proposed changes to existing courses are attached.