

# Civil Engineering

In the College of Engineering

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The undergraduate degree in Civil Engineering is accredited by the Accreditation Board for Engineering and Technology, Inc.

## Faculty

Emeritus: Chang, Chou, Johnson, Krishnamoorthy, McGhie, Noorany  
Chair: Supernak  
The AGC Paul S. Roel Chair in Construction Engineering and Management: Walsh  
The William E. Leonhard, Jr. Chair in Civil and Environmental Engineering: Forman  
Professors: Banks, Hayhurst, Ponce, Supernak, Westermo  
Associate Professors: Bayasi, Sharabi, Walsh  
Assistant Professors: Forman, Valdes

## Offered by the Department of Civil and Environmental Engineering

Doctor of Philosophy degree in engineering sciences/applied mechanics.

Master of Science degree in civil engineering.  
Concentration in environmental engineering.  
Major in civil engineering with the B.S. degree.

## The Associated General Contractors (AGC) Paul S. Roel Chair in Construction Engineering and Management

The AGC-Paul S. Roel Chair in Construction Engineering and Management is funded with an endowment established by generous gifts from members of the Associated General Contractors in San Diego Chapter. Recognizing the need for expert construction professionals, the local construction community has invested considerable resources in this new degree program. In particular, the endowment is funded by a significant gift from Roel Construction, in honor of Paul S. Roel, the son of the company's founder and the man responsible for moving the family business to San Diego in 1959. The first appointee to the Chair, Dr. Kenneth D. Walsh, is an accomplished teacher-scholar, with a research background in improvement of production systems in construction in residential, commercial, and heavy civil settings.

## The William E. Leonhard, Jr. Chair in Civil and Environmental Engineering

The William E. Leonhard, Jr. Chair in Civil and Environmental Engineering is funded with an endowment created by generous gifts from William G. Leonhard, Jr. and his parents, William E. and Wyllis M. Leonhard. After Bill Leonhard graduated from San Diego State in 1964, he entered a career in the Air Force, rising to the rank of colonel. In January 1990, he retired from the Air Force, spent the next several years in private industry, and retired again in 1998. The first appointee to the Chair is Assistant Professor, Dr. Selena Forman, an expert in sediment water interactions, contaminated sediment transport, and river restoration design.

## Mission of the Department

The mission of the Department of Civil and Environmental Engineering is to provide a high quality undergraduate and graduate education in the civil and environmental engineering areas as well as the

advising and other support needed to ensure the students' academic success and preparation for a productive engineering career. In addition, through research and continuing professional development, the faculty produce, enhance and promote new developments within their areas of expertise for the benefit of society and the furtherance of their profession.

The objective of the program is to give the student a basic knowledge of civil and environmental engineering, as well as the interdisciplinary background and skills to meaningfully participate in and contribute technical advances toward this profession. The program integrates technical aspects with studies in the social sciences and humanities to ensure appropriate sensitivity to socially related problems.

Instruction is given both at the undergraduate level, leading to the bachelor's degree, and at the graduate level, leading to the master's or doctoral degrees. The undergraduate program builds upon concepts of mathematics, physics, chemistry and basic engineering with specialized study in civil and environmental engineering. Engineering design is emphasized, particularly in conjunction with computer utilization and practical civil and environmental engineering problems. Aspects of safety and engineering ethics are woven throughout the program. Breadth and depth of social science and humanities studies is assured by department approved courses. Completion of the undergraduate degree prepares the student for an entry-level professional position in addition to informal or formal graduate studies.

Many students who complete the civil or the environmental undergraduate program choose to continue their formal studies on a full or part-time basis at San Diego State University or at another institution. (See the *Bulletin of the Graduate Division* for additional information.) The objective of the graduate program is to broaden the student's technical competence and design abilities and allow for additional specialization.

The civil and environmental engineering program is enhanced through cooperation with the American Society of Civil Engineers, the American Public Works Association, the Associated General Contractors, the Chi Epsilon Civil Engineering Honor Society, and other national organizations who sponsor student chapters to further aid the student's professional development. The chapters at San Diego State University have won many awards in regional and national competition with other schools throughout the country.

## Educational Objectives

The objectives of the program are to prepare graduates to practice civil engineering in the areas of structures, geotechnical, water resources, transportation, environmental, and construction by providing them with the ability to apply the basic principles of the mathematical, physical, and social sciences to the analysis and solution of civil engineering problems including the design of civil engineering projects; to provide a basic understanding of issues faced during professional practice and a solid foundation for continuing education and graduate study.

## Transfer Credit

No credit will be given for upper division engineering coursework taken at an institution having an engineering program which has not been accredited by the Accreditation Board for Engineering and Technology, Inc., unless the student successfully completes the first 12 units of engineering work attempted at this University. At that time, and upon recommendation of the department, unaccredited work will be evaluated for full or partial credit.

**NOTE:** See the following chart for recommended sequence of courses for the major in civil engineering.

**CIVIL ENGINEERING MAJOR  
FRESHMAN YEAR**

<i>Fall Semester</i>	<i>Units</i>	<i>Spring Semester</i>	<i>Units</i>
CIV E 100, Introduction to Civil Engineering .....	1		
CIV E 120, CIV E Computer Applications I .....	3	CIV E 121, CIV E Computer Applications II.....	2
Chemistry 200, General Chemistry.....	5	Mathematics 151, Calculus II.....	4
Mathematics 150, Calculus I .....	5	Physics 195, Principles of Physics.....	3
*General Education .....	3	*General Education .....	6
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**SOPHOMORE YEAR**

<i>Fall Semester</i>	<i>Units</i>	<i>Spring Semester</i>	<i>Units</i>
CIV E 160, Statistical Methods for CIV E.....	2	CIV E 218, Surveying for Civil Engineers .....	3
CIV E 220, CIV E Computer Applications III .....	3	Engineering 280, Methods of Analysis .....	3
Engineering Mechanics 200, Statics .....	3	Engineering Mechanics 220, Dynamics .....	3
Mathematics 252, Calculus III .....	4	*General Education .....	9
Physics 196, Principles of Physics.....	3		
* General Education .....	3		
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**JUNIOR YEAR**

<i>Fall Semester</i>	<i>Units</i>	<i>Spring Semester</i>	<i>Units</i>
CIV E 301, Introduction to Solid Mechanics.....	3	CIV E 321, Structural Analysis I.....	3
CIV E 302, Solid Mechanics Laboratory .....	1	CIV E 481, Transportation Engineering .....	3
CIV E 395, Intro. to Civil Engineering Design.....	2	ENV E 355, Environmental Engineering .....	3
Engineering Mechanics 340, Fluid Mechanics.....	3	*General Education .....	9
Engineering Mechanics 341, Fluid Mechanics Lab	1		
#Engineering Science Elective.....	3		
* General Education .....	3		
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**SENIOR YEAR**

<i>Fall Semester</i>	<i>Units</i>	<i>Spring Semester</i>	<i>Units</i>
CIV E 401, Civil Engineering and Society .....	1	CIV E 495, Civil Engineering Design .....	3
CIV E 444, Applied Hydraulics .....	3	#Civil Engineering Option Courses .....	6
CIV E 462, Geotechnical Engineering .....	3	#Professional Electives.....	6
CIV E 463, Geotechnical Engineering Lab .....	1	*American Institutions.....	3
#Civil Engineering Option Courses .....	6		
* American Institutions.....	3		
	<hr/> 17		<hr/> 18

\* Refer to General Education section that begins on following page.  
# Approved as part of the student's master plan.

## General Education

Students will complete a minimum of 50 units in General Education, to include a minimum of nine upper division units taken after attaining junior class standing. No more than twelve units may be used for General Education credit from any one department or academic unit. No more than 7 units from one department can be used in Sections II, III, and IV combined (Foundations, American Institutions, and Explorations).

### I. Communication and Critical Thinking: 9 units

1. Oral Communication (3 units)
2. Composition (3 units)
3. Intermediate Composition and Critical Thinking (3 units)

### II. Foundations: 29 units

#### A. Natural Sciences and Quantitative Reasoning (17 units):

1. Physical Sciences (11 units)  
Engineering students will take Chemistry 200 which includes a laboratory (5 units).  
Physics 195 (3 units)  
Physics 196 (3 units)
2. Life Sciences (3 units)
3. Laboratory (satisfied under A.1. above)
4. Mathematics/Quantitative Reasoning  
Engineering students will take Mathematics 150, 3 units applicable to General Education

#### B. Social and Behavioral Sciences (3 units)

#### C. Humanities (9 units)

Complete three courses in three different areas. One of these courses and the one under IV.A. below must be taken in the same department.

**III. American Institutions:** Three units of the six units of coursework which meet the American Institutions graduation requirement may be used in General Education, excluding courses numbered 500 and above.

**IV. Explorations: Courses in this area must not be taken sooner than the semester in which you achieve upper division standing (60 units passed). Upper division courses in the major department may not be used to satisfy General Education.**  
Total: 9 units; must include one course of cultural diversity.

- Upper division Humanities (3 units)  
Three units must be taken from the same department as one of the Humanities courses selected in Foundations.
- Upper division Humanities (3 units from a department not selected in A above.)
- Upper division Social and Behavioral Sciences (3 units)

## The Major

Civil engineering is the application of engineering principles to the improvement of the human environment. The civil engineering major prepares students to design and supervise the construction of buildings, dams, roads, harbors, airports, tunnels, and bridges. It also provides training in the planning and construction of the complex systems that supply clean water to cities, remove sewage, control floods, and perform other functions which ensure continued health and safety.

Civil engineers are needed in both the private and public sectors. They are employed in the aerospace industry, usually as structural engineers; design and construction of roads, buildings, bridges, airports, dams and other structures; research and teaching at colleges and universities (with an advanced degree); public utilities and transportation; manufacturing; and offshore drilling, environmental pollution, and energy self-sufficiency. New job opportunities in civil engineering will result from growing demands in housing, industrial buildings, power generating plants, and transportation systems.

## Civil Engineering Major

With the B.S. Degree (Major Code: 09081)

**NOTE:** See chart on the previous page for the recommended sequence of courses for the major in civil engineering.

The program below describes 137 units required for the degree. Each course specifically listed in the program is required. In addition, the total number of units specified in each elective category represents the minimum requirement, and there is a minimum requirement of nine units for the combination of the Engineering Science Elective and the Professional Electives.

**Preparation for the Major.** Civil Engineering 100, 120, 121, 160, 218, 220; Chemistry 200; Physics 195, 196; Mathematics 150, 151, 252; Engineering 280; Engineering Mechanics 200, 220.

**Engineering Science Elective.** At least one of the following courses: Electrical Engineering 204; Mechanical Engineering 260, 352.

**General Education.** Engineering students must follow the specific General Education program outlined on the first page of this section. Other general education requirements and limitations, as well as listings of specific General Education course electives are presented in the General Education section of Graduation Requirements for the Bachelor's degree.

**Graduation Writing Assessment Requirement.** Completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better or passing the Writing Proficiency Assessment with a score of 10 or above.

**Major.** A minimum of 48 upper division units to include the following required and elective courses. Required upper division courses in the major: Engineering Mechanics 340, 341; Environmental Engineering 355; Civil Engineering 301, 302, 321, 395, 401, 444, 462, 463, 481, 495.

**Civil and Environmental Engineering Option Courses.** Course choices must consist of either (1) at least one course from at least four of the first five areas (Water through Geotechnical), or (2) at least two courses from the last area (Construction) and at least one course each from two of the first five areas (Water through Geotechnical).

**Water** – Civil Engineering 445, 530.

**Transportation** – Civil Engineering 482, 580.

**Environmental** – Environmental Engineering 553, 554, 555, 556, 558, 560.

**Structural** – Civil Engineering 421, 423, 479, 521, 525, 528.

**Geotechnical** – Civil Engineering 465.

**Construction** – Civil Engineering 479, 491, 492.

**Professional Electives.** At least six units selected from Engineering 430 and any 400- or 500-level Civil or Environmental Engineering courses not used to satisfy other requirements. *The student's choice of elective courses must be made in consultation with the adviser and documented by filing an approved master plan as soon as the civil engineering major is declared. Students are required to see their adviser prior to preregistration each semester.*

## Courses (CIV E)

**Note:** Proof of completion of prerequisites (copy of transcript) is required for all courses which list prerequisites.

### LOWER DIVISION COURSES

#### CIV E 100. Introduction to Civil Engineering (1)

Introduction to diverse field of civil and environmental engineering to include structural, geotechnical, water resources, transportation, construction engineering and management, and environmental engineering. Legal, ethical, and international dimensions of the profession.

#### CIV E 120. Civil and Environmental Engineering Computer Applications I (3)

Prerequisite: Credit or concurrent registration in Mathematics 150.

Computing tools for civil engineering. Use of spreadsheets, programming, mathematical analysis programs, presentation, and graphics programs.

### **CIV E 121. Civil and Environmental Engineering Computer Applications II (2) II**

Prerequisite: Civil Engineering 120.

Computer aided design for civil engineering applications (AutoCAD).

### **CIV E 160. Statistical Methods for Civil and Environmental Engineers (2) I, II**

Prerequisite: Mathematics 141.

Application of statistical methods to civil and environmental engineering problems in construction, hydrology, water quality, air pollution, and other related areas. Students with credit or concurrent registration in the following lower division statistics courses will be awarded a total of four units for the two (or more) courses: Civil Engineering 160; Biology 215; Economics 201; Political Science 201; Psychology 270; Sociology 201; Statistics 119, 250. (Formerly numbered Civil and Environmental Engineering 160.)

### **CIV E 218. Surveying for Civil Engineers (3) I, II**

Two lectures and three hours of laboratory.

Prerequisites: Civil Engineering 160 and Mathematics 151.

Principles of plane surveying. Measurement of horizontal distance, difference in elevation, and angles. Traverse surveys and computations. Horizontal and vertical curves. Principles of stadia. Topographic surveys. Earthwork. (Formerly numbered Civil and Environmental Engineering 218.)

### **CIV E 220. Civil and Environmental Engineering Computer Applications III (3) I**

Prerequisite: Civil Engineering 121.

Graphical information systems (GIS), specialized civil engineering software, advanced problem solving.

### **CIV E 296. Experimental Topics (1-4)**

Selected topics. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree.

## **UPPER DIVISION COURSES (Intended for Undergraduates)**

### **CIV E 301. Introduction to Solid Mechanics (3) I, II**

Prerequisites: Engineering Mechanics 200 and concurrent registration in Engineering 280 or Mathematics 342A.

Mechanics of solid deformable bodies involving analytical methods for determining strength, stiffness, and stability of load-carrying members. (Formerly numbered Engineering Mechanics 301 and Civil and Environmental Engineering 301.)

### **CIV E 302. Solid Mechanics Laboratory (1) I, II**

Three hours of laboratory.

Prerequisite: Credit or concurrent registration in Civil Engineering 301.

Laboratory studies in solid mechanics. Experimental stress analysis. Experimental confirmation of theory. (Formerly numbered Engineering Mechanics 302 and Civil and Environmental Engineering 302.)

### **CIV E 321. Structural Analysis I (3) I, II**

Prerequisites: Civil Engineering 301 and 302.

Analysis of beams, frames, trusses, and three-dimensional frameworks. Influence lines; deflections; introduction to statically indeterminate structures and moment distribution. (Formerly numbered Civil and Environmental Engineering 321.)

### **CIV E 395. Introduction to Civil Engineering Design (2)**

One lecture and three hours of laboratory.

Prerequisite: Credit or concurrent registration in Civil Engineering 301.

Civil engineering design process; identification and formulation of design problems; professional responsibilities of designers; documentation and presentation of designs.

### **CIV E 401. Civil Engineering and Society (1) I**

Prerequisite: Senior standing in civil engineering.

Role of civil engineers in society. Historical, political, esthetic, and philosophical perspectives on civil engineering. Contemporary issues involving civil engineering.

### **CIV E 421. Reinforced Concrete Design (3) I, II**

Prerequisite: Civil Engineering 321.

Properties and characteristics of reinforced concrete; design of structural components. Introduction to plastic theory and limit design. (Formerly numbered Civil and Environmental Engineering 421.)

### **CIV E 423. Timber Design (2) I, II**

Prerequisites: Civil Engineering 321.

Physical and mechanical properties of wood. Sawn lumber, glulam, plywood. Design of various types of wood structures. Connection design. (Formerly numbered Civil and Environmental Engineering 423.)

### **CIV E 444. Applied Hydraulics (3) I, II**

Prerequisite: Engineering Mechanics 340.

Open channel and pressure conduit flow, pumps and turbines, hydroelectric power, flood control, and water law. (Formerly numbered Civil and Environmental Engineering 444.)

### **CIV E 445. Applied Hydrology (3) II**

Prerequisite: Civil Engineering 444.

Basic hydrologic principles, hydrologic measurements, small and midsize catchment hydrology, frequency analysis, regional analysis, reservoir, stream channel and catchment routing, hydrologic design. (Formerly numbered Civil and Environmental Engineering 445.)

### **CIV E 462. Geotechnical Engineering (3) I, II**

Prerequisites: Civil Engineering 301, credit or concurrent registration in Engineering Mechanics 340, and concurrent registration in Civil Engineering 463.

Mechanics of soils as they apply to engineering problems, soil classification, compaction, swelling, consolidation, strength and permeability. Applications to geotechnical and environmental engineering problems. (Formerly numbered Civil and Environmental Engineering 462.)

### **CIV E 463. Geotechnical Engineering Laboratory (1) I, II**

Three hours of laboratory.

Prerequisite: Concurrent registration in Civil Engineering 462.

Laboratory procedures of soil testing for geotechnical and environmental engineering problems. (Formerly numbered Civil and Environmental Engineering 463.)

### **CIV E 465. Foundation Engineering and Earth Retaining Structures (3) II**

Prerequisites: Civil Engineering 462 and 463.

Soil mechanics theories applied to design of shallow and deep foundations; lateral pressure of soils, design of retaining walls. (Formerly numbered Civil and Environmental Engineering 465.)

### **CIV E 479. Construction Materials (3) II**

Two lectures and three hours of laboratory.

Prerequisites: Civil Engineering 462 and 481.

Selection, design and control of mixes of portland cement and asphalt concrete. Properties of these and other materials used in construction. (Formerly numbered Civil and Environmental Engineering 479.)

### **CIV E 481. Transportation Engineering (3) I, II**

Prerequisites: Civil Engineering 218.

Physical design of transportation facilities, traffic analysis and control for different modes, planning and demand analysis, introduction to environmental impacts of transportation systems and intelligent transportation systems. (Formerly numbered Civil and Environmental Engineering 481.)

**CIV E 482. Highway Engineering (3) I, II**

Two lectures and three hours of laboratory.  
Prerequisite: Civil Engineering 481.

Highway design, facility sizing, geometric design, drainage, earthwork, pavement design, traffic control devices, safety and environmental considerations. (Formerly numbered Civil and Environmental Engineering 482.)

**CIV E 491. Construction Methods (3) I**

Prerequisite: Civil Engineering 321.

Components and methods of construction including earthwork; foundations; wood, steel, and concrete construction; roofing and cladding; interior construction. (Formerly numbered Civil and Environmental Engineering 491.)

**CIV E 492. Construction Engineering (3) II**

Prerequisites: Civil Engineering 491 and Engineering 430.

Project oriented. Cost estimating; alternative cost-saving changes; critical path scheduling. (Formerly numbered Civil and Environmental Engineering 492.)

**CIV E 495. Civil Engineering Design (3) I, II**

One lecture and six hours of laboratory.

Prerequisites: Credit or concurrent registration in Civil Engineering 321, 421, 444, 462, 481, and Environmental Engineering 355. At least three of these courses must be completed prior to enrolling in this course.

Application of engineering principles and design techniques to the design of civil engineering projects. (Formerly numbered Civil and Environmental Engineering 495.)

**CIV E 496. Advanced Civil Engineering Topics (1-3) I, II**

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

Modern developments in civil engineering. See Class Schedule for specific content. Maximum credit six units for any combination of Civil Engineering 496, 499 and 596.

**CIV E 499. Special Study (1-3) Cr/NC I, II**

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

Individual study in the area of civil engineering. Maximum credit six units for any combination of Civil Engineering 496, 499 and 596.

**UPPER DIVISION COURSES  
(Also Acceptable for Advanced Degrees)**

**CIV E 521. Structural Analysis II (3) I**

Prerequisite: Civil Engineering 321.

Analysis of statically indeterminate structures by virtual work. Advanced treatment of slope deflection, moment distribution. Arch analysis, secondary stresses in trusses. Advanced treatment of influence lines. Introduction to matrix analysis of structures. (Formerly numbered Civil and Environmental Engineering 521.)

**CIV E 525. Design of Steel Structures (3) I, II**

Prerequisite: Civil Engineering 321.

Mechanical behavior of structural steel. Design of steel beams, girders, columns and members subjected to combined stresses. Design of various types of connections of steel structures; plate girders, continuous beams and rigid frames. (Formerly numbered Civil and Environmental Engineering 525.)

**CIV E 528. Masonry Structures Design (3) I**

Prerequisites: Civil Engineering 301 and 321.

Analysis and design of masonry beams, retaining walls, shear walls, bearing walls, and columns. Use of allowable stress and strength design methods. Design project, including structural system analysis and lateral design of masonry buildings.

**CIV E 530. Open Channel Hydraulics (3) I, II**

Prerequisite: Civil Engineering 444.

Principles of open channel flow; analysis and problems of critical, uniform, gradually-varied, and rapidly-varied flows, design and environmental problems; computer simulations and applications; and culvert hydraulics. (Formerly numbered Civil and Environmental Engineering 530.)

**CIV E 580. Traffic Engineering Design (3) II**

Prerequisite: Civil Engineering 481.

Sizing and configuration of highway facilities based on capacity analysis. Traffic signal design, impact and mitigation studies, parking, safety design. (Formerly numbered Civil and Environmental Engineering 580.)

**CIV E 596. Advanced Civil Engineering Topics (1-3) I, II**

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

Modern developments in civil engineering. See Class Schedule for specific content. Maximum credit of six units for any combination of Civil Engineering 496, 499 and 596 applicable to a bachelor's degree. Maximum combined credit of six units of Civil Engineering 596 and 696 applicable to a 30-unit master's degree.

**GRADUATE COURSES  
Refer to Bulletin of the Graduate Division.**

**For additional courses which are electives in the civil engineering program, refer to "Environmental Engineering" in this section of the catalog.**