
Civil Engineering

In the College of Engineering

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The undergraduate degree in Civil Engineering is accredited by ABET, Inc.

Faculty

Emeritus: Banks, Chang, Chou, Johnson, Krishnamoorthy, McGhie, Noorany, Sharabi

Chair: Supernak

The AGC Paul S. Roel Chair in Construction Engineering and Management: Walsh

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

Professors: Bayasi, Hayhurst, Ponce, Supernak, Walsh, Westermo
Associate Professor: Valdes

Assistant Professors: Beighley, Dowell, Kostic, Milberg, Serag
Adjunct: Penchina, Won

Offered by the Department of Civil, Construction, and Environmental Engineering

Doctor of Philosophy degree in engineering sciences/applied mechanics.

Master of Engineering.

Master of Science degree in civil engineering.

Concentration in environmental engineering.

Major in civil engineering with the B.S. degree.

Major in construction engineering with the B.S. degree.

Major in environmental 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, Construction, and Environmental Engineering

The William E. Leonhard, Jr. Chair in Civil, Construction, 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 Leonhard Chair is intended to promote excellence in undergraduate education in civil, construction, and environmental engineering.

Mission of the Department

The mission of the Department of Civil, Construction, and Environmental Engineering is to provide a high quality undergraduate and graduate education in the civil, construction, 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, construction, 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, construction, and environmental engineering. Engineering design is emphasized, particularly in conjunction with computer utilization and practical 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 undergraduate programs of the department choose to continue their formal studies on a full- or part-time basis at San Diego State University or at another institution. (See the *Graduate Bulletin* for additional information.)

The civil, construction, and environmental engineering programs are 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 civil engineering program are: 1) to provide graduates with the technical knowledge and skills required to practice civil engineering; 2) to provide graduates with an understanding of the ethical, social, legal, and professional issues faced in civil engineering practice; and 3) to provide graduates with a solid foundation for graduate studies, continuing education, and life-long professional development.

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 American Board for Engineering and Technology, 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.

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 12 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 and IV combined (Foundations of Learning and Explorations of Human Experience), nor more than 10 units from one department in Sections II, III, and IV combined (Foundations of Learning, American Institutions, and Explorations of Human Experience).

I. Communication and Critical Thinking: 9 units

You may **not** use Credit/No Credit grades in this section.

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

II. Foundations of Learning: 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. You may *not* use Credit/No Credit grades.

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. Civil engineering students will take Construction Engineering 101.

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 of Human Experience: 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.

A. Upper division Humanities (3 units)

Three units must be taken from the same department as one of the Humanities courses selected in Foundations of Learning.

B. Upper division Humanities (3 units from a department not selected in A above.)

C. 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.

Major Academic Plans (MAPs)

Visit <http://www.sdsu.edu/mymap> for the recommended courses needed to fulfill your major requirements. The MAPs Web site was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

Civil Engineering Major

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

The program below describes 136 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.

Preparation for the Major. Civil Engineering 100, 120, 121, 160, 218, 220; Chemistry 200; Construction Engineering 101; Engineering 280; Engineering Mechanics 200, 220; Mathematics 150, 151, 252; Physics 195, 196. (51 units)

Engineering Science Elective. At least one of the following courses: Electrical Engineering 204; Mechanical Engineering 240, 352.

General Education. Engineering students must follow the specific General Education program outlined in this section of the catalog. 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. Passing the Writing Proficiency Assessment with a score of 10 or above or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

Major. A minimum of 46 upper division units to include the following required and elective courses. Required upper division courses in the major: Civil Engineering 301 (or Mechanical Engineering 304), 302, 321, 401, 444, 462, 463, 481, 495; Construction Engineering 430; Engineering Mechanics 340, 341; Environmental Engineering 355.

Professional Electives. Course choices must consist of either (1) at least one course from at least four of the first five areas (Water through Geotechnical) and at least three units selected from any 400- or 500-level Civil or Environmental Engineering courses not used to satisfy other requirements, or (2) at least two courses from the last area (Construction) and at least one course each from three of the first five areas (Water through Geotechnical).

Water – Civil Engineering 445, 530.

Transportation – Civil Engineering 482, 580.

Environmental – Environmental Engineering 363, 441, 442, 554, 556, 558.

Structural – Civil Engineering 421, 521, 523, 525, 528.

Geotechnical – Civil Engineering 465.

Construction – Civil Engineering 491, 492; Construction Engineering 420, 479.

Master Plan. A master plan of elective courses must be approved by the undergraduate adviser and filed with the Office of Advising and Evaluations as soon as the civil engineering major is declared. Students are required to see their undergraduate adviser prior to registration each semester.

Courses (CIV E)

Refer to *Curricula and Courses and University Policies* sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

LOWER DIVISION COURSES

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

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. Computer Applications in Civil/Environmental Engineering and Construction (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. Computer Graphics for the Built Environment (3)

Two lectures and two hours of activity.
Prerequisite: Civil Engineering 120.
Computer aided design for civil engineering applications (AutoCAD).

CIV E 160. Statistical Methods for the Built Environment (3)

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; Administration, Rehabilitation and Postsecondary Education 201; Biology 215; Economics 201; Political Science 201; Psychology 270; Sociology 201; Statistics 119, 250.

CIV E 218. Surveying for Civil Engineering and Construction (3)

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.

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

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)

Prerequisite: Engineering Mechanics 200.
Mechanics of solid deformable bodies involving analytical methods for determining strength, stiffness, and stability of load-carrying members. Not open to students with credit in Mechanical Engineering 304.

CIV E 302. Solid Mechanics Laboratory (1)

Three hours of laboratory.
Prerequisite: Credit or concurrent registration in Civil Engineering 301 (or Mechanical Engineering 304).
Laboratory studies in solid mechanics. Experimental stress analysis. Experimental confirmation of theory.

CIV E 321. Structural Analysis I (3)

Prerequisites: Civil Engineering 301 (or Mechanical Engineering 304) and 302.

Analysis of beams, frames, trusses, and three-dimensional frameworks. Influence lines; deflections; introduction to statically indeterminate structures and moment distribution.

CIV E 401. Civil Engineering and Society (1)

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)

Prerequisite: Civil Engineering 321.
Properties and characteristics of reinforced concrete; design of structural components. Introduction to plastic theory and limit design.

CIV E 444. Applied Hydraulics (3)

Prerequisite: Engineering Mechanics 340.
Open channel and pressure conduit flow, pumps and turbines, hydroelectric power, flood control, and water law.

CIV E 445. Applied Hydrology (3)

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.

CIV E 462. Geotechnical Engineering (3)

Prerequisite: Civil Engineering 301 (or Mechanical Engineering 304) or Engineering Mechanics 340.
Mechanics of soils as they apply to engineering problems, soil classification, compaction, swelling, consolidation, strength and permeability. Applications to geotechnical and environmental engineering problems.

CIV E 463. Geotechnical Engineering Laboratory (1)

Three hours of laboratory.
Prerequisite: Concurrent registration in Civil Engineering 462.
Laboratory procedures of soil testing for geotechnical and environmental engineering problems.

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

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.

CIV E 481. Transportation Engineering (3)

Prerequisite: 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.

CIV E 482. Highway Engineering (3)

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.

CIV E 491. Construction Methods (3)

Prerequisite: Civil Engineering 321.
Components and methods of construction including earthwork; foundations; wood, steel, and concrete construction; roofing and cladding; interior construction.

CIV E 492. Construction Engineering (3)

Prerequisites: Civil Engineering 491 and Construction Engineering 430.
Project oriented. Cost estimating; alternative cost-saving changes; critical path scheduling.

CIV E 495. Capstone Design Project (3)

One lecture and six hours of laboratory.

Prerequisites: For civil engineering majors: Credit or concurrent registration in Civil Engineering 321, 444, 462, 481, and Environmental Engineering 355. At least three of these courses must be completed prior to enrolling in this course. For environmental engineering majors: Construction Engineering 430 and credit or concurrent registration in Environmental Engineering 441, 442, 554, 556, 558. At least three of these courses must be completed prior to enrolling in this course. For construction engineering majors, credit or concurrent registration in Construction Engineering 480 and 490.

Application of engineering principles and design techniques to the design of civil engineering projects.

CIV E 496. Advanced Civil Engineering Topics (1-3)

Prerequisite: 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

Prerequisite: 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)

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.

CIV E 523. Design of Light Framed Structures (3)

Prerequisite: Civil Engineering 321.

Material properties for wood and metal studs. Loads and structural forces for buildings. Design of beams, columns, bearing stud walls. Seismic forces and lateral force resisting systems. Roof, floor, and shear wall design. Composite beams.

CIV E 525. Design of Steel Structures (3)

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.

CIV E 528. Masonry Structures Design (3)

Prerequisite: Civil Engineering 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)

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.

CIV E 580. Traffic Engineering Design (3)

Prerequisite: Civil Engineering 481.

Sizing and configuration of highway facilities based on capacity analysis. Traffic signal design, impact and mitigation studies, parking, safety design.

CIV E 596. Advanced Civil Engineering Topics (1-3)

Prerequisite: Consent of instructor.

Modern developments in civil engineering. May be repeated with new content. 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. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

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

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