

# Construction Engineering

IN THE COLLEGE OF ENGINEERING

**OFFICE:** Engineering 424  
**TELEPHONE:** 619-594-6071  
**E-MAIL:** [ccee@sdsu.edu](mailto:ccee@sdsu.edu)  
**WEBSITE:** <http://ccee.sdsu.edu>

The undergraduate degree in Construction Engineering is accredited by the Engineering Accreditation Commission (EAC) of ABET, <http://www.abet.org>.

## Faculty

**Chair:** Supernak

**Director of Construction Engineering:** Mitropoulos

**Director of Construction Engineering and Management:** Alves

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

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

**Professors:** Bayasi, Supernak

**Associate Professors:** Alves, Mitropoulos

**Assistant Professor:** Akhavian

**Lecturer:** Lakrori

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

Doctor of Philosophy degree in engineering sciences: (bioengineering), (electrical and computer engineering), (mechanical and aerospace engineering), (structural engineering).

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 J.R. Filanc Construction Engineering and Management Program

The J.R. Filanc Construction Engineering and Management Program is supported by an endowment established by a generous gift from Jane E. and Jack R. Filanc in memory of their daughter, Julia L. Filanc, a graduate of San Diego State University. Jack Filanc founded what would become J.R. Filanc Construction Company in 1952. The endowment supports faculty and students in the program, as well as the biannual J.R. Filanc Lecture in Construction Ethics.

J.R. Filanc Construction Company specializes in the construction of water treatment and wastewater treatment plants, pump stations, and other water-related facilities for cities and municipal agencies throughout the Southwest. Functioning as a pure general contractor, the company self-performs 70% of the work on its construction projects.

## 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 current appointee to the chair, Dr. Thais da Costa Alves, has been teaching and advising students, researching, and collaborating with construction companies toward the dissemination and implementation of lean, especially in the field of production planning and control at construction sites.

## 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 current chair, Dr. Natalie Mladenov, promotes excellence in undergraduate education, research in environmental engineering, and conducts scholarly activities on the topic of water quality in environmental engineering.

## Mission of the Department

The mission of the Department of Civil, Construction, and Environmental Engineering is to ensure student success by providing a high-quality education through focused instruction, research, and continuing professional development for the benefit of the engineering profession, the environment, and society.

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.

## Program Educational Objectives

The construction engineering program is to reflect a collaborative effort between the construction industry and the university to provide an effective and vigorous workforce development for the continued growth of the San Diego region. Graduates of the construction engineering program will (1) be successful engineers in their respective fields of work; (2) be continually progressing in their chosen careers through formal and informal professional development; and (3) be contributing to their profession for the betterment of society and the environment.

### Transfer Credit

No credit will be given for upper division engineering course-work taken at an institution having an engineering program which has not been accredited by the Engineering Accreditation Commission (EAC) of ABET, 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.

### The Major

Construction engineering is the application of engineering principles to the human endeavor of construction. The construction engineering major prepares students to undertake careers in the leadership of construction enterprises for all types of construction, including public and private sectors. It also provides an understanding of the interaction between society and the built environment and the ethical issues involved in that interaction.

Construction engineers are needed in both the private and public sectors. They are employed in a range of capacities across the industry, from construction managers, owner's representatives, project engineers, among others. The dynamic and rapid expansion of the regional, national, and global economies and the continued need for housing and other facilities will drive demand for the degree in the foreseeable future.

### Retention Policy

The engineering program expects all majors will make reasonable academic progress toward the degree. Engineering pre-majors who have either (1) completed major preparatory courses, earned 60 units, but have less than a 2.7 cumulative GPA or (2) earned 60 units but have not completed major preparatory courses and/or have less than a 2.7 cumulative GPA may be removed from the premajor and placed in undeclared.

### Impacted Program

The construction engineering major is an impacted program. To be admitted to the construction engineering major, students must meet the following criteria:

- Complete with a grade of C (2.0) or better: Civil Engineering 225; Chemistry 202 (or 200); Mathematics 150, 151; Physics 195, 196. These courses cannot be taken for credit/no credit (Cr/NC);
- Have an overall cumulative GPA of 2.7.

To complete the major, students must fulfill the degree requirements for the major described in the catalog in effect at the time they are accepted into the premajor at SDSU (assuming continuous enrollment).

### Major Academic Plans (MAPs)

Visit <http://www.sdsu.edu/mymap> for the recommended courses needed to fulfill your major requirements. The MAPs website 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.

### Construction Engineering Major

With the B.S. Degree

(Major Code: 09254) (SIMS Code: 442010)

This program requires 133 units to include general education. In addition, the number of units specified in each elective category represents a minimum requirement.

**Preparation for the Major.** Construction Engineering 101, 201, 215 (or Civil Engineering 121), 280; Accountancy 201; Biology 100 or 101; Chemistry 202 (or 200); Civil Engineering 160 (or Statistics 250), 218, 220, 225; Economics 102; Geological Sciences 100, 101; Mathematics 150, 151; Philosophy 101; Physics 195, 195L, 196. (59 units)

Civil Engineering 225; Chemistry 202 (or 200); Mathematics 150, 151; Physics 195, 196 must be completed with a grade of C (2.0) or better. These courses cannot be taken for credit/no credit (Cr/NC).

**General Education.** Students with this major are required to take Philosophy 332 [or Sustainability 332] to satisfy three units

of upper division Humanities, IV.C. Students are strongly encouraged to take Spanish 101, 102, 201, 202, 211, 212, 281, or 282 to satisfy three units of Foundations of Learning, C. Humanities.

**Graduation Writing Assessment Requirement.** Passing the Writing Placement Assessment with a score of 10 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 44 upper division units to include Construction Engineering 301, 312, 320, 330, 340, 401, 479, 480, 590; Civil Engineering 301, 302, 321, 462, 463, 495; and three units selected from the following:

**Technical Electives.** Construction Engineering 520; Civil Engineering 421, 465, 523, 525, 528.

### Courses (CON E)

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

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

### LOWER DIVISION COURSES

#### CON E 101. Construction and Culture (3) [GE]

Cultural context of construction, emphasizing its centrality in evolution and expansion of built environments as expressions of ethical and historical value systems. Relationship between culture, geography, construction materials, and built expressions of cultural legacy. Interdependence of built environment and society.

#### CON E 102. Fundamentals of Construction Management (1)

Construction industry and its projects. Functions of main actors and phases of construction projects. Tasks performed by construction managers and how they relate to and impact projects. Common processes and technologies in construction management field.

#### CON E 201. Construction Concepts and Building Codes (3)

Concepts of control and information exchange in construction. Purpose and function of fundamental information flows, function, and development of construction-related codes and standards to protect public health and safety, compliance with requirements, and design using codes.

#### CON E 215. Virtual Design and Construction (3)

Two lectures and two hours of activity.  
Building information modeling (BIM). Connectivity to other aspects of the construction enterprise to include estimating, planning, and scheduling deployment. Constructability review.

#### CON E 240. Introduction to Construction Materials (3)

Prerequisite: Physics 180A.  
Properties of materials used for construction to include aggregate, ceramic, concrete asphalt, decorative and finish materials, soil, steel aluminum, and wood. Key material properties and material performance.

#### CON E 262. Soil Mechanics (3)

Two lectures and three hours of laboratory.  
Prerequisites: Mathematics 150 and Physics 180A with a grade of C (2.0) or better in each course.  
Formation of soils. Classification of soils and their behavior. Compaction, consolidation, permeability, strength, and swelling.

#### CON E 280. Construction Methods (3)

One lecture and six hours of laboratory.  
Components and methods of construction including earthwork; foundations; wood, steel, and concrete construction; roofing and cladding; interior construction. Field experience in conducting and/or observing construction operations. Concepts of production in a construction setting.

#### CON 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)

**CON E 301. Construction Ethics, Law, and Contracts (3)**

Prerequisites: Construction Engineering 101, 201, Philosophy 101. Legal and ethical environment of construction. Study of documents and common procedures in construction administration and their legal and ethical contexts for general contractors and sub-contractors. Contract documentation, claim in various construction delivery methods.

**CON E 312. Mechanical and Electrical Principles for Construction (3)**

Two lectures and three hours of laboratory. Prerequisites: Mathematics 150. For construction engineering majors: Physics 196. For construction management majors: Physics 180B.

Engineering principles for mechanical, electrical, plumbing systems. Thermodynamics, energy principles, psychometrics. Electrical theory, circuits, motors. Static and dynamic principles for fluids, pipe flow. Mechanical and plumbing equipment.

**CON E 320. Construction Estimating (3)**

Two lectures and three hours of laboratory. Prerequisites: Construction Engineering 280 and Mathematics 150.

Identifying and estimating time and cost requirements for construction operations based on drawings and specifications. Use computer applications for estimating.

**CON E 330. Principles of Engineering Economy (3)**

Prerequisite: Mathematics 150. Mathematics of finance applied to engineering and managerial decision making. Framework for cost management in engineering and construction. (Formerly numbered Construction Engineering 430.)

**CON E 340. Analysis and Design of Construction Operations (3)**

Prerequisites: Construction Engineering 320 and 330. Properties and methods for use of construction equipment and integration into production system. Assessment of equipment needs and selection. Site utilization and layout planning, incorporating efficiency and safety of operations. (Formerly numbered Construction Engineering 310.)

**CON E 350. Construction Project Controls (3)**

Prerequisites: Construction Engineering 280, 330, and Accountancy 201.

Characteristics of the construction industry and impacts on project controls. Associated costs in business and construction projects. Lease or buy decisions, pricing of change orders, progress payments, and schedules of values.

**CON E 400. Preconstruction Management (3)**

Prerequisites: Construction Engineering 350 and Business Administration 350.

Addressing general conditions, organizing site logistics, and project start-up. Assembling teams and defining contractual scopes of work. Organizing the pursuit of projects. Phases related to building a proposal.

**CON E 401. Construction Planning and Scheduling (3)**

Two lectures and three hours of laboratory. Prerequisites: For construction engineering majors: Civil Engineering 160 and credit or concurrent registration in Construction Engineering 320. For civil engineering majors: Civil Engineering 160 and 321. For construction management majors: credit or concurrent registration in Construction Engineering 320 and Statistics 119.

Fundamentals of scheduling logic including critical path method, deterministic and probabilistic scheduling, and impact of constraints. Development of construction plan and representation in schedule format using common computer applications used in industry.

**CON E 479. Construction Materials (3)**

Two lectures and three hours of laboratory. Prerequisites: Chemistry 202 (or 200) and Civil Engineering 301 (or Mechanical Engineering 304).

Selection, design and control of mixes of portland cement and asphalt concrete. Properties of these and other materials used in construction.

**CON E 480. Design of Temporary Structures (3)**

Prerequisites: Civil Engineering 321 and 462. Design of structures for temporary support of constructed work, including scaffolding and formwork, bracing, and excavations. Influence of codes and standards on the design process, selection of degrees of safety, and concepts of liability.

**CON E 495. Capstone Design Project (3)**

One lecture and six hours of laboratory. Prerequisites: Credit or concurrent registration in Construction Engineering 590 and for construction engineering majors: Construction Engineering 480. For construction management majors: Construction Engineering 400. Open to majors in construction engineering and construction management.

Application of engineering principles, design and management techniques to construction projects.

**UPPER DIVISION COURSES**

(Also Acceptable for Advanced Degrees)

**CON E 520. Environmentally Conscious Construction (3)**

Two lectures and three hours of laboratory. Prerequisite: Construction Engineering 312 for construction engineering and construction management majors; Civil Engineering 444 for civil engineering majors; concurrent registration in Civil Engineering 495 for environmental engineering majors.

Design and design processes to target a sustainable structure. Construction practices associated with protection of environment. Application of industry standards for environmental and energy performance of buildings. Impacts on selection of methods, materials, and equipment for construction. Design of procurement and management systems to support environmentally conscious building. Commissioning and startup. (Formerly numbered Construction Engineering 420.)

**CON E 590. Construction Management and Safety (3)**

Prerequisites: Construction Engineering 330 and 401. Management and control of critical project processes for construction projects. Definition, planning, and execution of projects based on plan, estimate, and bid documentation. Fundamentals of construction safety planning, design, and requirements. (Formerly numbered Construction Engineering 490.)

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For additional courses in the construction engineering program, refer to "Civil Engineering" in this section of the catalog.

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**GRADUATE COURSES**

Refer to the *Graduate Bulletin*.