DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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More Information: https://engineering.case.edu/civil-and-environmental-engineering

The Department of Civil and Environmental Engineering offers programs of study in environmental, geotechnical, and structural engineering, construction engineering and management, engineering mechanics, and pre-architecture.

Civil and environmental engineers plan, design, and construct facilities for meeting the needs of modern society. Civil and environmental engineers also help reduce the environmental impact of these designs to help make modern society more sustainable. Examples of such facilities are transportation systems, schools and office buildings, bridges, dams, land reclamation projects, water treatment and distribution systems, commercial buildings, and industrial plants. Civil and environmental engineers can choose from a broad spectrum of opportunities in industry and consulting practice; as well as in research and development in firms in which civil engineers are often owners or partners. Employment can be found among a wide variety of industrial, governmental, construction, and private consulting organizations. There is a large demand for civil engineers nationally. The program at Case Western Reserve University is built around small classes, good faculty-student relationships and advising, and a program flexible enough to meet students' personal career goals.

The Department of Civil and Environmental Engineering of the Case School of Engineering offers a Bachelor of Science in Engineering degree program with a major in Civil Engineering with courses in almost all the traditional Civil Engineering subjects. The graduate program offers the Master of Science and Doctor of Philosophy degrees in areas of structural, geotechnical, environmental engineering, and engineering mechanics. A cooperative education program involving participating engineering firms is also available for both undergraduate and graduate students.

The Department's active research programs provide opportunities for students to participate in projects related to design, analysis, and testing. Projects are in areas such as air quality, blast engineering, bridges, carbon capture, climatic adaptation, computational mechanics, contaminated sediments, contaminant fate and transportation, dynamics and wind engineering, earthquake engineering, foundation engineering, fracture mechanics, infrastructure materials, infrastructure systems optimization, pavement engineering, probabilistic design, response of concrete and steel structures, risk assessment, static and dynamic behavior of soils, structural health monitoring, subsurface and *ex-situ* remediation, urban hydraulics, water and wastewater treatment, and water reuse.

Mission

The Department of Civil and Environmental Engineering has developed its own mission statement and educational objectives that are consistent with those of the Case School of Engineering. This process involved the entire department faculty along with the department's Advisory Committee and alumni. Assessing the Department's mission and educational objectives is an ongoing process.

Our mission is to prepare students for leadership roles in Civil and Environmental Engineering. The Department provides facilities and research expertise to advance the state of the Civil and Environmental Engineering profession within the mission of the Case School of Engineering. Students address problems, building on solid technical foundations while taking advantage of advanced technologies. Our graduates adhere to high technical and ethical standards, in service to the public. Graduates are prepared for the pursuit of advanced learning in Civil and Environmental Engineering and related fields, as well as for the practice of Civil and Environmental Engineering at the highest professional levels.

Research

Research underway in Civil and Environmental Engineering includes work in analytical, design and experimental areas and is sponsored by industry, state, and federal government sources. Major areas of research interest are:

- **Structural Engineering**
  - Behavior of reinforced and prestressed concrete
  - Behavior and design of steel structures
  - Fiber-reinforced concrete
  - Fiber-reinforced composites
  - Wind engineering
  - Earthquake analysis and design of structures
  - Passive vibration control of structures
  - Finite element methods
  - Nondestructive Testing of Structures
  - Structural health monitoring
  - Blast loading of structures
  - Multiscale simulation of nonlinear dynamic structural behavior
  - Modeling of structural materials and structural systems
  - Extreme dynamic load resistant design
  - Multi-hazard and structural risk assessment
  - High and low-cycle fatigue
  - Fracture mechanics and size effect
- **Geotechnical and Infrastructure**
  - Geotechnical/Pavement Materials
  - Non-destructive testing evaluation of soils and pavement materials
  - Static behavior of anisotropic clays and sands
  - Soil liquefaction
  - Centrifuge modeling of static and dynamic soil behavior
  - Dynamic soil-structure interaction
  - Measurement of dynamic soil properties
  - Design of structures for high-speed vehicles
  - Stability of tailings dams
  - Environmentally conscious manufacturing

- Geoenvironmental engineering
- Infrastructure engineering
- Sensor technology
- Smart materials
- Intelligent infrastructure and transportation system
- Transportation safety
- Driver safety
- Energy structures and geotechnology
- Building materials
- Climatic adaptation

- **Environmental Engineering**
  - AI/machine learning in environmental engineering
  - Environmental chemistry
  - Air Quality
  - Water and wastewater treatment
  - Environmental data science
  - Environmental remediation
  - Microbiomes
  - Bioinformatics
  - Fate and transport of environmental contaminants
  - Environmental modeling and software development
  - Sediment remediation
  - Bioremediation
  - Biofuel development
  - Urban hydraulics
  - Soil contamination standards
  - Brownfields/structural remediation
  - Environmental materials
  - Environmental hazard and risk engineering

Faculty

Elias Ali, PhD
(Drexel University)
Assistant Professor
Structural Engineering; structural fire engineering; blast and extreme loading on structures; thin-walled structures; multi-functional composite materials

Christian Carloni, PhD
(University of Bologna)
Associate Professor
Composite materials for strengthening of reinforced concrete and masonry structures; fracture mechanics, damage mechanics, and fatigue of quasibrittle materials; small and large scale experimental testing of concrete, masonry, geopolymers and other quasibrittle materials and structural systems; mechanics of materials

Bridget Hegarty, PhD
(Yale University)
Assistant Professor
Environmental Engineering; understanding and engineering microbiomes; air quality; drinking water and wastewater treatment; AI and machine learning in environmental engineering; metagenomics and metatranscriptomics for environmental engineering applications

Yue Li, PhD
(Georgia Institute of Technology)
Professor
Probabilistic analysis, structural and systems reliability, multi-hazard assessment and mitigation, risk-informed decision making, resilient and sustainability civil infrastructure systems, earthquake engineering, wind engineering, impact of climate change and adaptation strategies

Hyoung Suk Suh, PhD
(Columbia University)
Assistant Professor
Energy and environmental geotechnics; poromechanics; computational mechanics; fracture mechanics; constitutive modeling; transport in porous and granular media; data-driven methods

Katie P. Wheaton, MS, SE, PE
(Lehigh University)
Senior Instructor
Structural engineering; steel, concrete, and wood structures; geomatics; CAD modeling

Xiong (Bill) Yu, PhD, PE
(Purdue University)
Professor
Geotechnical engineering; infrastructure; construction material testing; information technology; intelligent infrastructure; energy geotechnology; sustainable design; sensors: structural health monitoring

Huichun (Judy) Zhang, PhD
(Georgia Institute of Technology)
Professor
Environmental engineering, environmental chemistry, AI and machine learning in environmental engineering, fate and transformation of emerging contaminants, redox transformation at mineral-water interface, absorption, advanced inorganic and polymer materials for contaminant removal, water and wastewater treatment, and groundwater and soil remediation

Emeritus Faculty

J. Ludwig Figueroa, PhD
(University of Illinois)
Professor Emeritus

Dario A. Gasparini, PhD
(Massachusetts Institute of Technology)
Professor Emeritus

Arthur A. Huckelbridge, DEng, PE
(University of California Berkeley)
Professor Emeritus

Aaron Jennings, PhD, PE
(University of Massachusetts Amherst)
Professor Emeritus

Adel S. Saada, PhD, PE
(Princeton University)
Professor Emeritus

Secondary Appointment

Kurt R. Rhoads, PhD, PE
(Environmental Engineering; fate of organic pollutants, bio-remediation, algal biofuel development)
Associate Professor

Chris Yinchun Yuan, PhD
Professor, Mechanical and Aerospace Engineering
Sustainable Manufacturing

Adjunct Faculty

Esmaeel Asadi, PhD
Adjunct Instructor
Structural Engineering

Vincent Beach, BS, PE
Adjunct Instructor
Construction Management and Estimation

Gina Beim, MS, PE
Adjunct Instructor
Civil Engineering Infrastructure; Water Resources Engineering

Katherine Holmok, BS, PLA
Adjunct Instructor
Environmental Engineering

Alexandra Litofsky, MS, PE
Adjunct Instructor
Environmental Engineering, Hydraulics and Hydrology

Phil Nagle
Adjunct Instructor
Building Information Modeling, Remote Sensing, Construction Management

Jamal Nusairat, PhD, PE
Adjunct Instructor
Geotechnical Engineering

John Picuri, BE, BS, PE, PS
Adjunct Instructor
Civil Engineering Senior Project

Michael Pollino, PhD, SE, PE
Adjunct Instructor
Structural Engineering

Martin Schmidt, PhD
Adjunct Instructor
Solid and Hazardous Waste Management

Tyler Stillings, MS, PE
Adjunct Instructor
Structural Engineering, Forensic Engineering

Robert Yin, MS, PE
Adjunct Instructor
Structural Engineering, Bridge Engineering

Dan Ghiocel, PhD
Adjunct Professor
Structural Engineering

Xiangwu (David) Zeng, PhD
Adjunct Professor
Geotechnical Engineering

Programs

- Civil Engineering, BSE
- Civil Engineering, Minor
- Civil Engineering, MS
- Civil Engineering, PhD
- Environmental Engineering, Minor

Dual Degrees

- Programs Toward Graduate or Professional Degrees

Facilities

ASCE Lounge

Provides a comfortable space for student studying, collaboration, and relaxation. This space fosters community and connection among undergraduate students, and hosts American Society of Civil Engineers (ASCE) student chapter and Steel Bridge Team meetings.

Strength of Materials and Concrete Laboratory

The laboratory space is adjacent to the Structural Engineering Laboratory. It includes a room for concrete batching (Bingham G74), a humidity and temperature-controlled room (Bingham G70) to support small-scale specimen preparation and storage, and newly-renovated curing room. The laboratory houses metal and wood fabrication equipment that includes MIG, TIG, Stick and Oxyacetylene welders, plasma cutter, drill press, mag drill, bench grinders, mitter and vertical saws. A 55-kip MTS Landmark Series, 110-kip MTS 880 Series, 220-kip MTS 244 Series servo-hydraulic universal testing machines together with an axial (55 kip)-torsional (20,000 in-lb) MTS 312 Series servo-hydraulic machine are part of the laboratory. In addition, a 600-kip compression machine (ControlsGroup USA) is available. Fixtures for fracture mechanics setups (one for spans up to 20 in and the other for spans up to 48 in.) are available. Clevis-type grips are available for tensile tests on composite coupons and fracture mechanics compact tests. Contact Dr. Christian Carloni for more information.

Civil Engineering Study Lounge

This study area is designed to supplement the computer laboratories with a quiet workplace for individual or group study.

Concepts in Surveying Laboratory

The Concepts in Surveying Laboratory was established to put surveying equipment into the hands of students. Civil Engineering infrastructure work begins with high-quality, accurate survey data. The experience of surveying in the field using advanced equipment, such as levels and total stations, supports a student's use of teamwork and creative problem-solving. From outdoor data collection to computer modeling, students then post-process data using CAD software. The dynamic and exciting science of Geomatics and modern map-making is then introduced with software-based lab work that explores LiDAR, Photogrammetry, and Geographic Information Systems (GIS).

Environmental Engineering Laboratory

This laboratory is one in a suite of laboratories that support Environmental Engineering teaching and research. The facilities include a teaching laboratory, an advanced instrumentation laboratory, a remediation research laboratory and an electronic classroom/software laboratory. The Environmental Engineering Laboratory is equipped for conventional Standard Methods analysis of water, wastewater, soil, solid waste, and air samples (pH meters, furnaces, glove box, ovens, incubators, hoods, etc.), advanced analytical instruments including high performance liquid chromatography (HPLC), Ion chromatography (IC), UV-visible spectrometer, and ATR-FTIR spectroscopy, and for aerobic and anaerobic microbiology work. The lab also offers generous bench top space for student teams to explore laboratory procedures and provides direct access to research, instrumentation, and computational facilities. Contact Dr. Huichun (Judy) Zhang for more information.

Environmental Microbiology and Biotechnology Laboratory

This laboratory has a suite of cutting-edge molecular biology instruments. It is equipped with a QX600 droplet digital PCR machine, Duet quantitative PCR instrument, spectrophotometer (fluorescence and UV-Vis with shaking and temperature control), centrifuges, incubators, fridges, freezers, analytical balances, and more. Contact Dr. Bridget Hegarty for more information.

Geotechnical Engineering Laboratories

The new state of the art Geotechnical Engineering Laboratories and Educational Facilities offer an ideal environment for teaching and research:

The Frank Gerace Undergraduate Laboratory operates an undergraduate geotechnical testing laboratory to conduct most routine ASTM and AASHTO tests, following their standardized procedures.

The Richard A. Saada Intelligent Geosystems Laboratory houses innovative interdisciplinary research including sensor and non-destructive technologies such as Time Domain Reflectometry (TDR), ultrasonics, fiber optic sensors, smart and functional materials, multiphysics processes in porous materials, etc.

The Saada Family Geotechnical Laboratory has a full array of strength and deformation testing units; notable are automated triaxial units for generalized extension and compression tests, units permitting simultaneous application of hydrostatic, axial and torsional static and dynamic loads, units by means of which one dimensional consolidation in the triaxial cell can be achieved, and various pore pressure, force and deformation measuring devices. Also available is a longitudinal and torsional resonant column device and a large size oedometer equipped with bender elements.

A 20g-tons fully automated centrifuge with a servo-hydraulic earthquake shaker is in operation.

The Warren C. Gibson library has a large array of reference materials, conference proceedings and internet connection to the University library and other sources of technical information. Contact Dr. Bill Yu for more information.

Haptic Research Laboratory

The haptic interface laboratory hosts two state-of-the-art driving simulators. It provides holistic driving simulations for advanced research, education and training in the area of transportation safety, human perception and human-machine interface. Contact Dr. Bill Yu for more information.

Miller Library

The Miller Library named in honor of Craig J. Miller, a former Civil Engineering faculty member, acts as both a library and as the Department's premier meeting space.

Neff Civil Engineering Undergraduate Computer Laboratory

This laboratory provides Civil Engineering students with access to all the computer resources needed for both course work and research. All of the computers in the Neff lab can act as independent workstations or provide access via a fiber optic link to other campus computers.

Vanderhoof-Schuette Structural Laboratory

The laboratory is a premiere facility for large-scale structural testing used for both education and research on the performance of large-scale infrastructure components.

The facility is designed for both static and dynamic testing. Controlled force, displacement, or strain may be applied at frequencies up to 20Hz. The performance of innovative structural components, new structural connections, sign supports, pipelines, and systems for new energy facilities can be evaluated. More specifically, studies to determine stiffness, static strength, fatigue strength, fracture toughness, cyclic behavior, and effective damping can be performed. Wind excitation, earthquake excitation, and vehicle-induced vibration can be simulated.

The facility supports one of the principal objectives of the Civil and Environmental Engineering Department at Case Western Reserve University: to provide advanced education and perform advanced research focused on our built infrastructure.

The facility features a 1,500 square foot strong floor and L-shaped 28-foot-high strong wall with tie-down points on a 2-foot grid with a capacity of 60,000 pounds each. The wall also provides a 500-ton reaction test cell. Four 6 foot by 6 foot uni-directional shaking tables provide capabilities for application of dynamic horizontal support motions. Laboratory hydraulic fluid is supplied at 3000 psi to actuators through a stainless steel pipe network to five power stations. A 95 gallon per minute hydraulic power supply is situated in a separate, sound-containing room. The pump and oil temperature are controlled by a separate water cooling loop and rooftop heat exchanger. The hydraulic system is controlled by a four-channel MTS FlexTest 60 digital controller. Laboratory activities are supported by a 15-ton crane, 32-foot scissor lift and 2-ton forklift. One 110-kip, two 55-kip, and four 22-kip hydraulic actuators are available for structural testing. A broad selection of sensors is available and includes LVDTs, clip-on gauges, and extensometers. Contact Dr. Christian Carloni for more information.

Vose Room

The Department uses the Vose Room equipment for meetings and video conferencing.