

# CONSTRUCTION ENGINEERING

## Description

Construction engineering (CONE) is a program of the Charles W. Durham School of Architectural Engineering and Construction. The construction engineering major integrates engineering, construction and management courses. This program is designed for persons fulfilling the construction industry's need for licensed professional engineers. It resembles the construction management program but provides a greater emphasis on engineering, scientific, and technical courses to meet requirements for licensure as a professional engineer. The courses focus on the application of engineering principles to solve real-world construction problems. They include instruction in civil engineering, structural principles, material testing and evaluation, project management, computer-assisted design, 3D animation, sustainability, and graphic communication.

The Durham School Construction Engineering program is accredited by the Engineering Accreditation Commission (EAC) of ABET, Inc.

The educational objectives of the construction engineering program are to produce graduates who will (in three to five years after graduation):

- Possess knowledge acquisition skills enabling them to remain current throughout their careers.
- Apply engineering principles of analysis and design to the systems being constructed.
- Employ technical skills with innovation and dedication to pursue improved functionality, increased efficiency, and decreased costs.
- Use communication skills to effectively share their ideas with many forms of media.
- Adapt to the constantly changing, interdisciplinary design and construction fields by applying teamwork and team building skills.
- Apply appropriate construction practices, including business organization, estimating, scheduling, project delivery, and ethics.

Under the stimulus of increasing demand for global services, many Nebraska companies have expanded their reach well beyond U.S. borders. This demand gives the construction engineering graduate an unprecedented number of opportunities for employment—locally, nationally, and internationally—and for pursuing an advanced degree at the University of Nebraska–Lincoln or elsewhere.

Construction engineers participate in the preparation of engineering and architectural documents, including specifications, which they translate into finished projects such as buildings for housing, commerce and industry, highways, railroads, waterways, airports, power plants, energy distribution systems, military bases, and space center complexes. These projects involve thousands of details shared by a team of owners, architects, engineers, general constructors, specialty constructors, manufacturers, material suppliers, equipment distributors, regulatory bodies and agencies, labor resources and others. The constructor assumes responsibility for delivery of the completed project at a specified time and cost and also accepts associated legal, financial, and management obligations. Because of the broad scope of the construction

engineer's project responsibility, he/she must assure the project's constructability as well as its capability to be operated and maintained.

Construction engineering students are required to enroll in a set of courses specifically designed for a general construction education. Each student selects, with the guidance of an advisor, a set of approved electives. The program outlined below leads to the bachelor of science degree in construction engineering.

## College Requirements

### College Admission

#### College Entrance Requirements

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Students must have an ACT (enhanced) score of 24 or greater (or equivalent SAT). Students who lack entrance requirements may be admitted based on ACT scores, high school rank and credits, or may be admitted to pre-engineering status in the Exploratory and Pre-Professional Advising Center. Pre-engineering students are advised within the Exploratory and Pre-Professional Advising Center.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Exploratory and Pre-Professional Advising Center or other Colleges at Nebraska.

Students should consult their advisor, their department chair, or Engineering Student Services if they have questions on current policies.

### Other Admission Requirements

Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE freshman entrance requirements and have a minimum cumulative GPA of 2.5 and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to

the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska at Kearney and at Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

All transfer students must adopt the curricular requirements of the undergraduate catalog current at the time of transfer to the COE—not that in use when they entered the University of Nebraska–Lincoln. Upon admission to Nebraska, students wishing to pursue degree programs in the COE will be classified and subject to the policies defined in the subsequent section.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 in order to be readmitted to COE.

## College Degree Requirements

### Grade Rules

#### Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to his/her instructor and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal his/her case through the College Academic Appeals Committee on his/her campus.

## Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

## Learning Outcomes

Graduates of the construction engineering program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The above student outcomes have been approved by the ABET Engineering Area Delegation for use beginning with the 2019-20 academic year, and have been adopted by the faculty of the Charles W. Durham School of Architectural Engineering and Construction.

## Major Requirements

### Requirements for the Degree (Lincoln Campus)

#### First Semester

CHEM 109	General Chemistry I	4
COMM 286	Business and Professional Communication	3
CONE 103	Introduction to Construction Engineering	1
CSCE 155N	Computer Science I: Engineering and Science Focus	3
ENGR 10	Freshman Engineering Seminar	0
MATH 106	Calculus I	5
Credit Hours Subtotal:		16

#### Second Semester

CNST 112	Construction Communications	3
MATH 107	Calculus II	4
PHYS 211	General Physics I	4
PHYS 221	General Physics Laboratory I	1
<i>ACE Elective</i>		
Choose one course from not yet satisfied ACE outcomes 5, 7, or 9		3
Credit Hours Subtotal:		15

#### Third Semester

CIVE 221 / CONE 221	Geometric Control Systems	3
ENGR 20	Sophomore Engineering Seminar	0
MATH 208	Calculus III	4
MECH 223	Engineering Statics	3
PHYS 212	General Physics II	4
JGEN 200	Technical Communication I	3
Credit Hours Subtotal:		17

#### Fourth Semester

CNST 225	Introduction to Building Information Modeling (BIM)	3
BSEN 206 / CONE 206	Engineering Economics	3
MATH 221	Differential Equations	3
MECH 325	Mechanics of Elastic Bodies	3
MECH 373	Engineering Dynamics	3
Credit Hours Subtotal:		15

#### Fifth Semester

ECEN 211	Elements of Electrical Engineering I	3
CIVE 341	Introduction to Structural Engineering	4
CONE 319	Construction Methods and Equipment	3

CONE 378 / CNST 378	Construction Estimating I	3
MECH 310 / CIVE 310	Fluid Mechanics	3
Credit Hours Subtotal:		16
<b>Sixth Semester</b>		
CIVE 334	Introduction to Geotechnical Engineering	4
CIVE 378	Materials of Construction	3
ECON 212	Principles of Microeconomics	3
STAT 380 or MECH 321	Statistics and Applications Engineering Statistics and Data Analysis	3
<i>ACE Elective</i>		
Choose one course from not yet satisfied ACE outcomes 5, 7, or 9		3
Credit Hours Subtotal:		16
<b>Seventh Semester</b>		
CIVE 440	Reinforced Concrete Design I	3
CONE 414 or CNST 444	Accident Prevention in Construction Construction Site Safety Management	3
CONE 476 / CNST 476	Project Budgets and Controls	3
CONE 485 / CNST 485	Construction Planning, Scheduling, and Controls	3
<i>Technical Elective</i>		
Credit Hours Subtotal:		15
<b>Eighth Semester</b>		
CIVE 441	Steel Design I	3
CONE 489	Construction Engineering Capstone Course	3
BLAW 371	Legal Environment	3
<i>Technical Elective</i>		
<i>ACE Elective</i>		
Choose one course from not yet satisfied ACE outcomes 5, 7, or 9		3
Credit Hours Subtotal:		15
Total Credit Hours		125

## Additional Major Requirements

### Grade Rules

#### C- and D Grades

All coursework must be of C grade level or higher to be credited toward graduation requirements or to be valid as a prerequisite for another course.

### Electives

Students are required to enroll in a predetermined set of courses specifically designed for general construction education. Each student selects, with the approval of his/her advisor, a set of approved electives.

Technical electives are selected from the following list. One (3 credit hour) of the required two electives needs to be considered a design technical elective.

#### Design Technical Electives

CONE 416	Wood and / or Contemporary Materials Design	3
CONE 417	Formwork Systems	3

CONE 481	Highway and Bridge Construction	3
CONE 483	Support of Excavation	3
CIVE 443	Advanced Structural Analysis	3
CIVE 444	Structural Design and Planning	3
CIVE 446	Steel Design II	3
CIVE 447	Reinforced Concrete Design II	3

### Technical Electives

All previously listed Design Technical Electives

CNST 379	Construction Estimating II	3
CNST 434	The Design-Build Project Delivery System	3
CONE 450	Sustainable Construction	3
CONE 466	Heavy and/or Civil Estimating	3
CONE 498	Special Projects	1-6
MECH 420	Heat Transfer	3

### ACE Requirements

The CONE program follows the University's ACE general education requirements. Because of the specific needs of the program, several of these courses are specified in the curriculum. Please contact Melissa Hoffman at melissa.hoffman@unl.edu or 402-554-4482, if you are interested in more information about this program.

#### CONE 103 Introduction to Construction Engineering

**Description:** Introduction to the organization and terminology of construction engineering. Overview of technical and management skills required to succeed in the construction engineering profession.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded

**Prerequisite for:** CONE 211

#### CONE 206 Engineering Economics

**Crosslisted with:** BSEN 206

**Prerequisites:** Sophomore standing

**Description:** Introduction to methods of economic comparisons of engineering alternatives: time value of money, depreciation, taxes, concepts of accounting, activity-based costing, ethical principles, civics and stewardship, and their importance to society.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** CNST 476, CONE 476; CONE 319; MECH 343

**ACE:** ACE 8 Civic/Ethics/Stewardship

#### CONE 211 Construction Business Methods

**Prerequisites:** CONE 103 or CNST 131 or AREN 101

**Description:** Business concepts and practices used by construction contractors. The construction industry, management principles, forms of business ownership, company organization, construction contracts, estimating and bidding, business ethics, bonds and insurance, financial statements, cost accounting, equipment management, planning and scheduling, labor relations and personnel management.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Prerequisite for:** CONE 414

**CONE 221 Geometric Control Systems****Crosslisted with:** CIVE 221**Prerequisites:** MATH 106

**Description:** Introduction to the theory and application of mensuration and geometric information processing in civil engineering. Measurement of distance, direction, elevation, and location using mechanical, electronic, and satellite systems. Collection of field data and error propagation. Elementary geometric data bases for design, construction, operation, and control of civil works.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CIVE 361**CONE 319 Construction Methods and Equipment****Prerequisites:** CONE 206

**Description:** Characteristics, capabilities, and selection of equipment and methods used in the building construction industry. Estimating job production, equipment production rates, machine operating costs, earth-moving equipment, hoisting equipment, operations analysis, and use of various other construction and methods and equipment.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CONE 414**CONE 378 Construction Estimating I****Crosslisted with:** CNST 378**Prerequisites:** CNST 112

**Description:** Preparation of detailed cost estimates based on contract documents. Identify and analyze cost components of building and site scopes of work to perform detailed quantity take-offs. Apply labor, material, and equipment pricing from RS Means. Use production rates and quantity takeoffs to prepare a preliminary construction schedule. Complete quantity takeoffs from 2D plans and from 3D BIM software models.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** CNST 379; CNST 440; CNST 476, CONE 476**CONE 414 Accident Prevention in Construction****Prerequisites:** Senior standing; CONE 211 and 319.

**Description:** Safety practices in the construction industry and the national safety and health standards of the Occupational Safety and Health Administration (OSHA). The theory of accidents; personal attitudes; statistics and environment; accident occurrence; prevention and inspection in connection with the construction of buildings, highways, and associated heavy facilities. Nationally accepted safety codes and their relationship to accept practices in the industry.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 416 Wood and / or Contemporary Materials Design****Crosslisted with:** CONE 816**Prerequisites:** CIVE 341

**Description:** Design of structural timber, beams, columns, and connections. Introduction to applicable design philosophies and codes. Overview of materials design. Masonry, aluminum, and contemporary materials such as plastics and fiber reinforced systems and composite material groups. Design considerations, cost and constructability analysis.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 417 Formwork Systems****Crosslisted with:** CONE 817**Prerequisites:** CONE 416; parallel CIVE 441

**Description:** Design of structural timber, beams, columns, and connections. Introduction to applicable design philosophies and codes. Overview of materials design. masonry, aluminum, and contemporary materials such as plastics and fiber reinforced systems and composite material groups. Design considerations, cost and constructability analysis.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CONE 450 Sustainable Construction****Crosslisted with:** CONE 850**Prerequisites:** Senior standing.

**Description:** Sustainable construction and its application to the green building industry. LEED certification process, sustainable building site management, efficient waste water applications, optimizing energy performance, indoor environmental issues, performance measurement and/or verification, recycled content and certified renewable materials.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 459 BIM I: Introduction to Building Information Modeling (BIM)****Crosslisted with:** CONE 859**Prerequisites:** CNST 112 Construction, or Graduate standing in AREN, CIVE, CNST, or CONE.

**Description:** This course instructs CAD users on the effective use of Building Information Model (BIM) for Integration of design, document and Construction Estimate. Topics include: model-based 3D design, file formats, interoperability, and MEP modeling.

**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option

**CONE 466 Heavy and/or Civil Estimating****Crosslisted with:** CONE 866**Prerequisites:** CONE 319, CONE 378, and CONE 485.**Description:** Estimating techniques and strategies for heavy and/or civil construction. Unit pricing, head and civil constructions takeoffs and estimating, equipment analysis, overhead cost and allocations, estimating software and government contracts.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 476 Project Budgets and Controls****Crosslisted with:** CNST 476**Prerequisites:** CNST 378, and BSEN 206 or FINA 300**Description:** The basic systems related to revenues and expenses associated with record keeping of construction contracts. Managerial accounting related to planning and control of construction projects.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 481 Highway and Bridge Construction****Crosslisted with:** CONE 881**Prerequisites:** Senior standing; CONE/CNST 241.**Description:** The methods and equipment required in the construction of roads and bridges. Methods and equipment necessary for roads and bridges. Substructure and superstructures, precast and cast-in-place segments, and standard and specialized equipment.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 482 Heavy and/or Civil Construction****Crosslisted with:** CNST 482, CNST 882, CONE 882**Prerequisites:** CNST 379**Notes:** Not open to non-degree graduate students**Description:** History, theory, methods, and management principles of planning and executing heavy and/or civil projects. Emerging and new equipment capabilities. Economical use of equipment and management of costs associated with production.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 483 Support of Excavation****Crosslisted with:** CONE 883**Prerequisites:** Senior standing.**Description:** The design and placement of excavation supports according to OSHA requirements and industry standards. A variety of routine to moderately complex support systems. Open excavations, sheet piling and cofferdams, soil mechanics, lateral loads, hydrology, and pumping methods.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CONE 485 Construction Planning, Scheduling, and Controls****Crosslisted with:** CNST 485, CNST 885, CONE 885**Prerequisites:** CNST 378**Notes:** Not open to non-degree graduate students**Description:** Planning and scheduling a project using the critical path methods (CPM) with computer applications. Project pre-planning, logic networks, precedence diagrams, time estimates, critical path, float time, crash programs, scheduling, short interval schedules, pull planning, and monitoring project activities.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Prerequisite for:** CNST 489**CONE 489 Construction Engineering Capstone Course****Prerequisites:** Senior standing.**Notes:** To be taken in the term preceding graduation. Embodies the cumulative CONE experience in a project format and uses teams to simulate actual construction enterprises operating in cooperative and competitive situations which replicate the construction industry.**Description:** An integrated, comprehensive project.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**ACE:** ACE 10 Integrated Product**CONE 495 Internship****Crosslisted with:** CNST 495**Prerequisites:** Permission of instructor, Letter of application, Letter of agreement from industry mentor**Notes:** Not open to non-degree graduate students**Description:** Participation in a full-time summer internship associated with a construction-related entity. Includes weekly assignments and a final presentation designed to foster interactions between the intern and the business side of the entity. General topics include personnel and time management, structuring business plans, scheduling work, finance and budgets, marketing plans, contracts, risk analysis, and communication and leadership.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SUMMER**CONE 498 Special Projects****Prerequisites:** Permission.**Description:** Individual research on a selected technical, structural, materials or management problem in construction.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded**PLEASE NOTE**

This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education

abroad, undergraduate research, learning communities, and service learning and community-based learning.

- Construction Engineering Co-op, Alfred Benesch and Company - Omaha NE

## Career Information

*The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.*

### Jobs of Recent Graduates

- Construction Engineer, Olsson Associates - Omaha NE
- Project Engineer, JE Dunn Construction - Denver CO
- Assistant Project Manager, Adolfson & Peterson Construction - Aurora CO
- Project Engineer, Team Industrial - Omaha NE
- Project Engineer, Darland Construction Co. - Omaha NE
- Superintendent Apprentice, Eriksen Construction - Blair NE
- Field Engineer, Mortenson Construction - Minneapolis MN
- Project Engineer, DPR Construction - Sacramento CA
- Engineer, Kiewit Building Group - Omaha NE
- Project Engineer, The Waldinger Corporation - Omaha NE
- Project Engineer, Howard S. Wright - Portland OR
- Special Inspections Technician, Olsson Associates - Omaha NE
- Superintendent-in-Training, J.E. Dunn Construction Company - Omaha NE
- Estimator, Sampson Construction - Lincoln NE

### Internships

- Field Technician, Thiele Geotech Inc. - Omaha NE
- Intern, The Whiting-Turner Contracting Company - Boston MA
- Project Management Intern, Cheever Construction Company - Lincoln NE
- Intern, The Department of Design and Construction - New York NY
- Field Engineer, Kiewit - Phoenix AZ
- Project Engineer, DPR Construction - Omaha NE
- Estimating Intern, Haselden Construction - Denver CO
- Project Intern, Lueder Construction - Omaha NE
- Construction Engineering Intern, Kiewit Building Group - Austin TX
- Controller, Kiewit Building Group - Omaha NE
- Intern, The Whiting-Turner Contracting Company - Council Bluffs IA
- Field Engineer Intern, Kiewit Southwest - Phoenix AZ
- Intern, Thomas David Builders - Omaha NE
- Field Inspector Intern, Alfred Benesch & Company - Lincoln NE
- Construction Engineering Co-op, The Village at Breckenridge Homeowners Assoc - Breckenridge CO
- Field Engineer, Kiewit - Corpus Christi TX
- Field Engineer, Kiewit Southwest District - Phoenix AZ
- Office Engineer Intern, Kiewit Building Group - Omaha NE
- Intern, Dream Home Drafting - Omaha NE
- Intern, Olsson Associates - La Vista NE
- Estimating Intern, Kiewit Engineering Company - Omaha NE
- Intern, Lamp Rynearson Associates - Omaha NE
- Project Controls Intern, Kiewit Building Group Inc. - Omaha NE
- Intern, Olsson Associates - La Vista NE