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 the requirements for licensure as a professional engineer. The courses cover 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-aided design, 3D animation, sustainability, and graphic communication.

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

Program Educational Objectives (PEOs)
1. Professional Achievement: The Construction Engineering program prepares graduates to become Licensed Professional Engineers and Certified Professional Constructors.
2. Career Achievement: The Construction Engineering program prepares graduates to contribute to society by working in an occupation related to the architecture-engineering-construction industry.

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 contractors, specialty contractors, 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, they 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 a bachelor of science degree in construction engineering.

Professional Admission Requirements
In order to be professionally admitted into the construction engineering program, students must complete at least 43 credit hours of courses listed in the first two years of the required curriculum with a minimum GPA of 2.5 for those major courses (not necessarily the cumulative GPA).

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 or computer science)
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. Students without test scores who are missing a full unit of trigonometry/pre-calculus/calculus or chemistry or physics will be evaluated through College Review.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) or a grade lower than B in high school English, must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Engineering requires that student performance meet one of the following standards: composite ACT of 24, SAT of 1180, ACT Math subscore of 24, SAT Math subscore of 580, or a 3.5 cumulative GPA.

Any domestic first-year student who does not gain admission to Engineering but does gain admission to the University of Nebraska-Lincoln (UNL) will be reviewed through College Review. College Review is conducted through the College Review Committee which considers factors beyond standardized testing. Any first-year student who is not admitted through college review is placed in Pre-Engineering (PENG) with the Exploratory and Pre-Professional Advising Center (Explore Center). Students in the Explore Center can transfer to the College of Engineering once college admission requirements are met.

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 Explore Center or other colleges at UNL.

Students should consult their advisor, their department chair, or Engineering Student Services (ESS) 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 first-year student entrance requirements, 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 Kearney and the University of Nebraska 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.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 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 their instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal their case through the College Academic Appeals Subcommittee.

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 graduation.

Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska–Lincoln. This decision should be made in consultation with the student’s College of Engineering academic advising team (e.g., ESS professional advisor and the chief faculty advisor for the student’s declared degree program). The chief faculty advisor has the final authority for this decision. Eligibility is based on a) enrollment in a community college during the catalog year the student wishes to utilize, b) maintaining continuous enrollment at the University of Nebraska–Lincoln within 1 calendar year from the student’s last term at the previous institution, and c) continuous enrollment at the University of Nebraska–Lincoln within 1 calendar year from the student’s last term at the previous institution.

Students must complete all degree requirements from a single catalog year and within the timeframe allowable for that catalog year.

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)

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credit Hours Subtotal: 16</th>
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<tbody>
<tr>
<td>CHEM 109A &amp; CHEM 109L or CHEM 113A</td>
<td>General Chemistry I and General Chemistry I Laboratory (ACE 4) 4</td>
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<tr>
<td>&amp; CHEM 113L</td>
<td>Fundamental Chemistry I and Fundamental Chemistry I Laboratory</td>
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<tr>
<td>ENGR 100</td>
<td>Interpersonal Skills for Engineering Leaders (ACE 2) 3</td>
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<tr>
<td>CONE 103</td>
<td>Introduction to Construction Engineering 1</td>
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<tr>
<td>CSCE 101</td>
<td>Fundamentals of Computer Science 3</td>
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<tr>
<td>ENGR 10</td>
<td>Freshman Engineering Seminar 0</td>
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<td>MATH 106</td>
<td>Calculus I (ACE 3) 5</td>
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<td><strong>Credit Hours Subtotal:</strong></td>
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<tr>
<td>CNST 112</td>
<td>Construction Communications 3</td>
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<tr>
<td>MATH 107</td>
<td>Calculus II 4</td>
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<tr>
<td>PHYS 211</td>
<td>General Physics I 4</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>General Physics Laboratory I 1</td>
</tr>
<tr>
<td><strong>ACE Elective</strong></td>
<td><strong>Choose one course from not yet satisfied ACE outcomes 5, 7, or 9</strong> 3</td>
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<td><strong>Credit Hours Subtotal:</strong></td>
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<th>Third Semester</th>
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<tr>
<td>CONE 221</td>
<td>Geometric Control Systems 3</td>
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<tr>
<td>ENGR 20</td>
<td>Sophomore Engineering Seminar 0</td>
</tr>
<tr>
<td>JGEN 200</td>
<td>Technical Communication I (ACE 1) 3</td>
</tr>
<tr>
<td>MATH 208</td>
<td>Calculus III 4</td>
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Learning Outcomes
### Additional Major Requirements

#### Grade Rules

**C- and D Grades**

All coursework (including ACE courses and electives) must be of C grade level or higher to be credited toward graduation requirements or to be valid as a prerequisite for another course.

**GPA Requirements**

A minimum GPA of 2.5 is required for professional admission.

#### 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 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 Electives*

- **CNST 379** Construction Estimating II 3
- **CNST 434** The Design-Build Project Delivery System 3
- **CNST 498** Special Topics in Construction Management 1-6
- **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 DurhamSchool@unl.edu 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 446; MECH 446H
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
Prerequisites: MATH 104 or MATH 106
Description: Surveying fundamentals and theory related to construction, including building layout, measurement procedures, vertical control, and surveying instrument operation. Measurement of distance, direction, elevation, and location using mechanical and electronic systems. Explain the concepts of surveying and project layout as they apply to construction. Demonstrate the use of various surveying instruments, equipment, technologies, and control on construction project examples.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $15

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 buildings 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
Prerequisite for: CONE 489

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, heet 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

CONE 489 Construction Engineering Capstone Course
Prerequisites: CONE 485 and CONE 476
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
Experiential Learning: Fieldwork

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.

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 - 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 - 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, 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 - Omaha, NE
- Intern, Olsson Associates - La Vista, NE
- Construction Engineering Co-op, Alfred Benesch and Company - Omaha, NE