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; and
• 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 UNL 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. 4 units of mathematics: 2 of algebra, 1 of geometry, 1 of precalculus and trigonometry.
2. 4 units of English.
3. 3 units of natural science that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management).
4. 2 units of a single foreign language.
5. 3 units of social studies.
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 College of Engineering.

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.

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**

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**

Majors in construction engineering will develop:

1. An ability to apply knowledge of mathematics, science, and engineering. (a)
2. An ability to design and conduct experiments, as well as to analyze and interpret data. (b)
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (c)
4. An ability to function on multidisciplinary teams. (d)
5. An ability to identify, formulate, and solve engineering problems. (e)
6. An understanding of professional and ethical responsibility. (f)
7. An ability to communicate effectively. (g)
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. (h)
9. A recognition of the need for, and an ability to engage in life-long learning. (i)
10. A knowledge of contemporary issues. (j)
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. (k)

**NOTE:** Letters are references to ABET Engineering Accreditation Commission outcomes (a through k).
ACE Elective
Choose one course from not yet satisfied ACE outcomes 5, 7, or 9
Credit Hours Subtotal: 16

Seventh Semester
CIVE 440 Reinforced Concrete Design I 3
CONE 414 Accident Prevention in Construction 3
or CNST 444 Construction Site Safety Management 3
CONE 476 / CNST 476 Project Budgets and Controls 3
CONE 485 / CNST 485 Construction Planning, Scheduling, and Controls 3
Technical Elective 3
Credit Hours Subtotal: 15

Eighth Semester
CIVE 441 Steel Design I 3
CONE 489 Construction Engineering Capstone Course 3
BLAW 371 Legal Environment 3
Technical Elective 3
ACE Elective
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 course work 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
Format: LEC
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
Format: LEC
Prerequisite for: MECH 343
ACE: ACE 8 Civic/Ethics/Stewardship

CONE 211 Construction Business Methods
Prerequisites: CONE 103.
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
Format: LEC
Prerequisite for: CONE 414
CONE 221 Geometric Control Systems
Crosslisted with: CIVE 221
Prerequisites: MATH 106/106B/108H.
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
Format: LAB
Prerequisite for: CIVE 361

CONE 319 Construction Methods and Equipment
Prerequisites: (UNO) ISMG 2060
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
Format: LEC
Prerequisite for: CONE 414

CONE 378 Construction Estimating
Crosslisted with: CNST 378
Prerequisites: CNST 242 or (UNO) CONE 2420.
Description: Preparation of detailed cost estimates based on contract documents. Identify and analyze cost components to perform a reliable quantity take-off. Recap components in their common trade areas for labor, material, and equipment pricing. Introduction to subcontractor bids and assembly of bid proposal.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC

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
Format: LEC
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
Format: LEC

CONE 476 Project Budgets and Controls
Crosslisted with: CNST 476
Prerequisites: CONE/CNST 378; ISMG 2060 (UNO).
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
Format: LEC

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
Format: LEC

CONE 482 Heavy and/or Civil Construction
Crosslisted with: CNST 482, CNST 882, CONE 882
Prerequisites: Senior or Graduate standing in ARCH, AREN, CIVE, CNST, or CONE.
Description: Application of management principles to the construction of heavy and/or civil projects. History, theory, and methods of planning and constructing heavy and/or civil projects. Emerging equipment and new equipment capabilities. Economical use of equipment and managing costs associated with production.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

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
Format: LEC

CONE 485 Construction Planning, Scheduling, and Controls
Crosslisted with: CNST 485, CNST 885, CONE 885
Prerequisites: CNST 378; CNST 2250 (UNO)
Description: Planning and scheduling a construction project using the critical path methods (CPM) with computer applications. Project pre-planning, logic networks, network construction, time estimates, critical path, float time, crash programs, scheduling, and monitoring project activities.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
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
Format: LEC
ACE: ACE 10 Integrated Product

CONE 493 Internship Workshop
Crosslisted with: CNST 493, CNST 893
Prerequisites: Permission of instructor, Letter of application, Letter of agreement from industry mentor
Notes: Permission of instructor, Letter of application, Letter of agreement from industry mentor
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 associated with the business side of the entity between the Construction entity and the intern. General topics include Time Management and Scheduling Work, Business Plans and Structures, Finance and Budgets, Marketing Plans, Contracts, Risk Analysis and Management, Personnel Management, Communication and Leadership.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LAB
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
Format: IND

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