Construction

Construction Degrees
The Charles W. Durham School of Architectural Engineering and Construction offers students an education that opens up a full range of professional opportunities in the construction industry. The two bachelor’s degree options, Construction Engineering and Construction Management, are described in further detail below.

Construction Engineering

Construction engineering (CONE) is a program of the Charles W. Durham School of Architectural Engineering and Construction located at Nebraska Hall on the City Campus in Lincoln and at the Peter Kiewit Institute (PKI) on the Scott campus in Omaha. 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. 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, increasing efficiency and decreasing costs;
- Use communication skills to effectively share their ideas with many forms of media;
- Adapt to the constantly changing, interdisciplinary design and construction 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 the US 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 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, s/he 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 general construction education. Each student selects, with the guidance of an advisor, a set of approved electives. The program outlined leads to the Bachelor of Science degree in Construction Engineering.

Learning Outcomes

Majors in Construction Engineering will be able to:

a. Professional Achievement: The Construction Engineering program prepares graduates to become Licensed Professional Engineers and Certified Professional Constructors.

b. Career Achievement: The Construction Engineering program prepares graduates to contribute to society by working in an occupation related to the architecture-engineering-construction industry.

Construction Management

Construction Management (CNST) is a complete undergraduate degree program available to students within The Charles W. Durham School of Architectural Engineering and Construction located at Nebraska Hall on the City Campus in Lincoln and at the Peter Kiewit Institute (PKI) on the Scott Campus in Omaha. Construction is one of the largest and most diversified industries in the country, accounting for approximately 4 percent of the U.S. gross domestic product (GDP). The key professional in this vast enterprise is the “constructor,” a term given to leaders and managers in the construction industry who are responsible for planning, scheduling and building the projects designed by architects and engineers. These highly specialized efforts are indispensable in meeting the country’s growing need for new structures, infrastructure, and environmental controls that are of high quality, and are cost effective, efficient, and sustainable.

Construction firms vary in size from extremely large international corporations to small proprietorships and partnerships. These are often classified according to the kind of construction work they do: general contractors, heavy and highway contractors, specialty contractors – including mechanical and electrical – and residential builders and developers. Many firms engage in more than one category of work. Some larger companies incorporate the architectural and engineering design functions as part of their role as a design/build firm. Collectively, constructors manufacture our entire built environment – buildings for housing, commerce and industry, highways, railroads, waterways, airports, power plants, energy distribution systems, military bases and space center complexes. Thus, the construction management field is broad, requiring a unique educational background for its professional practitioners.

Although the range of construction activities appears wide and diverse, the general educational requirements for construction management are universal regardless of a particular firm’s area of specialization. Since construction is a technical business enterprise, the graduate must have a sound background in business management and administration, as well as an understanding of the fundamentals of architecture and engineering as they relate to project design and the actual construction process in the field. Professional expertise lies in the fields of construction science, methods, and management. A working knowledge of structural design, mechanical and electrical systems, methods and materials, soil mechanics, and construction equipment is also essential.

The Construction Management curriculum embraces a course of study in:

1. construction project management from pre-design through commissioning
2. project life-cycle and sustainability
3. health and safety, accident prevention, and regulatory compliance
4. law, contract documents administration, and dispute prevention
5. resolution
6. materials, labor and methods of construction
7. finance and accounting principles
8. planning and scheduling
9. cost management including plan reading, quantity take offs and estimating
10. project delivery methods
11. leadership and managing people
12. business and communication skills

**Student Learning Outcomes**

Technical and humanities electives provide a well-rounded education that leads to a rewarding career in the construction industry. Upon graduation, students will be able to demonstrate construction management skills and knowledge with:

(a) an ability to apply knowledge of mathematics, science, and applied sciences
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to formulate or design a system, process, or program to meet desired needs
(d) an ability to function on multidisciplinary teams
(e) an ability to identify and solve applied science problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of solutions in a global and societal context
(i) a recognition of the need for and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice

*NOTE:* Letters are references to ABET Engineering Accreditation Commission outcomes (a through k).

The long-term program educational objectives are to produce graduates who, as leaders in the field who can:

- Ensure quality and safety through design, measurement, analysis, and control.

Educational standards and criteria for construction education are established by the American Council for Construction Education (ACCE) which is the accrediting agency for construction education programs at all levels. The program at the University of Nebraska–Lincoln, having met these standards and criteria, is currently fully accredited by both ABET and ACCE.

**Degrees Offered**

- Construction Engineering, Bachelor of Science
- Construction Management, Bachelor of Science

**CONE 1030 INTRODUCTION TO CONSTRUCTION ENGINEERING (1 credit)**

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

**CONE 2060 ENGINEERING ECONOMICS (3 credits)**

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

*Prerequisite(s)/Corequisite(s):* Sophomore Standing.

**CONE 2110 CONSTRUCTION BUSINESS METHODS (3 credits)**

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.

*Prerequisite(s)/Corequisite(s):* CONE1030

**CONE 2210 GEOMETRIC CONTROL SYSTEMS (3 credits)**

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, error propagation; elementary geometric data bases for design, construction, operation and control of civil works. (Cross-listed with CIVE 221).

*Prerequisite(s)/Corequisite(s):* MATH1950, not open to nondegree students

**CONE 2310 CONSTRUCTION METHODS AND EQUIPMENT (3 credits)**

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 methods and equipment.

*Prerequisite(s)/Corequisite(s):* ISMG 2060

**CONE 2370 CONSTRUCTION ESTIMATING (3 credits)**

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. (Cross-listed with CNST 3780)

*Prerequisite(s)/Corequisite(s):* CNST 2420.
CONE 4140 ACCIDENT PREVENTION IN CONSTRUCTION (3 credits)
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 accepted practices in the industry.
Prerequisite(s)/Corequisite(s): Senior standing and CONE2110 and CONE2410

CONE 4160 WOOD/CONTEMPORARY MATERIALS DESIGN (3 credits)
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. (Cross-listed with CONE 8166)
Prerequisite(s)/Corequisite(s): CIVE 341

CONE 4170 FORMWORK SYSTEMS (3 credits)
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. (Cross-listed with CONE 8176)
Prerequisite(s)/Corequisite(s): CONE 4160; Pre/Co-req.: CIVE 441

CONE 4500 SUSTAINABLE CONSTRUCTION (3 credits)
Sustainable construction and its application to the green building industry. Topics include: the LEED certification process, sustainable building site management, efficient wastewater applications, optimizing energy performance, indoor environmental issues, performance measurement/verification, recycled content and certified renewable materials. (Cross-listed with CONE 8506.)
Prerequisite(s)/Corequisite(s): Senior standing

CONE 4590 INTRODUCTION TO BUILDING INFORMATION MODELING (3 credits)
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. (Cross-listed with CONE 8596)
Prerequisite(s)/Corequisite(s): CNST 1120, or Graduate standing in AE, CIVE, CNST or CONE.

CONE 4660 HEAVY AND/OR CIVIL ESTIMATING (3 credits)
Estimating techniques and strategies for heavy and/or civil construction. Unit pricing, heavy and civil construction takeoffs and estimating, equipment analysis, overhead cost and allocations, estimating software and government contracts. (Cross-listed with CONE 8666).
Prerequisite(s)/Corequisite(s): CONE2410 and CONE3780 and CONE4850

CONE 4760 PROJECT BUDGETS AND CONTROLS (3 credits)
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. ACCT 2020 may be substituted toward degree requirements for CONE/CNST 4760. Credit toward degree can be earned in only one of ACCT 2020 and CONE/CNST 4760. (Cross-listed with CNST4760)
Prerequisite(s)/Corequisite(s): CONE/CNST 3780 and CONE/ISMG 2060.

CONE 4810 HIGHWAY & BRIDGE CONSTRUCTION (3 credits)
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. (Cross-listed with CONE8816)
Prerequisite(s)/Corequisite(s): CONE2410 or CNST2410

CONE 4820 HEAVY AND/OR CIVIL CONSTRUCTION (3 credits)
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. (Cross-listed with CNST 4820, CNST 8826, CONE 8826)
Prerequisite(s)/Corequisite(s): Senior standing and (ARCH major or AE major or CIVE major or CNST major or CONE major), not open to nondegree students

CONE 4820 SUPPORT OF EXCAVATION (3 credits)
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. (Cross-listed with CONE8836)
Prerequisite(s)/Corequisite(s): CET 2180 and CET 3290

CONE 4850 CONSTRUCTION PLANNING, SCHEDULING, AND CONTROLS (3 credits)
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. (Cross-listed with CNST 4850, CNST 8856, CONE 8856)
Prerequisite(s)/Corequisite(s): CNST 3780 and CNST 2250.

CONE 4890 CONSTRUCTION ENGINEERING CAPSTONE (3 credits)
CONE 4890 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. An integrated, comprehensive project; to be taken in the term prior to graduation.
Prerequisite(s)/Corequisite(s): Senior standing

CONE 4980 SPECIAL TOPICS IN CONSTRUCTION MANAGEMENT (1-6 credits)
Individual or small group study of special topics in construction management. Topic varies. A signed student-instructor learning contract is required. (Cross-listed with CNST 4980, CNST 8986)
Prerequisite(s)/Corequisite(s): Master of engineering in construction management or related discipline and permission