

CIVIL ENGINEERING, MS

Introduction

Graduate Education Policies and Procedures apply to these programs.

There are many reasons to consider a master's degree in Civil Engineering:

- Gain advanced training in your chosen civil engineering specialty.
- Become an expert in your chosen thesis (or report) research.
- Position yourself in a competitive employment market.
- Earn more than those with only a bachelor's degree.

The Master of Science (MS) in Civil Engineering at CU Denver is intended for students who have previously earned an undergraduate degree in engineering or a similar field. Students of other backgrounds are welcome but usually have more prerequisites to complete before they can be admitted to the MS program.

The Civil Engineering graduate program is designed for both full-time and part-time students who want to advance their academic and professional skills in civil engineering and related areas. Our graduate programs are designed for working professionals and offer ample opportunities for hands-on research.

Many students are full-time, while many also work full-time jobs and complete evening classes. Depending on a student's pace, the master's program typically takes 2-4 years to complete. Most graduate courses are offered in the afternoons or evenings.

Specialty Areas

- Construction Engineering and Management
- Geomatics and Geographic Information Systems (GIS)
- Geotechnical Engineering
- Hydrologic, Environmental, and Sustainability Engineering
- Structural Engineering
- Transportation Engineering

Program Prerequisites

Prerequisite classes are in addition to the 30 semester hours needed to complete a master's degree, as they are necessary background information that is usually included in an engineering bachelor's program. Students must receive a grade of C minus (C-) or better for the prerequisite class to apply to the program.

Students may complete prerequisite classes either before or after being admitted to a degree program. However, applicants with 5 or more incomplete prerequisites will not be admitted. You may complete no more than nine credit hours of graduate work before completing these prerequisites. Note, all courses taken at CU Denver while enrolled graduate studies count toward your grade point average (GPA).

If prerequisites are taken after admission to the master's program, students must maintain a 3.0 overall GPA, per Graduate Education policies and procedures. The student's faculty advisor may also specify undergraduate courses that must be completed before starting graduate course work, but these will not count toward the semester hour requirements for the degree.

Transfer Credits

Master's students may transfer up to 9 semester hours from another institution toward their master's degree, if approved by their advisor. Students who completed their undergraduate degree at CU Denver may have additional options available.

Program Requirements

1. Students must complete a minimum of 30 credit hours at the graduate level, including a master's report or thesis.
2. Students must complete 6 credit hours of master's thesis or 3 credits of master's report. Both require a written comprehensive exam and an oral defense to a committee of at least two graduate faculty for a report and three graduate faculty for a thesis. The student's topic must be approved by the faculty advisor.
3. Students must complete a minimum of 15 credit hours within Civil Engineering, not including master's report or thesis. Any courses taken outside of Civil Engineering must be approved by the faculty advisor.
4. Students must earn a minimum grade of B- in all major courses taken at CU Denver and must achieve a minimum cumulative major GPA of 3.0. All graded attempts in required and elective courses are calculated in the major GPA. Students cannot complete any course requirements as pass/fail, or satisfactory/unsatisfactory.
5. The MS must be completed within seven years of the date the student begins the degree program.

Construction Engineering and Management

The Master's program in construction engineering and management provides the necessary decision-making skills to support complex construction projects and subsequent management throughout their useful life. Construction engineering and management concerns the design, planning and management of the construction, maintenance and disposal of structures, infrastructure, transportation systems, site work, and commercial, industrial, residential and environmental projects (for example: highways, bridges, airports, buildings, dams, reservoirs, light and high-speed rail systems, hospitals, laboratories, residential communities, utilities and environmental restoration projects).

Code	Title	Hours
<i>Research Credits (requires advisor approval). Choose 1 of the following</i>		
CVEN 5950	Master's Thesis	6
CVEN 5960	Master's Report	3
<i>Required core courses</i>		9
CEMT 5231	Construction Materials and Methods	
CEMT 5232	Construction Planning and Control	
CEMT 5233	Construction Cost Estimating	
<i>Construction Electives</i>		9
CEMT 5234	Sustainable Construction	
CEMT 5235	Advanced Construction Engineering	
CEMT 5236	Project Management Systems	
CEMT 5237	Advanced Project Management	
CEMT 5238	Integrated Construction Leadership	
CEMT 5239	Introduction to Temporary Structures and Construction Engineering	
CEMT 5240	Building Information Modeling (BIM)	

CEMT 5242	Construction Safety
CEMT 5245	Construction Dispute Resolution
CEMT 5246	Construction, Business and Innovation
CEMT 5701	Surveying Basics
CEMT 5702	Surveying Data Collection/Surveying Lab
CEMT 5703	Surveying Data Processing and Analytics
CEMT 5724	Construction Technology 1 (Drones, construction coordination and VR/AR)
CEMT 5734	Construction Technology 2 (Robotics, AI and data analytics)
CEMT 5800	Special Topics in Construction

Graduate Electives 6-9

Course selection should be based on planned career path, masters report focus, eligibility and availability of the courses. The following courses are some of the possibilities, but you should discuss course choices with your advisor.

Choose 9 credits from one of the following options:

- Graduate courses in the Business School
- Graduate courses in the College of Architecture and Planning
- Graduate courses in the School of Public Affairs

Graduate courses with the same prefix in the College of Engineering, Design and Computing or the College of Liberal Arts and Sciences

Geomatics and Geographic Information Systems (GIS)

The Geomatics Engineering and Geographic Information Systems (GIS) graduate program at the University of Colorado Denver provides broad-based expertise and cutting-edge skills that span the growing geospatial field and helps alleviate the shortage of well-educated geospatial professionals. The program is intended for engineers and other geospatial, environmental and urban infrastructure professionals seeking skills in using and managing rapidly developing geospatial data technologies.

All GIS graduate courses are entirely online, as they have been for more than 20 years. However, master's degree students have the option of taking some courses on the CU Denver campus from other programs such as geography or computer science.

Our Geomatics and GIS curriculum covers a wide range of geospatial principles. Students learn from industry professionals in areas of surveying, geodesy, mapping science and cartography, photogrammetry, remote sensing, high-definition surveying, and relational GIS databases.

Our program prepares graduates for careers in industry and/or science. Students who complete the program have a comprehensive understanding in these disciplines, empowering them to advance their careers in geospatial engineering and analysis or to continue their research.

Code	Title	Hours
<i>Research credits (requires advisor approval) Choose 1 of the following</i>		
CVEN 5950	Master's Thesis	6
CVEN 5960	Master's Report	3
<i>Required course</i>		
CVEN 5381	Introduction to Geographic Information Systems	3
<i>GIS electives</i>		12

CVEN 5382	Geospatial Data Development
CVEN 5383	GIS Analysis
CVEN 5384	GIS Project Management
CVEN 5385	GIS Relational Database Systems
CVEN 5387	Advanced Remote Sensing
CVEN 5388	Geographic Information Systems for Transportation Infrastructure (GIS-T)
CVEN 5390	Interactive Web Mapping GIS
CVEN 5391	Introduction to Geomatics
CVEN 5392	Unmanned Aerial Systems
CVEN 5395	GPS/GNSS
CVEN 5396	HDS/LiDAR Tools & Data Analyses
Other topics as approved by faculty advisor	

Graduate Electives 12-15

Any 5000+ CEMT or CVEN course	
GEOG 5090	Environmental Modeling with Geographic Information Systems
GEOG 5092	GIS Programming and Automation
URPL 6260	Advanced Geo-Spatial Methods
Other topics as approved by faculty advisor	

Hydrologic, Environmental, and Sustainability Engineering

The graduate track in hydrologic, environmental, and sustainability engineering (HESE) in the Department of Civil Engineering at the University of Colorado Denver brings together the hydrologic cycle, environmental processes, and sustainability—the powerful notion that everything we engineer should support economic prosperity, environmental health, and social justice.

Graduate coursework in the HESE track requires breadth and depth. Students are required to take at least one graduate course in each of the three areas plus at least two additional courses in one of those three areas. The program also includes graduate-level electives, allowing students to customize their program to match their professional needs and intellectual curiosity.

Code	Title	Hours
<i>Research credits (requires advisor approval). Choose 1 of the following</i>		
CVEN 5950	Master's Thesis	6
CVEN 5960	Master's Report	3
Breadth courses		9
Depth courses		6
Elective courses		6-9
<i>Hydrology and Hydraulics</i>		
CVEN 5333	Surface Water Hydrology	
CVEN 5334	Groundwater Hydrology	
CVEN 5335	Vadose Zone Hydrology	
CVEN 5426	Pipe Network and Sewer Design	
CVEN 5427	Storm Water System Design	
<i>Environmental Engineering</i>		
CVEN 5402	Contaminant Fate and Transport	
CVEN 5404	Water and Wastewater Treatment	
CVEN 5434	Biological Treatment Processes	
<i>Sustainability Science</i>		

CVEN 5405	Environmental Life Cycle Assessment
CVEN 5460	Introduction to Sustainable Urban Infrastructure
CVEN 5520	Structural Engineering and the Ocean Environment

Graduate Electives

Any CVEN course listed above	
ARCH 5330	Sustainable Systems I
ARCH 5450	Sustainable Design Practices
CEMT 5234	Sustainable Construction
CVEN 5381	Introduction to Geographic Information Systems
CVEN 5633	Sustainable Transportation Systems
ENVS 5280	Environmental Hydrology
ENVS 5757	Urban Climate and Air Quality
GEMM 6000	21st Century Global Energy Issues and Realities
GEMM 6200	Environmental, Regulatory, Legal & Political Environment in the Energy Industry
GEMM 6240	Environmental, Social, Governance (ESG) Trends in Energy & Commodities
GEOG 5060	Remote Sensing I: Introduction to Environmental Remote Sensing
GEOG 5335	Climate Change & Society
GEOG 5757	Urban Climate and Air Quality
URPL 5040	Urban Sustainability
URPL 6555	Transportation, Land Use, and the Environment
Other topics as approved by faculty advisor	

Structural Engineering

Structural engineering is the analysis and design of structures that support or resist loads. At CU Denver the area of structural engineering includes structural and bridge engineering; repair, evaluation, maintenance and rehabilitation of civil infrastructure, maintenance and experimental analysis of concrete; and more.

Code	Title	Hours
<i>Research credits (requires advisor approval). Choose 1 of the following</i>		
CVEN 5950	Master's Thesis	6
CVEN 5960	Master's Report	3
<i>Structural Engineering Electives</i>		24-27
CVEN 5110	Advanced Structural Classical Analysis	
CVEN 5111	Structural Dynamics	
CVEN 5112	Structural Design Loads	
CVEN 5121	Intermediate Solid Mechanics and Stress Analysis	
CVEN 5520	Structural Engineering and the Ocean Environment	
CVEN 5540	Masonry Design	
CVEN 5550	Highway Bridge Design	
CVEN 5565	Advanced Timber Structure Design	
CVEN 5575	Advanced Topics in Structural Steel Design	
CVEN 5585	Advanced Topics in Reinforced Concrete	
CVEN 5590	Design of Prestressed Concrete	
CVEN 5591	Design of Composite Structures	
CVEN 5592	Computer-Aided Structural Analysis and Design	
CVEN 5682	Pavement Design	
CVEN 5738	Foundation Design	

CVEN 6111	Structural Dynamics II
Other topics as approved by faculty advisor	

Transportation Engineering

By shifting conventional transportation engineering practice towards a more human-centered approach, our Masters' programs in transportation engineering seek to cultivate forward-thinking transportation professionals. The Master of Science (MS) program is intended for those with an engineering background. The Master of Engineering (MEng) program is intended for students from any discipline.

Students in both programs take the foundational courses, but much of the remaining coursework can be tailored to needs and aspirations of each individual student. Students with more of a transportation engineering background tend to add knowledge from related disciplines such as urban & regional planning or by adding skills such as GIS, statistics, or data science. Students coming from other disciplines tend to take more transportation engineering courses. Whatever the case, we have the flexibility to provide students with the technical knowledge and skills necessary to succeed in their chosen area.

Students can also select one or more of the following core areas: Healthy Active Communities, Equitable Road Safety, and/or Smart Sustainable Mobility.

Our transportation students will develop the advanced problem-solving skills needed to be able to propose innovative and sustainable solutions that prioritize human needs, societal well-being, and environmental considerations. They will foster the ability to empathize with diverse user groups, incorporate qualitative and quantitative data to inform decision-making, and begin to design transportation systems that enhance accessibility, safety, and the overall human experience. They will cultivate the collaboration and communication skills necessary for interdisciplinary work in transportation which will put our graduates in a position to embark on a transportation-related career for which they are passionate and can make a positive difference in the world.

Code	Title	Hours
<i>Research credits (requires advisor approval). Choose 1 of the following</i>		
CVEN 5950	Master's Thesis	6
CVEN 5960	Master's Report	3
<i>Transportation Engineering Required Course</i>		3
CVEN 5633	Sustainable Transportation Systems	
<i>Transportation Engineering Electives</i>		12
CVEN 5602	Advanced Highway Design	
CVEN 5611	Transportation Engineering Statistics	
CVEN 5612	Traffic Impact Assessment	
CVEN 5613	Traffic Simulation Modeling	
CVEN 5621	Highway Capacity Analysis	
CVEN 5622	Traffic Operations and Control	
CVEN 5631	Transport Modeling and Big Data	
CVEN 5632	Transportation Data Analytics	
CVEN 5641	Transit System Planning and Design	
CVEN 5642	Transit Operations	
CVEN 5650	Urban Street Design	
CVEN 5662	Transportation System Safety	
CVEN 5388	Geographic Information Systems for Transportation Infrastructure (GIS-T)	

<i>Graduate Electives</i>		9-12
CVEN 5381	Introduction to Geographic Information Systems	
URPL 5000	Planning History and Theory	
URPL 5010	Planning Methods	
URPL 5050	Urban & Regional Development	
URPL 6205	Plan Making	
URPL 6225	Urban Policy Analytics	
URPL 6250	GIS for Urban Planning	
URPL 6350	City Design Fundamentals	
URPL 6555	Transportation, Land Use, and the Environment	
URPL 6600	Regional Growth and Equity	
Other topics as approved by faculty advisor		