

# CIVIL AND INFRASTRUCTURE ENGINEERING, MS

**Banner Code:** EC-MS-CEIE

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This MS is designed for students who have completed a bachelor's degree in civil engineering, although domestic students with related undergraduate degrees may be considered for provisional admission. The MS educates students in the theory and practice of civil engineering science and design, with a technical concentration. The master's degree is increasingly expected for high level practice in civil engineering, and prepares graduates to practice in civil engineering for: federal, state, or local government; engineering design firms; construction firms; public utilities; non-governmental organizations; and local and regional planning firms, among others. The MS degree serves as a foundation for subsequent study in a doctoral program in civil engineering, as well as for graduate studies in architecture, law, business, economics, finance, and public policy and administration.

Both part-time and full-time study is available. Full-time students typically complete the degree in one and a half, to two years.

## Admissions & Policies

### Admissions

To be considered for admission to the program, a candidate must:

- Satisfy general University and College of Engineering and Computing requirements for admission to a graduate program,
- Have earned a baccalaureate degree in engineering or a related science,
- Provide two letters of reference, submitted by former professors or supervisors,
- Provide a goals statement and professional résumé.

Acceptance to the degree program is based on an assessment of the applicant's capacity to pursue graduate studies successfully. Consideration is given to the undergraduate record, any previous graduate work, professional work experience, and reference letters.

## Requirements

### Degree Requirements

Total credits: 30

All MS students must develop a faculty-approved plan of study with a minimum of 30 graduate credits. These credits include two core courses (CEIE 601 Infrastructure Modeling and CEIE 605 Risk and Uncertainty in Civil Engineering), specific requirements of a concentration declared by the student, and seminar requirement (CEIE 795 Civil and Infrastructure Engineering Seminar).

### Plan of Study

Students are responsible for developing and receiving advisor approval on a plan of study no later than the end of their second semester of study. Courses taken without prior approval by the faculty advisor may not be accepted for credit toward the degree. No more than three courses used for credit toward the MS may be cross-listed as undergraduate courses. None may repeat material completed as part of the student's previous studies. Most MS courses are offered on a two-semester or three-semester rotation.

### Core Courses

All MS students must complete the following two core courses, preferably within the first 12 credit hours of their MS studies. These courses provide a common background for understanding the breadth and complexity of civil and infrastructure engineering and for analyzing and solving engineering problems.

Code	Title	Credits
CEIE 601	Infrastructure Modeling	3
CEIE 605	Risk and Uncertainty in Civil Engineering	3
Total Credits		6

### Concentration in Construction Engineering and Management (CEM)

Code	Title	Credits
Select at least three from the following five construction engineering and management core courses:		9
CEIE 571	Construction Administration <sup>1</sup>	
CEIE 572	Building Information Modeling <sup>1</sup>	
CEIE 573	Legal Aspects of the Construction Process	
CEIE 575	Design for Constructability	
CEIE 576	Construction Cost Estimating <sup>1</sup>	
Total Credits		9

<sup>1</sup> Cross-lists with an undergraduate course

### Electives

A list of approved electives for the construction engineering and management concentration is provided below. Note that the remaining construction engineering and management core courses can also be selected as electives.

Code	Title	Credits
CEIE 501	Sustainable Development <sup>1</sup>	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 531	Earth Retaining Structures and Slope Stability	3
CEIE 532	Foundation Design <sup>1</sup>	3
CEIE 574	Construction Computer Application and Informatics <sup>1</sup>	3
CEIE 578	Construction Planning and Scheduling <sup>1</sup>	3
CEIE 607	Public Infrastructure Management and Finance	3

CEIE 636	Sources of Geotechnical Data	3
CEIE 677	Construction Simulation	3
CEIE 678	Infrastructure Asset Management	3
CEIE 679	Special Topics in Construction Management	3
GG5 553	Geographic Information Systems	3

<sup>1</sup> Cross-lists with an undergraduate course

### Concentration in Environmental and Water Resources Engineering (EWRE)

Code	Title	Credits
Select at least three from the following five environmental and water resources engineering core courses:		9
CEIE 557	Remote Monitoring Techniques for Civil Engineering Applications <sup>1</sup>	
CEIE 641	Water Resources Engineering I: Principles and Practice	
CEIE 642	Flood Hazards Engineering	
CEIE 658	Water Quality	
CEIE 742	Water Resources Engineering II: Water Resource Systems	
Total Credits		9

#### Electives

A list of approved electives for the environmental and water resources engineering concentration is provided below. Note that the remaining environmental and water resources engineering core courses can also be selected as electives.

Code	Title	Credits
CEIE 540	Water Supply and Distribution <sup>1</sup>	3
CEIE 542	Open Channel Flow <sup>1</sup>	3
CEIE 550	Environmental Engineering Systems <sup>1</sup>	3
CEIE 553	Water and Wastewater Treatment Processes <sup>1</sup>	3
CEIE 607	Public Infrastructure Management and Finance	3
CEIE 634	Geoenvironmental Design	3
CEIE 643	Coastal Flood Hazards	3
CEIE 649	Special Topics in Water Resources Engineering	3
CEIE 657	Environmental Engineering Microbiology	3
CEIE 659	Hazardous Waste	3
CEIE 664	Transportation Engineering and the Environment	3
CEIE 683	Water and Wastewater Systems Security	3
COMM 637	Risk Communication	3
CHEM 627	Aquatic Environmental Chemistry	3
CHEM 651	Environmental Chemistry of Organic Substances	3
CSI 501	Introduction to Scientific Programming	3
CSI 690	Numerical Methods	3
CSI 720	Fluid Mechanics	3
CSI 721	Computational Fluid Dynamics I	3

EVPP 524	Introduction to Environmental and Resource Economics	3
EVPP 670	Environmental Law	3
GG5 553	Geographic Information Systems	3
GG5 656	The Hydrosphere	3
GG5 671		3
GG5 787	Scientific Data Mining for Geoinformatics	3
STAT 554	Applied Statistics I	3

<sup>1</sup> Cross-lists with an undergraduate course

### Concentration in Geotechnical Engineering (GEOE)

Code	Title	Credits
Select at least three from the following five geotechnical engineering core courses:		9
CEIE 531	Earth Retaining Structures and Slope Stability	
CEIE 634	Geoenvironmental Design	
CEIE 635	Advanced Soil Mechanics	
CEIE 636	Sources of Geotechnical Data	
CEIE 638	Advanced Foundation Design	
Total Credits		9

#### Electives

A list of approved electives for the geotechnical engineering concentration is provided below. Note that the remaining geotechnical engineering core courses can also be selected as electives.

Code	Title	Credits
CEIE 524	Introduction to Bridge Engineering	3
CEIE 532	Foundation Design <sup>1</sup>	3
CEIE 535	Engineering Geology <sup>1</sup>	3
CEIE 573	Legal Aspects of the Construction Process	3
CEIE 575	Design for Constructability	3
CEIE 607	Public Infrastructure Management and Finance	3
CEIE 637	Tunneling and Ground Improvement	3
CEIE 639	Special Topics in Geotechnical Engineering	1-3
CEIE 659	Hazardous Waste	3
GG5 553	Geographic Information Systems	3

<sup>1</sup> Cross-lists with an undergraduate course

### Concentration in Structural Engineering (STRE)

Code	Title	Credits
Select at least three of the following five structural engineering core courses:		9
CEIE 526	Structural Steel Design II	
CEIE 527	Pre-stressed Concrete	
CEIE 611	Structural Analysis II	
CEIE 612	Mechanics of Materials II	
CEIE 613	Structural Dynamics	
Total Credits		9

## Electives

A list of approved electives for the structural engineering concentration is provided below. Note that the remaining structural engineering core courses can also be selected as electives.

Code	Title	Credits
CEIE 512	Structural Steel Design <sup>1</sup>	3
CEIE 513	Reinforced Concrete Design <sup>1</sup>	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 532	Foundation Design <sup>1</sup>	3
CEIE 575	Design for Constructability	3
CEIE 607	Public Infrastructure Management and Finance	3
CEIE 619	Special Topics in Structural Engineering	3
CEIE 620	Intelligent Systems in Civil Engineering	3
CEIE 623	Reinforced Concrete Design II	3
CSI 690	Numerical Methods	3
CSI 742	The Mathematics of the Finite Element Method	3

<sup>1</sup> Cross-lists with an undergraduate course

## Concentration in Transportation Engineering (TRNE)

Code	Title	Credits
Select at least three of the following five transportation engineering core courses:		9
CEIE 662	Travel Demand Modeling	
CEIE 663	Intelligent Transportation Systems	
CEIE 664	Transportation Engineering and the Environment	
CEIE 767	Traffic Engineering Modeling and Analysis	
STAT 554	Applied Statistics I	
Total Credits		9

## Electives

A list of approved electives for the transportation engineering concentration is provided below. Note that the remaining transportation engineering core courses can also be selected as electives.

Code	Title	Credits
CEIE 560	Public Transportation Systems	3
CEIE 561	Traffic Engineering <sup>1</sup>	3
CEIE 562	Urban Transportation Planning <sup>1</sup>	3
CEIE 607	Public Infrastructure Management and Finance	3
CEIE 665	Travel Survey Methods and Data Analysis	3
CEIE 667	Multi-modal Transportation Systems	3
CEIE 668	Transportation Economics	3
CEIE 669	Special Topics in Transportation Engineering	3
CEIE 762	Network Models for Transportation Planning	3
CEIE 763	Discrete Choice Analysis in Transportation	3

CS 504	Principles of Data Management and Mining	3
GG5 553	Geographic Information Systems	3

<sup>1</sup> Cross-lists with an undergraduate course

Note:

For all concentrations, electives outside of the chosen concentration can only be taken or substituted with the approval of the faculty advisor or the department.

## Project or Thesis Option

Students, with the consent of a faculty advisor and departmental approval, may be approved to complete a project or thesis.

## Research Project

Students complete CEIE 798 Research Project in Civil Engineering, during which they prepare and present a scholarly paper. The scholarly paper is a technical report on an independent study, laboratory or computer experimentation, or literature search on a current civil and infrastructure engineering topic selected with approval of a faculty advisor. CEIE 798 Research Project in Civil Engineering credits count toward elective credit hours required for the MS degree.

Code	Title	Credits
CEIE 798	Research Project in Civil Engineering	3
Total Credits		3

## Master's Thesis

Students complete CEIE 799 Master's Thesis which counts toward the 30 credit hours required for the MS degree. The MS thesis should reflect a significant, independent research effort that advances engineering science, and is worthy of publication. The work is conducted with the approval of a faculty thesis advisor, and the final written thesis and oral defense are defended before a three-member faculty committee. The thesis is recommended for those students who wish to develop and document their research skills, or contemplate subsequent enrollment in a PhD program. Students are advised of the university's continuous registration requirement for thesis and dissertation research credits. Upon first enrolling in CEIE 799 Master's Thesis, the student must continue registration for each fall and spring semester until the thesis is successfully completed. CEIE 799 Master's Thesis credits count toward elective credit hours required for the MS degree.

Code	Title	Credits
CEIE 799	Master's Thesis (must complete 6 credits)	1-6
Total Credits		1-6

## Seminar Requirement

All degree candidates must attend a minimum of five graduate seminars approved by the CEIE Department for the degree program. Students must enroll in CEIE 795 Civil and Infrastructure Engineering Seminar and receive a satisfactory (S) grade by their final semester. This course is used to verify the seminar attendance requirement and is repeatable. Continuous enrollment every semester is encouraged for attendance tracking and for dissemination of seminar information but is not required.

Code	Title	Credits
CEIE 795	Civil and Infrastructure Engineering Seminar	0
Total Credits		0

## Accelerated Master's

# Civil and Infrastructure Engineering, BS/ Civil and Infrastructure Engineering, Accelerated MS

## Overview

Highly-qualified students in the Civil and Infrastructure Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-bs/>) have the option of obtaining an accelerated Civil and Infrastructure Engineering, MS.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

## Admission Requirements

Students in the Civil and Infrastructure Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-bs/>) program may apply to this option if they have earned 60 undergraduate credits with an overall GPA of at least 3.30. All other criteria for admission are identical to criteria for admission into the Civil and Infrastructure Engineering, MS program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

## Accelerated Option Requirements

Students register for up to 12 credits of overlapping graduate level courses in place of undergraduate technical elective courses.

Students are encouraged to take up to four of the following courses, based on their chosen concentration area in the master's program:

## Concentration in Construction Engineering and Management (CEM)

Code	Title	Credits
CEIE 571	Construction Administration	3
CEIE 572	Building Information Modeling	3
CEIE 573	Legal Aspects of the Construction Process	3
CEIE 575	Design for Constructability	3
CEIE 576	Construction Cost Estimating	3

## Concentration in Environmental and Water Resources Engineering (EWRE)

Code	Title	Credits
CEIE 540	Water Supply and Distribution	3
CEIE 542	Open Channel Flow	3
CEIE 550	Environmental Engineering Systems	3
CEIE 553	Water and Wastewater Treatment Processes	3
CEIE 557	Remote Monitoring Techniques for Civil Engineering Applications	3

## Concentration in Geotechnical Engineering (GEOE)

Code	Title	Credits
CEIE 501	Sustainable Development	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 531	Earth Retaining Structures and Slope Stability	3
CEIE 532	Foundation Design	3
CEIE 535	Engineering Geology	3

## Concentration in Structural Engineering (STRE)

Code	Title	Credits
CEIE 512	Structural Steel Design	3
CEIE 513	Reinforced Concrete Design	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 532	Foundation Design	3
CEIE 575	Design for Constructability	3

## Concentration in Transportation Engineering (TRNE)

Code	Title	Credits
CEIE 560	Public Transportation Systems	3
CEIE 561	Traffic Engineering	3
CEIE 562	Urban Transportation Planning	3
STAT 544	Applied Probability	3

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program from the list below. Reserve graduate credits do not apply to the undergraduate degree.

Code	Title	Credits
CEIE 601	Infrastructure Modeling	3
CEIE 605	Risk and Uncertainty in Civil Engineering	3

## Degree Requirements

Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs, and students must have satisfactory performance (grade of 'B' or better) in each of the graduate courses intended to be applied towards the MS degree.

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition Form (<https://registrar.gmu.edu/wp-content/uploads/BAMT-Bach-Acel-Masters-June21.pdf>). At the completion of MS requirements, a master's degree is conferred.

## Mechanical Engineering, BS/Civil and Infrastructure Engineering, Accelerated MS

### Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Mechanical Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/>) and a Civil and Infrastructure Engineering, MS, in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

### Admission Requirements

Students in the Mechanical Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/>) program may apply to this option if they have earned 60 undergraduate credits with an overall GPA of at least 3.30. All other criteria for admission are identical to criteria for admission into the Civil and Infrastructure Engineering, MS program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for both the BS and MS programs. Students register for up to 12 credits of overlapping graduate level courses in place of undergraduate technical elective courses.

Students are encouraged to take up to four of the following courses, based on their chosen concentration area in the master's program:

### Concentration in Construction Engineering and Management (CEM)

Code	Title	Credits
CEIE 571	Construction Administration	3
CEIE 572	Building Information Modeling	3
CEIE 573	Legal Aspects of the Construction Process	3

CEIE 575	Design for Constructability	3
CEIE 576	Construction Cost Estimating	3

### Concentration in Environmental and Water Resources Engineering (EWRE)

Code	Title	Credits
CEIE 540	Water Supply and Distribution	3
CEIE 542	Open Channel Flow	3
CEIE 550	Environmental Engineering Systems	3
CEIE 553	Water and Wastewater Treatment Processes	3
CEIE 557	Remote Monitoring Techniques for Civil Engineering Applications	3

### Concentration in Geotechnical Engineering (GEOE)

Code	Title	Credits
CEIE 501	Sustainable Development	3
CEIE 524	Introduction to Bridge Engineering	3
CEIE 531	Earth Retaining Structures and Slope Stability	3
CEIE 532	Foundation Design	3
CEIE 535	Engineering Geology	3

### Concentration in Structural Engineering (STRE)

Code	Title	Credits
CEIE 512	Structural Steel Design	3
CEIE 513	Reinforced Concrete Design	3
CEIE 525	Structural Evaluation and Rehabilitation	3
CEIE 532	Foundation Design	3
CEIE 575	Design for Constructability	3

### Concentration in Transportation Engineering (TRNE)

Code	Title	Credits
CEIE 560	Public Transportation Systems	3
CEIE 561	Traffic Engineering	3
CEIE 562	Urban Transportation Planning	3
STAT 544	Applied Probability	3

Students also have the option of taking the following one or two additional graduate-level courses for reserve that will only count for the graduate degree program:

Code	Title	Credits
CEIE 601	Infrastructure Modeling	3
CEIE 605	Risk and Uncertainty in Civil Engineering	3

## Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

## Advising & Plan of Study

Each student is assigned a faculty advisor upon acceptance. Students must meet with their advisors during their first semester and design an

approved plan of study. Students are encouraged to seek out their advisor when questions arise and when their plan of study needs to be revised.

Students must have a working background in their selected concentration area. A student lacking these foundations may be required to take one or more foundation courses.