John A. Reif, Jr. Department of Civil & Environmental Engineering

CEE CE 485 – 005: BUILT ENVIRONMENT INFORMATION MODELING AND PROCESSING

(3 credits)

Lectures Tuesdays, 10:00 AM – 12:50 PM MALL PC, Room 39

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Office Hours: Mondays, 10:00 AM – 1:00 PM
Office Location: Colton Hall, Room 215

Prerequisite
See special topic requirements.

Recommended Textbook

- Design Integration Using Autodesk Revit 2026 (Architecture, Structure & MEP) by Daniel John Stine, SDC Publications (https://www.sdcpublications.com/Textbooks/Design-Integration-UsingAutodesk-Revit/ISBN/978-1-63057-726-1/), ISBN: 978-1-63057-726-1

Course Description *(from NJIT's course catalog)*

This course introduces the application of Building Information Modeling (BIM) and Civil Information Modeling (CIM) in the context of the design and construction of the built environment. The course covers fundamental methods, theories, and practices geared toward creating graphical, data-rich representations of building components and geometries in alignment with current Architectural, Engineering, and Construction (AEC) standards. A central focus will be on how these models function as decision-support tools for a range of applications such as design analysis, constructability planning, simulation, cost estimation, documentation, site coordination, facility management, and sustainability assessment. In addition to virtual modeling, this course covers advanced reality-capturing technologies, including laser scanning, point cloud management, and photogrammetry, to build a working understanding of how real-world data is integrated into digital construction workflows. The course introduces clash detection techniques using Navisworks, guiding students in identifying and resolving potential design and coordination issues prior to construction. This further supports enhanced constructability planning, management, and analysis, leading to more efficient and sustainable project outcomes.

Course-specific Learning Objectives

- Evaluate industry standards and protocols governing BIM/CIM practices.

- Design and develop virtual architectural, structural, and custom components for project prototyping.
- Apply virtual models with detailed design documentation to analyze construction workflows and processes.
- Perform model-based quantity take-offs and cost estimation.
- Process point cloud data and execute Scan-to-BIM workflows.
- Conduct photogrammetry data processing for construction applications.
- Implement BIM for construction scheduling and create 4D (3D + time) simulations to support planning and sequencing.
- Examine emerging trends and propose future applications of BIM/CIM for digital project delivery.

POLICIES & PROCEDURES

Academic Integrity: It is expected that NJIT's University Code on Academic Integrity will be followed in all matters related to this course. Refer to NJIT's Dean of Students website to become familiar with the Code on Academic Integrity and how to avoid Code violations.
https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

Communication: Students are welcome to reach out with questions related to the course. Before contacting the instructor, it is encouraged to:

1. Review the course materials available on Canvas.
2. Carefully read through this syllabus.
3. Then, if your question remains unanswered, feel free to reach out.

When sending an email, please include "CE 485" in the subject line to ensure a prompt response. Allow up to 48 hours for a reply. Important course-related updates and announcements will be posted regularly on Canvas; students are expected to check the platform regularly to stay informed.

Lectures/Class: NJIT Canvas will be used in this course. All the class schedules, lecture notes, references, assignments, in-class exercises, projects, etc., will be posted on Canvas.

Attendance: Given that there will be in-class assignments, regular and timely attendance is essential and expected from all students. If you are unable to attend class due to a valid reason, you must inform the instructor via email before the class session and arrange for a classmate to update you on any action items to ensure the absence is considered excused.

Technology Literacy: Throughout the semester, we will primarily utilize Autodesk Revit, Navisworks, and Recap Photo/Pro, along with a few other digital tools. Students have access to a FREE education version of these software and must register with the site to verify their student credentials at:
https://www.autodesk.com/education/home

- Autodesk Revit (Student): http://www.autodesk.com/education/free-software/revit
- Autodesk Navisworks (Student): http://www.autodesk.com/education/free-software/navisworks

To fully engage in this course, students should ensure they have access to a **computer** capable of running the latest versions of these software programs. Students can download and install free educational versions of the software on their personal devices. Therefore, bringing a personal laptop to class is strongly recommended to support hands-on learning and in-class activities. If you do not currently own a computer, please reach out to the Dean of Students or visit the campus library to explore available options and resources. Additionally, some software may be available on computers in the NJIT Computing Lab or PC MALL (Room PC39) for on-campus use. For Mac users, please note that these programs are Windows-based. You may be able to run

them on macOS using virtualization tools (such as Parallels or VMware) or through Apple's Boot Camp to create a Windows partition. Please utilize tech-related assistance from the IST Service Desk at ServiceDesk@njit.edu or 973-596-2900.

Syllabus Change: The syllabus may be subject to change at the instructor's discretion to best support the learning objectives of the course. Any syllabus-related updates will be communicated in class, and a revised version will be made available on the course website.

Assignments: All assignments, projects, and deliverables must be submitted through Canvas by the stated deadline. Email is not an acceptable form of submission and will only be used for communication purposes, such as questions or notifying the instructor of absence. Work sent via email will not be graded unless prior approval has been granted under exceptional circumstances.

Course-Specific Expectations and Policies:

- Students are expected to maintain a focused, professional, and respectful learning environment.
- The use of cell phones during class is discouraged.
- Professional behavior is essential—this includes arriving on time, engaging respectfully in discussions, and remaining attentive during class sessions.
- This course emphasizes active participation as a core component of the learning experience. Students are encouraged to contribute to discussions freely, and all contributions made in good faith are valued. Participation is about engaging with the material, not delivering perfect answers.
- Regular and punctual attendance is critical. Missed in-class assignments, including quizzes or assessments, will receive a zero unless a documented excuse from the Dean of Students is provided. In the case of emergencies or exceptional circumstances, timely communication with the instructor is essential to explore possible accommodations.
- Late submissions will not be graded; students are expected to submit their work by the designated deadline. Unless advance notice is given and supported by substantial justification, any missed graded activity will result in a zero.
- All written submissions, including homework and presentations, must be typed, clearly formatted, and submitted as per the course guidelines.
- Students who miss multiple assignments or show significantly low performance (e.g., consistently below the class average or multiple failing grades) will be issued an academic alert and may be asked to submit a written improvement plan for continuation in the course.
- While grading will be conducted carefully and fairly, students who believe an error has occurred may request a review within two weeks of receiving their grade. Reasonable concerns will be addressed professionally and without penalty.

Evaluation: This course adopts an active learning approach designed to foster knowledge development both within and beyond the classroom. Class sessions will feature hands-on activities focused on idea generation, solution development, and outcome demonstration, with an emphasis on the information modeling process. The integration of in-class exercises and homework assignments is structured to develop both the technical and conceptual skills necessary to cover the course objectives. These experiences are also intended to prepare students and the future workforce for informed decision-making through virtual infrastructure modeling, a critical competency in contemporary AEC practice. Student performance will be evaluated based on participation in class activities, the quality and completeness of homework assignments, and the final semester project.

Course Grade Breakdown

- Assignments (55%)
- In-Class Exercises, Participation, and Attendance (25%)
- Final Project (20%)

Calculation of Course Grade: All cumulative points for course requirements will be rounded up to the nearest whole number. The final grade will then be determined based on the scale provided below:

Letter Grade	*Percentile*
A	100-90
B+	89-85
B	84-80
C+	79-75
C	74-70
D	69-60
F	Below 60

Students are encouraged to review their grades regularly on Canvas, which will be updated throughout the semester. If you have any questions or concerns about a posted grade, please reach out to the instructor as soon as possible, ideally within two weeks of the grade being posted. Addressing concerns early allows for timely resolution and helps avoid last-minute issues. Requests to replace zeros for missed assignments will be considered only with an official excuse from the Dean of Students. Final grades are determined with careful attention to fairness and consistency. While they are not open to negotiation, students are always welcome to communicate any concerns or seek clarification throughout the semester.

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly and consistently.

AI statement: The use of artificial intelligence (AI) is permitted in this course only when explicitly stated in assignments. If students use AI for any course-related work, they must cite it according to the guidelines provided on the **NJIT Library AI Citation page**. If you have any questions about AI use in this course, please contact the course instructor before submitting any assignments. In cases where AI use is not allowed, students are expected to complete work without AI assistance to develop their skills in this subject area.

Students with Documented Disabilities: NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation, and accommodation processes can be found on the webpage at: (http://www.njit.edu/counseling/services/disabilities.php)

Tentative Course Schedule

Week	Dates	Module Topics and Activities
1	Tuesday, September 2nd, 2025	• Course Introduction and Foundations of BIM for Infrastructure ○ Overview of course structure and expectations ○f Evolution and definition of BIM ○ Exploration of emerging technologies in infrastructure modeling ○ Key distinctions between BIM and traditional CAD tools ○ Getting started with Revit: Interface and basic navigation
2	Tuesday, September 9th, 2025	• Fundamentals of BIM Authoring – Architectural Modeling ○ Core modeling principles ○ Project setup workflows ○ Creating exterior building components
3	Tuesday, September 16th, 2025	• BIM Authoring Continued – Architectural Modeling ○ Object hierarchy in BIM ○ Step-by-step modeling of a sample building
4	Tuesday, September 23rd, 2025	• BIM Authoring Continued – Project-Based Modeling ○ Continuation of the modeling process for the sample project
5	Tuesday, September 30th, 2025	• Advanced BIM Authoring – Family Creation ○ Family object replication ○ Family object integration
6	Tuesday, October 7th, 2025	• BIM Authoring – Structural Modeling ○ Structural modeling with family object integration
7	Tuesday, October 14th, 2025	• BIM for Construction Planning ○ Applications for construction processes and fieldwork (quantity takeoff and estimating)

8	Tuesday, October 21st, 2025	• Reality Capture and Digital Contextualization ○ Image ranging ○ 3D reconstruction workflows for digital modeling (e.g., Scan-to-BIM)
9	Tuesday, October 28th, 2025	• Reality Capture and Digital Contextualization Continued ○ Image ranging ○ 3D reconstruction workflows for digital modeling (e.g., Scan-to-BIM)
10	Tuesday, November 4th, 2025	• BIM Specialty Applications (Autodesk Navisworks) ○ Integrated model review ○ Navigating composite models for construction insights ○ Working with object properties, selection sets, and saved viewpoints
11	Tuesday, November 11th, 2025	• Construction Planning and Visualization ○ 4D modeling to simulate construction sequences ○ Timeline integration for project phasing and progress tracking ○ Coordination workflows using BIM-Track ○ Clash detection, rule-based checking, and model auditing
12	Tuesday, November 18th, 2025	• Immersive Visualization and Interaction ○ Introduction to virtual reality in construction workflows ○ Creating VR-ready environments
13	Tuesday, November 25th, 2025	• **Thanksgiving Holidays**
14	Tuesday, December 2nd, 2025	• Final Project
15	Tuesday, December 9th, 2025	• Final Project

Course Objectives Matrix - CE 485 - Built Environment Information Modeling and Processing

Student Learning Outcomes	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Develop communication skills to function as civil engineers, including written, oral, and computer-based techniques.			
Indicate the importance of communication skills in the life and functions of the civil engineer	3	1, 2, 3	Discussions and group presentation,
Develop knowledge in Revit/Navisworks to design civil infrastructure and execute construction processes	3	1, 2, 3	Homework assignments and projects
Student Learning Outcome 2: Use BIM as a tool for selected civil engineering problems.			
Introducing BIM concepts	7	1	Homework assignments
Apply Revit/Navisworks to projects	7	1	Projects
Student Learning Outcome 3: Develop an understanding of the importance of effective communications in all phases of the life of civil engineers.			
Discuss various aspects of communication and its importance in the life of the civil engineer.	3	1, 2, 3	Discussions, individual comments, and written papers

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarships among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and

sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2. **Professional Growth:** Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as academia, business, and law through further education.
3. **Service:** Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Student Outcomes

Our **Student Outcomes** are what students are expected to know
and be able to do by the time of their graduation:

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 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 conclusion
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
Updated 8/2025