

Engineering and Construction Analytics using BIM

CGN 4905/CCE 6515C

Class Periods: Tuesday Period 7 (1:55PM-2:45PM); Thursday Period 7-8 (1:55PM – 3:50PM)

Location: WEIL408D

Academic Term: Fall 2025

Instructor:

Eric Jing Du; eric.du@essie.ufl.edu

Course Description

3 credit hours

Course Pre-Requisites / Co-Requisites

None

Course Objectives

Exploration of data-rich, object-oriented, and parametric representation technologies of civil engineering facilities, from which views and information can be extracted and analyzed for construction project acquisition, planning, and controls. Topics include Building Information Modeling (BIM) for engineering design, model-driven cost estimating, construction operations simulation, scanning and photogrammetry technologies, and advanced topics in construction modeling and simulation. Students will:

1. Understand the use of Building Information Modeling (BIM) in construction management
2. Learn how to create a Building Information Model (BIM for design)
3. Learn how to detect clashes between building components using BIM (constructability review)
4. Learn how to create 4D Construction Visualization Models (BIM simulation)
5. Learn how to use BIM to estimate project cost (5D)

Required Textbooks and Software

No required textbooks. **The following software packages are required to be installed:**

- Autodesk Revit 2026
- Autodesk Navisworks Manage 2026 (note: Not “Navisworks 360”)
- Autodesk Recap Pro
- **Optional:** Lumion 3D (<https://lumion.com/>) This program requires high-end graphic cards to be installed in your computer. It is optional.

All Autodesk software packages are free to UF students. Please go to <http://www.autodesk.com>. Register and login with your UF email, and then go to “Manage Products and Downloads”.

Materials and Supply Fees

No materials and supply fees. However, computers (desktop or laptop) that can support Autodesk software packages (listed in “Required Textbooks and Software”) are required for homework and team projects.

Specifications recommended by Autodesk can be found at <https://www.autodesk.com/support/system-requirements/overview>

***Apple Users:** Please note Apple operation systems (e.g., MacOS) are NOT compatible with Autodesk products. If you own Apple computers (e.g., MacBook, iMac), please use Boot Camp to install Windows OS as the secondary operation system. Make sure to allocate enough disk space to the secondary Windows OS (>300 GB) as most Autodesk software packages take up a lot of space. Another option is to use lab computers in Weil 408 but seats are not guaranteed outside of class hours.

***UF Apps: if you are having troubles installing the required software packages on your personal computer, an alternative is UF Apps.** <https://info.apps.ufl.edu/>. UF Apps allows you to use your web browser or “virtual machine” to open remote software packages installed on UF IT servers. It provides access to software applications from any computing device--laptops, tablets, desktops, and smartphones--from any location, at any time. We will go over UF Apps together on day 1 of the class.

Recommended Materials (Optional)

- *BIM and Construction Management: Proven Tools, Methods, and Workflows*
- Brad Hardin

- 2015 2nd edition
- ISBN: 978-1-118-94276-5
- *BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers*
- Rafael Sacks, Chuck Eastman, Ghang Lee, and Paul Teicholz
- 2018 3rd edition
- ISBN: 978-1119287537

Course Schedule

Dates	Topics	Presenters	Homework Due
Week 1 (8/21)	Introduction and Course Overview	Dr. Eric Jing Du	
Week 2 (8/26)	A brief history of BIM	Dr. Eric Jing Du	
Week 2 (8/28)	Lab: Revit tutorial 1 - Architecture	LAB	
Week 3 (9/2)	BIM Overview	Dr. Eric Jing Du	
Week 3 (9/4)	Lab: Revit tutorial 2 - Architecture – cont'd	LAB	
Week 4 (9/9)	Class Exercise – Bidding Game & Info Flow	Dr. Eric Jing Du	
Week 4 (9/11)	Lab: Revit tutorial 3 - Structure	LAB	
Week 5 (9/16)	BIM Overview – cont'd	Dr. Eric Jing Du	
Week 5 (9/18)	Lab: Revit tutorial 4 - MEP	LAB	
Week 6 (9/23)	BIM and Pre-construction	Dr. Eric Jing Du	
Week 6 (9/25)	Dream House Homework Presentations	Students	Dream House Models Due
Week 7 (9/30)	4D BIM - BIM for Scheduling	Dr. Eric Jing Du	
Week 7 (10/2)	Lab: Navisworks tutorial 1 - Clash Detection	LAB	
Week 8 (10/7)	Scanning: LiDAR	Dr. Eric Jing Du	
Week 8 (10/9)	Lab: Navisworks tutorial 2 - 4D Simulation	LAB	
Week 9 (10/14)	Scanning: Photogrammetry	Dr. Eric Jing Du	
Week 9 (10/16)	Lab: 3D Scanning – LiDAR & Photogrammetry	LAB	
Week 10 (10/21)	Scanning: Guest Lecture	Guest	
Week 10 (10/23)	Clash Detection Homework Presentations	Students	Clash Detection Due
Week 11 (10/28)	Drones	Dr. Eric Jing Du	
Week 11 (10/30)	4D and Scanning homework presentations	Students	4D BIM Due; Photogrammetry or Scanning Files Due
Week 12 (11/4)	5D BIM - BIM for Estimating	Guest	
Week 12 (11/6)	Lab: Assemble tutorial 1	LAB	
Week 13 (11/13)	Lab: Assemble tutorial 2	LAB	
Week 14 (11/18)	VR/AR Technologies	Dr. Eric Jing Du	
Week 14 (11/20)	Final Presentations	Students	5D BIM Due
Week 15	HOLIDAY – NO CLASS	NO CLASS	
Week 16 (12/2)	Final Presentations – cont'd	Students	All Presentations/Final report Due

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance is expected. Students are responsible for any information communicated during class. Project presentation attendance is mandatory. Missed presentations can only be made up when it is an excused absence. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. Student must contact the instructor as soon as the student knows that he/she will have an excused absence to arrange for makeup.

Evaluation of Grades – Undergraduate students

ID	Assignment	Total Points	Percentage of Final Grade
Individual project			
A	My Dream House project	100	30%
B	Pop quizzes (attendance)	100	10%
Team projects			
C	Constructability and Clash Detection	100	10%
D	Construction Estimating	100	10%
E	4D Construction Model	100	10%
F	Photogrammetry Project	100	10%
G	Final Presentation	100	20%
H	Peer Evaluation (team members)	1.0	Multiplier
Final Grade=A*30%+B*10%+H*(C+D+E+F)*10%+H*G*20%			

My Dream House Project

1. Create the Revit model of your dream house (no drawings will be provided) (using Revit).
2. Submit the “.rvt” file containing your model using Google Drive (link to be provided).
3. Put as many building components as you can. (Ex. foundation, walls, columns, doors, windows, MEP, and so on)
4. No accurate dimension is required.
5. Prepare a walkthrough using Revit or other tools such as Lumion etc.
6. Prepare a video to “sell” your dream house.
7. **Give a 5-min presentation to the class on September 25.**
8. The model will be evaluated by the class (50%) and instructor (50%) based on completeness 30% (if architecture, structure and MEP systems are modeled and presented), design 40% (how good the design is) and presentation 30% (how well the model is presented).
9. **Bonus point: a demo with Virtual Reality or Augmented Reality (tools of your selection).**

Constructability and Clash Detection

1. A model will be provided - Review the provided model.
2. Find any clashes between building components (using Navisworks).
3. Produce a discrepancy report presenting 10 most critical clashes and solutions.
4. A proper description, necessary snapshots, and some suggestions are expected for each clash.
5. Submit the “.doc” file containing the discrepancy report using Google Drive (link to be provided).
6. Demonstrate the “.nwd” file containing the federated model.
7. **Give a 5-min presentation to the class on October 23.**
8. The ability to detect clashes and explain them will be evaluated by the classmates (20%) and the instructor (80%).
9. **Bonus point: Using BIM Cloud tools (e.g., 360 or Modelo) to coordinate with other team members and present the process.**

4D Construction Model (undergraduate and graduate students)

1. Develop the list of the activities (line items) and their durations.
2. Combine the 3D model and line item information (in Navisworks or Synchro).
3. Submit the “.nwd” or “.syn” file containing a 4D Construction Model using Google Drive (link to be provided).
4. **Give a 6-min presentation (3 mins for 4D and 3 mins for scanning, see blow) to the class on October 30.**
5. The ability to develop a 4D Construction Model will be evaluated by the classmates (20%) and the instructor (80%).

Photogrammetry or scanning project (undergraduate and graduate students)

1. Build a 3D model of any UF structure (interior or exterior) using Photogrammetry or LiDAR.
2. Submit the model (file or address) using Google Drive (link to be provided).

3. **Give a 6-min presentation (3 mins for 4D and 3 mins for scanning) to the class on October 30.**

4. Present to the class; it will be evaluated by the classmates (20%) and the instructor (80%).

Construction Estimating using BIM (undergraduate and graduate students)

1. Extract the Bill of Material (BOM) from the Revit model (using Assemble).
2. Produce an Excel spreadsheet presenting the assumed construction cost (using Assemble).
3. Submit the “.rvt” file and “.xls” file containing the BOM and construction cost.
4. The ability to accurately produce the BOM and construction cost will be evaluated by the instructor, including: (1) completeness of building objects captured in Assemble (50%); (2) accuracy of unit costs (20%); (3) correct use of Assemble filters and output formats (30%).
5. **No presentations needed.**

Final Project – BIM Presentation (undergraduate and graduate students) Each team forms a BIM consulting company.

1. Prepare a whole lifecycle solution for construction management using BIM (must include main techs learned in this class).
2. Develop a visual-based presentation material for your plan to manage the project.
3. Submit “.pptx” file using Google Drive (link to be provided).
4. **Give a 10-min presentation to the class on November 20 and December 2.**
5. Graduate students must include emerging visualization technologies in their presentation.
6. The final project will be evaluated by the classmates (20%) and the instructor (80%).

BIM Future Essay (graduate students only)

1. Write an essay discussing the future of BIM technologies at three milestones: 5 years, 10 years, and 20 years into the future.
2. Your discussion should address anticipated technological advancements (e.g., newer scanning tech, AI, computer vision methods, better hardware systems etc.), industry adoption, challenges, and potential impacts on construction management practices.
3. Support your arguments with references to academic papers, industry reports, or case studies (at least 3 credible sources required).
4. The essay should be at least 2,000 words, double-spaced, in Times New Roman 12-point font, with proper citations (APA or IEEE style).
5. Submit your essay as a “.pdf” file through Google Drive (link to be provided).
6. **Due Date: December 5.**
7. **The essay will count toward the graduate student grade component as part of the Final Project – BIM Presentation.**

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: <https://go.ufl.edu/syllabuspolices>. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWC OE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu