



CE 470: Building Information Modeling: Project Visualization and Simulation for Management

Units: 4

Fall 2023—Mondays—Time: 10:00am to 1:50pm

Location: RTH 115

Instructor: Burçin Becerik-Gerber, Professor

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Office Hours: Tuesdays 1:30 to 3:30pm

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Course Description

Building Information Modeling (BIM) is a process focused on the development, use and transfer of a centralized data-rich virtual project model that facilitates documentation, design exploration, model-based quantity take-off and estimating, interference checking, construction coordination and sequencing, digital fabrication and building information visualization. In this course, students will learn BIM's use in the architecture, engineering, and construction (AEC) industry, examine geometry, spatial relationships, building information, quantities, and properties of building components, and understand the benefit and improvement areas BIM process offers. This course focuses on the role of BIM in the AEC industry, and it covers recent developments in the area of BIM and integrated practice, both of which have a great potential to better project outcomes and maximize efficiency. In addition, the course brings cutting edge and emerging technology solutions into the classroom and tries to link these solutions into the BIM environment.

Learning Objectives and Outcomes

- *Familiarity with BIM*
- *Develop an understanding of the shift from 2D representation to 3D simulation*
- *Evaluate and effectively communicate the new means of coordination and collaboration of design and construction*
- *Develop an understanding for linking and maintaining continuity of existing and designed BIM information and other vital information, such as vendors for specific materials, location of details and quantities required for estimation, bidding and scheduling, into the model*
- *Learn new project delivery systems and technologies for integrated practice*

Registration Restriction: Registration is only open to the following class level(s): Junior, Senior, Master Student, and Doctoral Student

Course Notes

METHODS OF TEACHING

A combination of lectures, hands on software training, experiments with new technologies and discussions. Additional out of class time required for directed learning, course assignments and reviewing relevant material.

CLASS COMMUNICATION

Desire to Learn (D2L) course management system will be used for class communication, assignment submissions and reading materials.

Technological Proficiency and Hardware/Software Required

REQUIRED SOFTWARE

We will use various software solutions in this course. Below is a list of solutions and instructions for downloading them.

Autodesk Revit– FREE for students: <https://www.autodesk.com/education/home>

Autodesk Navisworks Manage - <https://www.autodesk.com/education/home>

Please go to <http://students.autodesk.com>, register and download Revit and Navisworks Manage with your USC e-mail address. Please note that if you decide to use another version of

Revit/Navisworks, it is important all team members to use the same version. Also, both of these software solutions are available on Enhanced Desktop Pool (virtual machine).

Revit and Navisworks are PC only but can be used on a Mac with Boot Camp (ships free with your Mac: go to Applications/Utilities/Boot Camp Assistant) or Parallels (<http://www.parallels.com>) that allows a Mac to run Windows. NOTE: to run Revit on a Mac, you must have a copy of the Windows operating system (Windows OS is available to students through Viterbi IT).

Solibri Model Checker – software will be available on Enhanced Desktop Pool (virtual machine), instructions on using the virtual machine will be provided during the semester.

Synchro Pro - software will be available on Enhanced Desktop Pool (virtual machine), instructions on using the virtual machine will be provided during the semester.

RELATED SOFTWARE

Graphisoft; ArchiCAD	http://www.graphisoft.com/archicad/
Bentley OpenBuildings Designer	https://www.bentley.com/software/openbuildings-designer/
Digital Project	http://www.digitalproject3d.com/
Tekla	http://www.tekla.com/us
VICO	https://vicooffice.dk/en/
IES	http://www.iesve.com/
Green Building Studio	https://gbs.autodesk.com/GBS/
Assemble Systems	http://assembleystems.com/
Ecodomus	https://new.siemens.com/global/en/products/buildings/digital-building-lifecycle/ecodomus-software.html
Innovaya	http://www.innovaya.com
Autodesk Insight	https://www.autodesk.com/products/insight/overview

RELATED BIM RESOURCES

Analysis, Research and Reviews of AEC Technology - AECbytes	- http://www.aecbytes.com/
Building Smart Alliance	- https://www.buildingsmart.org/
National BIM Standard (NIBS)	- https://www.nationalbimstandard.org/
BIM Forum	- http://www.bimforum.org/
BIM and Integrated Design	- http://bimandintegrateddesign.com/
BIM Object	- https://www.bimobject.com/en-us/search

REVIT RESOURCES

Revit On-line Help	- https://help.autodesk.com/view/RVT/2021/ENU/
Revit City	- http://www.revitcity.com/index.php
AUGI (Autodesk User Group International)	- http://forums.augi.com/ (navigate to Forums >AEC > Revit)
Club Revit	- http://clubrevit.com (on LinkedIn)
The Revit Kid	- http://therevitkid.blogspot.com/
BIM Boom/ Revit 3D	- http://bimboom.blogspot.com/
Tips and Tricks Series by AECbytes	- http://www.aecbytes.com/tipsandtricks/index.html

Readings and Supplementary Materials

RECOMMENDED TEXTBOOK

BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors- Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 2nd Edition.

Description and Assessment of Assignments

This course is heavy in terms of hands-on project-based assignments. Recommended textbook is a suggestion and not required.

Assignment 1 (Midterm Assignment): 2D drawings of a typical campus building will be provided to the students. Students (in teams) will model (architectural and structural) this campus building based on their Revit knowledge acquired through the in-class-tutorials and self-practice. Teams can divide the work by discipline or by floor or any other way they choose. The goal of this exercise is to understand the collaborative effort of modeling and coordination between different disciplines. A short report and milestone submissions (see the schedule below) are required with the submission of the BIM models. The report should clearly state each team member's contribution. More details will be provided.

Assignment 2: Each student will research one BIM authoring or specialty tool that is available in the market. Students will identify the tool they will research and inform the instructors by the date indicated in the schedule below. Students will prepare a report outlining the strengths and weaknesses of the tool they have selected. It is expected that students will do bibliographical research and download the software, import their model to their selected BIM authoring software and explore software functionalities and capabilities. A short presentation and a write up, on the above-mentioned areas as well as the interoperability issues between Revit and the selected software, will be prepared and delivered on the due date of the assignment.

Assignment 3 (Final Assignment): Teams will perform interference checking and 4D simulation using Navisworks, Solibri and Synchro. Teams will use the models (architectural and structural) they have developed in their mid-term assignment. The MEP model of the building will be provided. Teams will present their work and findings on the pros and cons of each tool. In addition, the teams will research other BIM tools available for construction management and present their analysis. A short report and milestone submissions (see the schedule below) are required with the submission of the BIM models. The report should clearly state each team member's contribution. More details will be provided.

EVALUATION AND GRADING SCHEMA

Grades will be based on completeness and quality of assignments, attendance, and participation. Additional breakdown for grading for each assignment will be provided in assignment descriptions that will be handed out during the semester.

Grading Breakdown

Assignment	% of Grade
Midterm (Assignment 1) Milestone 1	10
Midterm (Assignment 1) Submission and Presentation	30
Assignment 2	15
Final (Assignment 3) Milestone 1	10
Final (Assignment 3) Submission and Presentation	30
Participation in discussions	5
TOTAL	100

Grading Scale

Course final grades will be determined using the following scale

A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Assignment Submission Policy

It is crucial that students turn in whatever they have on the due date. NO assignment will be accepted late. Assignments are due the beginning of the class as specified in the class schedule below. A grade of Incomplete for the course will only be issued when a student is unable to complete the work because of documented illness (verified with a letter from a medical professional) or emergency after the twelfth week of classes. **ALL ASSIGNMENTS ARE DUE 11:59AM ON THE DAY INDICATED IN THE SCHEDULE.**

Grading Timeline

Return of Course Assignments

Returned paperwork, unclaimed by a student, will be discarded after a year and hence, will not be available should a grade appeal be pursued following receipt of his/her grade.

Additional Policies

CLASS PARTICIPATION

Continuous attendance is critical for your success in this class as the class topics build on each other and attendance is part of the evaluation criteria. If you miss a class, it is your responsibility to ask at the next class what you missed or find out about topics covered. If you are late for class, it is your responsibility to make sure we check you present, if not you will not get credit for attendance.

Your participation in the class is part of the evaluation criteria. This is a highly interactive class. There is continuous interchange between the instructor, TA, guest lecturers and students. Questions and participation in discussions are highly encouraged.

Course Schedule: A Weekly Breakdown

This course is heavy in terms of hands-on project-based assignments. The recommended textbook is a suggestion and not required.

	Topics/Daily Activities	Due Dates
08/21	COURSE INTRODUCTION Course overview Student survey BIM INTRODUCTION Why is BIM important? How is BIM changing the AEC industry? INTRODUCTION TO BIM AUTHORING Introduction to modeling What is BIM and what is NOT BIM? Different uses of BIM	
08/28	MODELING (Revit) Accurately modeling building elements (walls, doors, windows, floors, roofs, etc.)	
09/04	NO CLASS – LABOR DAY	Teams must be established
09/11	COLLABORATION IN BIM (BIM 360) How to collaborate in a BIM environment Cloud based collaboration Sharing models	
09/18	STRUCTURAL MODELING (Revit) Structural systems	
09/25	DOCUMENTATION (Revit)	Submit the work for Midterm Milestone 1

	Sections, elevations, 3D views, schedules, quantities, etc. CUSTOM FAMILIES Creating custom parametric model elements and geometries	Choose your alternative BIM tool and report to the Instructor/TA for Assignment 2
10/02	BIM for CONSTRUCTION MANAGEMENT Challenges and case studies of BIM <i>Guest Speaker: Shobhit Baadkar</i>	
10/09	INTEGRATED PROJECT SESSION Team Presentations	Midterm assignment due
10/16	CONSTRUCTION COORDINATION (Navisworks) Principles of IPD Model integration	
10/23	STUDENT PRESENTATIONS Software environments/solutions Pros/cons of different BIM tools	Assignment 2 due
10/30	CONSTRUCTION COORDINATION (Solibri) Interference checking Identifying/resolving issues	
11/06	FUTURE TRENDS IN BIM Use of virtual environments for design exploration Data management & Cloud based BIM Laser scanning and BIM Computer aided manufacturing/fabrication Digital Twin <i>Guest Speaker: TBD</i>	Submit the work for Final Milestone 1
11/13	TIME-PHASED CONSTRUCTION PLANNING (Synchro) 4D simulation	
11/20	TIME-PHASED CONSTRUCTION PLANNING (Synchro) 4D simulation	
11/27	INTEGRATED PROJECT SESSION Team Presentations	Final presentations due Final assignment due 12/11 No exams!

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/ssu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.