

# USC School of Architecture

## PRELIMINARY

*(in-progress, last updated 12/07/21)*

### **Architecture 307: Digital Tools for Architects (Units: 3)**

**Spring Semester Tuesday / Thursday:** 11:00 am – 12:20 pm, WPH B36

**Instructor:** Karen Kensek, [kensek@usc.edu](mailto:kensek@usc.edu)

**Office:** Watt 309

**Office Hours:** send email for appointment

**Class Assistant:** to be announced

**Studio:** to be announced

**Office Hours:** to be announced, also available on Slack

**Prerequisite(s):** none

**Recommended Preparation:** basic computer skills, preferably also a 3D modeling program

### **Course Description and Learning Objectives**

Building information modeling (BIM) is a digital paradigm shift, in many ways similar to that of the CAD revolution of the 1980s. What is BIM? How is it different from CAD? Why does an architecture student need to know about it? This course provides an introduction to BIM from the viewpoint of the architect (Revit Architecture, Enscape for visualization), engineer (Revit Structure and Revit Mechanical), and contractor (Navisworks). Depending on time, other software such as Insight (preliminary energy modeling), Fusion (rapid prototyping), FormIt (conceptual modeling), Bluebeam, Dynamo (visual programming), or BIM 360 will be explored.

In order to effectively learn about BIM, it is important that you go to class and keep up with the required readings. You are required to attend all the lectures and complete all the assignments on-time. In addition to many hands-on computer sessions by the instructor, there will also be guest lecturers from the profession. They have spent considerable time and effort to come talk with the class. Listen, be attentive, and ask appropriate questions. They are valuable resources.

In this class, you will

- Learn what BIM is and how it has changed the AEC (architecture/engineering/construction) industry
- Become reasonably proficient in Revit Architecture
- Learn some Revit MEP, with an emphasis on how files are linked together for collaboration between architects and engineers
- Learn how contractors use Navisworks Manage
- Understand what is virtual reality and apply it to your project using Enscape
- Explore other BIM related software programs such as Navisworks, Insight, BIM 360, or Dynamo depending on class time

### **Technological Proficiency and Hardware/Software Required**

Download **Autodesk Revit** from <http://students.autodesk.com>. You will also be using Enscape and Navisworks Manage. More instructions will be provided during the semester on how to access other software as needed.

## Required Readings and Supplementary Materials

Specific due dates for the readings are listed on the syllabus. You are required to have read the material **before** class. There may be in-class quizzes on the readings and/or required questions to answer. There will be other readings posted on Blackboard.



### REQUIRED READING

**Technical Design Series: Building Information Modeling** (Routledge 2014)

Karen M. Kensek, LEED AP BD+C, Assoc. AIA

The book is available in English, French, Chinese, and Portuguese

<http://www.routledge.com/books/details/9780415717748>

### Introduction

#### Chapter 1: BIM Overview

Parametric modeling and the virtual building model, BIM "dimensions", Level of development, Summary

#### Chapter 2: Stakeholders and BIM's Many Roles

Architects, engineers, consultants, Construction managers, contractors, sub-contractors, Fabricators, Facilities managers and owners, Summary

#### Chapter 3: Data Exchange and Interoperability

Interoperability, Data exchange workflows, Single model and federated model systems, Data and communication formats, Summary

#### Chapter 4: BIM Implementation, **optional (but useful if you are going to work in an architecture office)**

Transforming the office to BIM, Delivery methods, Legal issues, Office standards, BIM Execution Plan (BEP), Metrics for BIM maturity, Summary

#### Chapter 5: Beyond Basic BIM

BIM analytics, Cloud computing, Computational design, Increased sophistication of owners, Summary

#### Application: Project Case Studies

designLAB architects: Small BIM Tames Big Brutalism

ZGF: BIM in Transition: Making the Leap at a Large Firm

CASE: Building Information Coordinators

Mortenson Construction: Outstanding Project Success Through Collaboration

### Conclusion



### OPTIONAL READING

**Design Computing: An Overview of an Emergent Field** (Routledge 2016)

Brian Johnson

Chapter 5: Doing What Designers Do

<https://www.routledge.com/Design-Computing-An-Overview-of-an-Emergent-Field/Johnson/p/book/9781138930971>

### Optional Teaching Videos: **LinkedIn Learning (accessible from Blackboard)**

There is a wealth of teaching videos on many topics for free!

## Course Organization

- BIM: communication & collaboration: the roles of architect, structural engineer, & mechanical engineer  
Homeworks 1, 2, 3, and 4
- BIM: modeling, rendering, and animation  
Homeworks 5, 6, 7, and 8
- BIM in the Profession  
Homework 9  
Guest Lectures
- Final Project – techniques for going from Rhino to Revit

## Grading Breakdown

	Percent of Grade	Assignments: unless otherwise indicated, assignments are done individually	Number of points
<b>Homeworks</b>	80%	Homework 1: communication (office building)	10
		Homework 2: introduction to Revit modeling (house)	20
		Homework 3: (teams of 2): architecture, structure, mechanical (house)	10
		Homework 4: clash detection and sequencing (office building)	10
		Homework 5: families	20
		Homework 6: modeling (new house)	20
		Homework 7: rendering (new house)	10
		Homework 8: virtual reality and animation (new house)	10
		Homework 9: parametric families and adaptive components (new house)	10
<b>Final Project</b>	15%	Final Project (Rhino to Revit)	100
<b>Participation</b>	5%	Pop-quizzes	varies
		Questions on readings	varies
		Other	varies

## Assessment of Assignments

**Late work will NOT be accepted; turn in what you have ON-TIME.**

It is critical that you finish by the deadlines that have been set. Feel free to get ahead in the work for the class, just not behind. Each assignment builds on the next. Sometimes you will be turning in a paper based assignment AND a file on Blackboard. Students are strongly encouraged to come by with work in progress for suggestions before the work is due and come by after grading to learn how they could improve in the future. Please read the assignments carefully – most are done as individuals, but some of the software exercises are done in teams.

Most assignments will be turned in both on Blackboard and as print-outs; read the specific requirements on each homework handout. They are due **before the beginning** of class. There are **no make-ups** on assignments, quizzes, or exams.

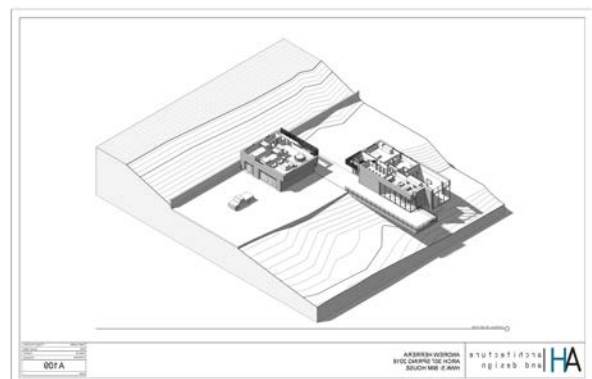
Assignments can be completed on your own computer, those in WPH, Watt, or Harris Halls or through the USC ITS Cloud apps at <https://itservices.usc.edu/vdi/>.

## Course Schedule: A Weekly Breakdown

Readings are due at the beginning of the week

	TUESDAY	THURSDAY	READING
<b>Week 1</b> Jan. 11, 13	Introduction to the Arch 307. Introduction to BIM.	Linking files, viewing, printing. Creating your first family, the title block. Exploded axon, overlay; section box; simple annotate	<i>Introduction Chapter 6</i>
<b>Week 2</b> Jan. 18, 20	Introduction to Revit. Instances, types, families Choosing a house.	<b>HWK 1 due</b> Introduction to Revit system families: walls, roofs, floors	<i>Chapter 7</i>
<b>Week 3</b> Jan. 25, 27	Introduction to Revit in-place families. Site and site annotation.	Introduction to Revit loadable families: windows, doors, family editor. Electric charging station; rain water cistern; solar cells; section box; annotate; tag material	<i>Chapter 8</i>
<b>Week 4</b> Feb. 1, 3	Introduction to Revit Structure	<b>HWK 2 due</b> Introduction to Revit Mechanical	<i>Chapter 9</i>
<b>Week 5</b> Feb. 8, 10	Clash detection Revit clash detection Navisworks clash detection	<b>HWK 3 due</b> Construction sequencing Revit phasing Navisworks sequencing (not on assignment)	<i>Chapter 1</i>
<b>Week 6</b> Feb. 15, 17	Understanding families: system, loadable, in-place Level of Development (LOD) (review homework 5)	<b>HWK 4 due</b> Understanding families: system, loadable, in-place; curtain walls. (review homework 5)	
<b>Week 7</b> Out of town Mar. 1, 3	Understanding families: system, loadable, in-place (review homework 5)	Creating parametric components: box, beam, door panel, overhang parameters: length, visibility, material (review homework 5)	<i>Chapter 2</i>
<b>Week 8</b> Mar. 8, 10	Detailing. BIM as a database. Schedules and legends: doors and windows as examples.	<b>HWK 5 due</b> Room legend. Room labels with square footages. Sheet index. Families associated with these.	
<b>Week 9</b> Mar. 15, 17	<i>Spring Break</i>		

<b>Week 10</b> Mar. 22, 24	Conceptual mass – use of the conceptual mass as a tool	<b>HWK 6a due</b> <b>BIM in the Profession</b>	<i>Chapter 3</i>
<b>Week 11</b> Mar. 29, 31	Rendering: setting up a view, materials	<b>HWK 6b due</b> Rendering: lights, cloud rendering, and illuminance.	<i>optional Chapter 4</i>
<b>Week 12</b> Apr. 5, 7	What is VR and AR/MR? Introduction to Enscape. Animation and sound. <a href="https://blog.enscape3d.com/external-design-renderings?utm_campaign=20210111_nl_january&amp;utm_medium=email&amp;utm_source=newsletter">https://blog.enscape3d.com/external-design-renderings?utm_campaign=20210111_nl_january&amp;utm_medium=email&amp;utm_source=newsletter</a>	<b>HWK 7 due</b> Gaming Engines	<i>Chapter 5</i>
<b>Week 13</b> Apr. 12, 14	Adaptive components (2 pt / 4pt) Parameters: length, visibility, offset, material	<b>HWK 8 due</b> Adaptive components (pattern based) Parameters: length, visibility, offset, material	<i>Conclusion</i>
<b>Week 14</b> Apr. 19, 21	<b>BIM in the Profession</b>	<b>HWK 9 due</b> Interoperability Rhino to Revit, part 1 Rhino-Inside Revit Final project discussion.	<i>optional Johnson, Chapter 5</i>
<b>Week 15</b> Apr. 26, 28	Interoperability Rhino to Revit, part 2	<b>Other topics in BIM</b> Dynamo. <a href="#">Suzhou lecture</a> Generative components. BIM 360. Insight. Class summary.	
<b>FINAL</b> May 10	<b>Final Project due, Tuesday, May 10, 11 am – 1 pm</b>		



Homework 6, Spring 2016, Arch 307. Andrew Herrera

## 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” <https://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, <http://policy.usc.edu/scientific-misconduct>.

### Support Systems

*Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call*

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. <https://engemannshc.usc.edu/counseling/>

*National Suicide Prevention Lifeline - 1-800-273-8255*

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

*Sexual Assault Resource Center*

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

*Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086*

Works with faculty, staff, visitors, applicants, and students around issues of protected class. <https://equity.usc.edu/>

*Bias Assessment Response and Support*

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

*The Office of Disability Services and Programs*

Provides certification for students with disabilities and helps arrange relevant accommodations. <http://dsp.usc.edu>

*Student Support and Advocacy – (213) 821-4710*

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

*Diversity at USC*

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. <https://diversity.usc.edu/>

*USC Emergency Information*

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, <http://emergency.usc.edu>

*USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.*

Provides overall safety to USC community. <http://dps.usc.edu>

## Religious Holidays

The University of Southern California recognizes the diversity of our community and the potential for conflicts involving academic activities and personal religious observation. The University provides a guide to such observances for reference and suggests that any concerns about lack of attendance or inability to participate fully in the course activity be fully aired at the start of the term. As a general principle students should be excused from class for these events if properly documented and if provisions can be made to accommodate the absence and make up the lost work. Constraints on participation that conflict with adequate participation in the course and cannot be resolved to the satisfaction of the faculty and the student need to be identified prior to the drop/add date for registration. After the drop/add date the University and the School of Architecture shall be the sole arbiter of what constitutes appropriate attendance and participation in a given course.

Please contact **Karen Kensek** at [kensek@usc.edu](mailto:kensek@usc.edu) by the end of the second week of class if you anticipate conflicts with religious holidays including missing lectures, inability to finish homework assignments on-time, or other items that may hinder your work in this class.

## Accreditation Statement

The USC School of Architecture's five year BARCH degree and the two year M.ARCH degree are accredited professional architectural degree programs. All students can access and review the NAAB Conditions of Accreditation (including the Student Performance Criteria) on the NAAB Website, [http://www.naab.org/accreditation/2009\\_Conditions.aspx](http://www.naab.org/accreditation/2009_Conditions.aspx).

The Master of Landscape Architecture degree program (for USC's +3 students with no prior design education, and our +2 for students admitted with advanced standing) is currently in "Candidacy Status" for accreditation by the Landscape Architecture Accreditation Board. All students can access and review the LAAB accreditation standards/process at <http://www.asla.org/Education.aspx>.

## Other notices

The estimate for the books for this course and other expenses is approximately \$75.



Spring 2016: Arch 307, hwk 6. Ana Michel and Magdalini Vraila



Spring 2019: Visitor center renderings in Enscape and Revit (507). (George Yang)