USC School of Architecture

PRELIMINARY
(in-progress, last updated 10/17/19)

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
Office: Watt 309
Office Hours: send email for appointment

Class Assistant: to be announced
Studio: to be announced
Office Hours: to be announced

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 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 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: Lynda (accessable from Blackboard)
http://www.lynda.com/Revit-Architecture-2011-tutorials/essential-training/62086-2.html
There might be other new teaching videos available also. Take a look!

VIDEO
▶ What is a **Revit family**? (3m)
From: Revit: MEP Families

- Let's get started by explaining what a **Revit family** actually is. For you AutoCAD users, it's a block that you insert into a drawing. Basically,...

COURSE
Revit: Families with Eric Wing
Covers the process of creating a family and adding parameters, 3D elements, symbolic lines, and materials.

2h 4m ▮▮▮ Intermediate   Views: 139,727   See Related Courses ⌄

VIDEO
▶ Understanding **Revit families** (3m 39s)
From: Revit Structure 2013 Essential Training

A **Revit family** is an object that has information built into it. Some will people define this as being an intelligent component, because it has...

COURSE
Revit: Family Curves and Formulas with Paul F. Aubin
Tame unruly parametric curves with the Revit Family Editor, and start controlling circles, arcs, arches, splines, and even complex curves like cyma moldings.

3h 51m ▮▮▮ Intermediate   Views: 53,893   See Related Courses ⌄

COURSE
Revit: Architectural **Families** with Eric Wing
Improve your Revit workflow with Revit families. Learn how to model reusable features such as chair rails and baseboards, doors, cabinets, and shelving with Revit architectural families.

3h 32m ▮▯▯ Appropriate for all   Views: 60,677   See Related Courses ⌄

COURSE
Revit: Tips, Tricks, and Troubleshooting with Paul F. Aubin
Get a new tip, trick, or troubleshooting technique for Revit 2017 every Tuesday. This weekly series offers workflow enhancements, customizations, and shortcuts for both Revit beginners and seasoned users alike.

▶ Place multiple elements with Dynamo (8m 4s)
▶ Using Dynamo to rename sheets (8m 3s)
▶ Using Dynamo to rename views (7m 2s)

11h 3m ▮▯▯ Appropriate for all   Views: 155,999   See Related Courses ⌄

COURSE
Dynamo: Revit Workflow with Ian Siegel
Use Dynamo to apply basic visual programming concepts to architectural design in Revit. Learn how to automate everyday tasks such as numbering rooms and calculating occupant loads.

▶ Highlight Revit elements with Dynamo (4m 14s)
▶ Calculate occupant loads with Dynamo (5m 12s)
▶ Concatenate lists of strings with Dynamo (4m 26s)
+ Show More

1h 29m ▮▯▯ Appropriate for all   Views: 23,493   See Related Courses ⌄

COURSE
Dynamo Essential Training with Ian Siegel
Learn how to use Autodesk Dynamo with Revit. Generate algorithms to analyze data, read and edit data from outside sources, create geometry in Dynamo itself, or edit the geometry in Revit files.

▶ What is Dynamo? (5m 35s)
▶ Placing Revit families with Dynamo (7m 36s)
▶ Placing adaptive components with Dynamo (3m 29s)
+ Show More

3h 3m ▮▯▯ Appropriate for all   Views: 93,157   See Related Courses ⌄

Optional Teaching Videos: revitcourse.com. USC has a partnership program with revitcourse.com.

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: BIM in the Profession
  Homework 9
  Guest Lectures
- Final Project – probably Rhino to Revit

Grading Breakdown

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

Assessment of Assignments

<div style="border:1px solid black; text-align:center; font-weight:bold;">

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

</div>

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.

Course Schedule: A Weekly Breakdown
*Readings are due at the beginning of the week*

	TUESDAY	THURSDAY	READING
Week 1 Jan. 14, 16	Introduction to the Arch 307. Introduction to BIM.	Linking files, viewing, printing. Creating your first family, the title block.	*Introduction* *Chapter 6*
Week 2 Jan . 21, 23	Introduction to Revit. Instances, types, families Choosing a house.	**HWK 1 due** Introduction to Revit system families: walls, roofs, floors	*Chapter 7*
Week 3 Jan . 28, 30	Introduction to Revit loadable families: windows, doors, family editor.	Introduction to Revit in-place families. Site and site annotation.	*Chapter 8*
Week 4 Feb. 4, 6	Introduction to Revit Structure	**HWK 2 due** Introduction to Revit Mechanical	*Chapter 9*
Week 5 Feb. 11, 13	Clash detection Revit clash detection Introduction to Navisworks	**HWK 3 due** Construction sequencing Revit phasing Navisworks sequencing	*Chapter 1*
Week 6 Feb. 18, 20	Detailing.	**HWK 4 due** Understanding families: system, loadable, in-place; curtain walls. (review homework 5)	
Week 7 Feb. 25, 27	Understanding families: system, loadable, in-place Level of Development (LOD) (review homework 5)	Editing and creating families. (review homework 5)	*Chapter 2*
Week 8 Mar. 3, 5	3D modeling techniques.	**HWK 5 due** Synthesis.	
Week 9 Mar. 10, 12	BIM as a database. Schedules and legends: doors and windows as examples.	Room legend. Room labels with square footages. Sheet index. Families associated with these.	*Chapter 3*
Week 10 Mar. 17, 19	SPRING BREAK	SPRING BREAK	
Week 11 Mar. 24, 26	Rendering: materials	**HWK 6 due** Rendering: lights, cloud rendering, and illuminance.	optional *Chapter 4*
Week 12 Mar. 31, Apr. 2	**BIM in the Profession** (Tuesday and Thursday could be switched)	**HWK 7 due** VR and animation. Introduction to Enscape.	

Week 13 Apr. 7, 9	VR in class. (Tuesday and Thursday could be switched)	BIM in the Profession	*Chapter 5*
Week 14 Apr. 14, 16	Creating parametric components: box, beam, door panel, overhang, conceptual mass	**HWK 8 due** Creating adaptive parametric components.	
Week 15 Apr. 21, 23	Interoperability Rhino to Revit, part 1 Final project discussion.	**HWK 9 due** Introduction to Dynamo.	*Conclusion*
Week 16 Apr. 28, 30	Rhino to Revit, part 2	Show projects. Class summary.	optional *Johnson, Chapter 5*
FINAL May 12	**Final Project due, Tuesday, May 12, 11 am – 1 pm**		

Samples of homework 6

Spring 2016, Arch 307. Andrew Herrera
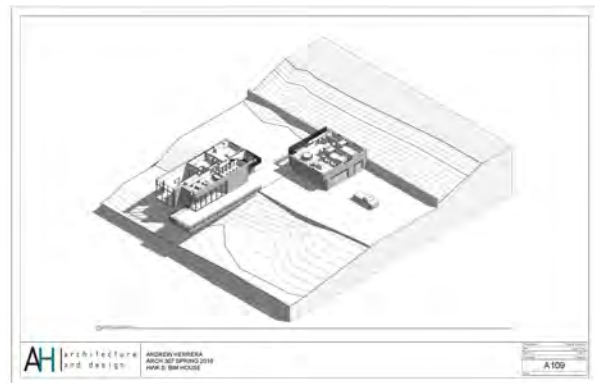
Spring 2016, Arch 307. Ana Michel   *Spring 2016, Arch 307. Magdalini Vraila*

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 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 .

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 .