

Introduction to Building Information Modeling

Instructor: Jason Van Nest
NYIT - Arch 291
1-3-3

Spring 2010

Course Description

This seminar will expose students to several stages of architectural document development with Building Information Modeling (BIM). The lectures and assignments will build an introductory knowledge of BIM and teach students how to create drawings in a professional setting. The seminar will review the following general concepts:

- [1] a brief history of BIM implementation in the architectural profession,
- [2] user interface of common BIM software packages with a focus on Autodesk Revit Architecture,
- [3] usage of BIM for the production of drawings for SD, DD and CD phases of project delivery,
- [4] leveraging Revit Architecture families for parametric design,
- [5] and usage of parameters and data flow families for all aspects of 2D documentation.

By the conclusion of the course, students will have produced both a basic schematic design set and a construction documents set for display in their portfolio. All new topics introduced will support the development of these documents.

No previous computer aided drafting (CAD) experience is required.

Course Objectives

Conceptual

- Define Building Information Modeling (BIM) and understand how it is like other databases
- Define the key differences between BIM and CAD
- Define BIM interoperability and how it enables a new method of delivering structures
- Introduce integrated data workflows in a BIM design process
- Introduce BIM project delivery methods like Integrated Project Delivery (IDP)

Software

- Understand the interface of Revit Architecture (Family Browsing, Modeling, Drafting, Scheduling, etc.)
- Illustrate the file structure of Revit Architecture (LOG files, system families, external families, etc.)
- Demonstrate project output from Revit Architecture (CAD, PDF, 3D, spreadsheets, animations, etc.)
- Understand families in Revit Architecture and their role in the parametric nature of BIM

Production

- Create a set of presentation documents and diagrams using Revit Architecture
- Create a set of construction documents using Revit Architecture
- Create interior and exterior movies from a building information model

Grading

15%	Attendance
10%	Pop Quizzes
45%	Homework (diagrams, component families, drawings, etc.)
15%	Mid Term Project (Design Development Set for assigned Modernist Home)
15%	Final Project (Rudimentary Construction Documents Set for same Modernist Home)

Schedule

(Subject to change)

CLASSES BEFORE MIDTERM

Week 1 - Introduction : Building Information Modeling

[Lecture topics]

Introduction, Syllabus, Course requirements, policies.

[Demonstration topics]

What is a database? What is a drawing set? What is BIM?

[Homework Assignment]

(Homework #1) Retrieve drawings for an assigned Modernist Home

Week 2 - Fundamentals : Views and System Families I

[Due]

Found Modernist Home drawings (progress - drawings)

[Lecture topics]

What are system views and system objects? (introduction)

[Demonstration topics]

Understanding the Revit Interface: Project Browser, Basic Plan Tools, Zooming and Panning, Modeling Simple Walls, Temporary Dimensions, Selecting with Tab, EQ Constraints, Filter Selections, Introducing Datum Elements, Creating Levels, Creating Grids, Splitting Walls, Trimming and Extending Walls.

[Homework Assignment]

(Homework #1) Retrieve drawings for an assigned Modernist Home - finalized.

Week 3 - Fundamentals : Views and System Families II

[Due]

Found assigned Modernist Home drawings (final - construction photos, interior photos...)

[Lecture topics]

What are system views and system objects? (continued)

[Demonstration topics]

2D View Types, Sections, Elevations, Floor Plans (Relationship to Levels), Callouts, 3D View Types, Axonometric, Perspective (Camera)

[Homework Assignment]

(Homework #2) Model grids, levels and walls of found home

Week 4 - Fundamentals : BIM and IDP I

[Due]

(Homework #2) Modeled Grid lines, Walls, etc.

[Lecture topics]

Integrated Project Delivery 1

[Demonstration Topics]

Inserting Doors and Windows, Controlling Visibility, View Properties, Visibility / Graphics Overrides, View Templates, Animations

[Homework Assignment]

(Homework #3) Model windows and doors of home

Week 5 - Fundamentals : BIM and IDP II

[Due]

(Homework #3) Modeled windows and doors

[Lecture topics]

Integrated Project Delivery II

[Demonstration Topics]

Sketch mode, Modeling Floors, Modeling roofs, Space Planning, Area Analysis, Creating Color Schemes

[Homework Assignment]

(Homework #4) Model Floors and Roofs of home

Week 6 - Fundamentals : Graphics and Annotation

[Due]

(Homework #4) Modeled Floors and Roofs

[Lecture topics]

TBD

[Demonstration Topics]

Drafting Views, Drafting Lines, Text/Notation, Object styles, 2D/3D Extents, Edit and Tools Toolbars, Moving and Copying Objects, Offsetting Objects, Creating Model Groups, Mirroring Objects, Copying and Pasting Techniques

[Homework Assignment]

Midterm Project - Building Diagrams in Revit Architecture

Week 7 - Mid-review : Class work session

[Due]

...

(Progress)

Diagrams of Student's Building

[Homework Assignment]

Midterm Project - Building Diagrams in Revit Architecture

Schedule

(Subject to change)

CLASSES AFTER MIDTERM

Week 8 - Midterm Presentations & Juries

[Due]

Presentation of SD-level drawings

[Lecture topics]

...

[Demonstration Topics]

...

[Homework Assignment]

(Homework #5) Transcription of Midterm presentations.

Week 9 - Computational Data : Types and Revit Families

[Due]

Transcription of Midterm presentations.

[Lecture topics]

Families (Classes), Inheritance and data types in Revit.

[Demonstration Topics]

Families in Revit I: Creating Parametric Dimensions, Reference Planes, Creating Family Geometry, Creating Family Types, Instance vs. Type Parameters

[Homework Assignment]

(Homework #6) Creating hosted Families in Revit I: Lights.

Week 10 - Computational Data : Types and Revit Families II

[Due]

(Homework #6) Presentations, findings, discussion.

[Lecture topics]

Families in Revit II: Elaborating Family Types, Visibility Display Settings

[Demonstration Topics]

Families in Revit II: Creating families, creating custom doors and windows, creating profiles, creating annotation families, detail components, line-based detail components,

[Homework Assignment]

(Homework #6) Creating hosted Families in Revit II: Picture Frame(s).

Week 11 - Development : Parametric Design in Architecture

[Due]

(Homework #6) Final discussion.

[Lecture topics]

Queries and Data: How Plans, Sections, Elevations, and Schedules are the same thing to any BIM platform.

[Demonstration Topics]

Scheduling, Legends, and Tabular information: Creating schedules, customizing schedules, limiting data, adding cost.

[Homework Assignment]

(Homework #7) Preparing a Cost Estimate - Week 1: Creating Schedules.

Week 12 - Data Flow in BIM

[Due]

Homework #6: presentations

[Lecture topics]

Parameters and Interoperability I - Windows and Door Schedules

[Demonstration Topics]

Project Parameters, Presetting Annotation Styles, Formatting Tables, and Exporting data.

[Homework Assignment]

(Homework #8) Preparing a Cost Estimate - Week 2: Creating the estimate.

Week 13 - Development : Student Projects

[Due]

Homework #8) Preparing a Cost Estimate - Week 2: Creating the estimate.

[Lecture topics]

Parameters and Interoperability II - Navisworks and Clash-detection.

[Demonstration Topics]

Call-outs, detail views, keynoting, and titleblocks.

[Homework Assignment]

(Final Project) Creating a Construction Set - Week 1: Titleblocks and drawings.

Week 14 - Development : Student Projects

[Due]

(Final Project) Creating a Construction Set - Week 1

[Lecture topics]

Frontiers of BIM - Integrated Project Development

[Demonstration Topics]

TBD

[Homework Assignment]

(Final Project) Creating a Construction Set - Week 2: Blocking out details.

Week 15 - Presentation of Final Projects

TBD

Homework Assignments

(Before Midterm)

The following are *summaries* of planned homework assignments for the class. Work is not to be started from these summaries, but from actual assignments posted to the class web site and/or from hand-outs in class.

Homework #1 : Find ALL Documentation of Assigned Home

Present found scale drawings of your assigned Modernist Home. At a minimum, submit scaled plans of all major levels, two scaled sections, all significant elevations to scale, interior and exterior photographs and one feature article from a major trade magazine. Extra credit for presenting the construction set of your assigned building (many of these firms are still in business).

Homework #2 : Revit Datums: Grids and Levels - System Families: Walls

Using the default plans, adjust the given levels to reflect the design of your assigned home. Then add grid lines. Finally, use the system family parameters to model wall types, and then model the walls of all levels of your assigned home. Use dimensions to illustrate scale and spacing, and constrain walls when needed.

Homework #3 : Hosted Families - Windows and Doors

Using the default window and door types provided, host all of your home's fenestration to the walls from assignment #2 (also use elements from the default library as needed). Create sections, exterior elevations and interior elevations to illustrate your progress.

Homework #4 : All other Hosting Families - Floors, Ceilings and Roofs

Using the plans and sections from previous assignments, create all the floors and roof planes for your assigned home. Create a fly-through animation to demonstrate your progress.

Midterm Project: Revit's Limitations producing a Schematic Design Set

Create a Design Development Set to present the design of your assigned home to its original client. All drawings must have appropriate line weight and annotation. At a minimum, your multi-page set should be formatted on provided 24"x36" title blocks and will include the following:

1/4" = 1'-0" Floor Plans - (Every major level and roof)
Room Titles, Floor Finishes, massing of fixtures

1/4" = 1'-0" Elevations - (Minimum four)
Showing materiality, fenestration and shadow

1/4" = 1'-0" Reflected Ceiling Plans - (Every level)
Showing light fixtures, soffits and door heads

1/4" = 1'-0" Building Sections - (Minimum two)

Diagrams: Circulation, Public/Private, Structure

Studies: Shadow Studies, major interior and exterior perspectives

NB: Homework #5 involve transcribing the three-minute presentation of this project.

Homework Assignments

(After Midterm)

Homework #5 : Midterm Review and Transcriptions

Students are to faithfully transcribe (verbatim) the provided recording of their three-minute presentations at midterm. Recordings are to be organized by students. Transcriptions will be reviewed by reading them while each recording plays. The second half of the assignment involves editing and improving the transcription to a written piece that can be included in a portfolio.

Homework #6 : Creating Families with Revit: Architectural Fixtures

Week I: Use family creation skills taught in class to create and apply lighting documentation to their assigned homes. Three original light fixtures are to be created from standard wall-based family templates. Students will further edit sections, interior elevations, and reflected ceiling plans to demonstrate progress.

Week II: Use the *family editing* tools taught in class to adjust existing families of cabinets, countertops, bath fixtures, etc. to their assigned homes. With the addition of these families, the homes should be largely complete.

Homework #7 : Data Flow in Revit: Creating a Cost Estimate

Week I: Create schedules to present quantities of known items in the house design to prepare the data for cost estimating. Required Schedules include Window, Door, Partition/Wall, Floor, Ceiling, Light Fixture, Appliance, Bathroom Fixture, etc. Extra credit for Door Hardware Schedules.

Week II: Students are required to use the schedules from Week I to assemble a 2004 cost estimate of their assigned homes. Supporting documentation for all costs is required -- See RS Means in the NYIT Library. Students will format their schedules into the provided spreadsheet to demonstrate progress.

Final Project

Complete a CD Set of the assigned house. Details to follow...

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Homework #1 : Find Documentation of your Project

This semester you will create a *schematic design set* and a *construction documents set* for an iconic Modernist House. The project is intended for display in your portfolio.

Week 1: Present found scale drawings of your assigned Modernist Home. At a minimum, *submit scaled drawings on paper*. These should include plans of all major levels, two scaled sections, all significant elevations to scale, etc.

Week 2: Present additional documentation of your home in the form of construction photos, interior and exterior photographs and one feature article from a major trade magazine. *Extra credit for presenting the construction set of your assigned building (some of these firms are still in business, and/or many of the CDs for these homes are in Architectural Libraries).*

Assigned Buildings include:

Vanna Venturi House

(by Robert Venturi)

Chestnut Hill, Philadelphia, Pennsylvania, USA

Taliesin West

(Frank Lloyd Wright)

12621 North Frank Lloyd Wright Blvd., Scottsdale, Arizona, USA

Fallingwater [a.k.a. *The Edgar J. Kaufmann Sr. Residence*]

(Frank Lloyd Wright),

1413 Mill Run Road, Mill Run, Pennsylvania, USA

The Isadore and Lucille Zimmerman House

(Frank Lloyd Wright)

223 Heather Street, Manchester, New Hampshire 03104, USA

Unity Temple

(Frank Lloyd Wright)

Lake Street at Kenilworth Avenue Oak Park, Illinois 60302, USA

Lovell Beach House

(Rudolph Schindler)

1242 W. Ocean Front Drive, Newport Beach, California, USA

Gamble House

(Charles and Henry Greene)

4 Westmoreland Place, Pasadena, California 91103, USA

Gropius Residence

(Walter Gropius)

68 Baker Bridge Road, Lincoln, Massachusetts 01773, USA

Villa Savoye

(Le Corbusier)

82 rue de Villiers, 78300 Poissy, France

Villa Stein [*a.k.a. Villa Stein-de Monzie*]

(Le Corbusier)

7 Rue de professeur Victor Pauchet, Garches, France

Villa La Roche [*a.k.a. Villa La Roche-Jeanneret*]

(Le Corbusier)

10 square du Docteur-Blanche, 75016 (16th arrondissement), Paris, France

Muller House [*a.k.a. Villa Müller*]

(Adolf Loos)

Nad Hradním vodojemem 14, CZ 162 00 Prague, Czech Republic

Tugendhat House [*a.k.a. Tugendhat House*]

(Ludwig Meis van der Rohe)

Černopolní ulice (Schwarzfeldgasse, Black field street) 45, Brno, Czech Republic

Schroder House

(by Gerrit Rietveld)

Prins Hendriklaan 50, Utrecht, The Netherlands

Trenton Bath House

(by Louis I. Kahn)

999 Lower Ferry Rd, Trenton, New Jersey, USA

64 Wakefield

(by Mack Scogin Merrill and Elam Architects - then "Scogin, Elam and Bray")

64 Wakefield Drive NE, Atlanta, Georgia, 30309, USA

Esherick House

(by Louis I Kahn)

204 Sunrise Lane, Chestnut Hill, Pennsylvania, USA

House VI [*a.k.a. The Frank residence*]

(by Peter Eisenman)

Cornwall, Connecticut, USA

Your Assigned Building is negotiable:

Do you not like your assigned building? That's Ok. With permission you can change it **by Friday of this week** (January 29, 2009). After email discussion and approval from the professor, you may select a building not on the above list. Houses will be approved if their documentation require the tools taught in the course (composite wall types, standard windows, no curtain wall systems, etc.). Such approvable houses tend to use standard geometry. Houses that do not fit this criteria include the following:

Farnsworth House
(Ludwig Mies van der Rohe)

Venice Beach House
(Frank Gehry)

Glass House [*a.k.a. Johnson House*]
(Phillip Johnson)

House El-Even-Odd
(Peter Eisenman)

Gehry House
(Frank Gehry)

Peter B. Lewis House
(Frank Gehry)

Research Resources:

All work in the semester requires this initial research. The assigned houses

Great Buildings Online

(Start **HERE!** These are great source for bibliographic resources...)
<http://www.greatbuildings.com>

Avery Index

(Avery Library, Columbia University)
http://www.columbia.edu/cu/lweb/indiv/avery/avery_index.html

Book

Key Houses of the Twentieth Century: Plans, Sections and Elevations by Colin Davies
(W.W. Norton & Co.; October 17, 2006. ISBN-13: 978-0393732054

Foundations:

Frank Lloyd Wright Foundation
Le Corbusier Foundation
Private Foundations per building
State Parks
etc...

Firms still doing business:

Venturi & Associates,
Mack Scogin and Merrill Elam Architects,
or others that you choose to pitch.