RETHINKING BIM

Location: Room 409, Avery Hall
Time: Monday, 11 am – 1 pm
Instructor: Joe Brennan, AIA - jab2315@columbia.edu

Introduction

Building Information Modeling (BIM) means different things to different people. For some, it is synonymous with Revit, a software platform for producing drawings and coordinating with consultants. For others, it is linked to parametric modeling and the generation of complex geometries. In this course, we will move beyond those narrow interpretations and approach BIM as **computational building delivery** - a way of working that combines design technology, collaboration, and systems thinking to fundamentally rethink how buildings and cities are conceived and brought into the world.

Rethinking BIM asks you to engage with BIM as more than a tool. We will treat it as a methodology: a framework that connects ideas across scales, disciplines, and stakeholders. This means examining closely how computational workflows can transform design, unlock new forms of collaboration, and create richer foundations for decision-making. It also means asking harder questions: *what should we be modeling, analyzing, or simulating in order to design better?* and *how can data help us see trade-offs more clearly, from cost to carbon to comfort?*

Collaboration will be a central theme. The architecture, engineering, and construction industry too often operates in silos, with information exchanged inefficiently and sometimes adversarially. In this class, we will practice building workflows that allow architects to work more fluidly with developers, engineers, fabricators, and contractors. We will also look outside our own field to industries such as **manufacturing, product design, and technology**, where iterative prototyping, automation, and lifecycle thinking are standard practices. What lessons can we adapt from those contexts, and how might they change the way we deliver buildings?

At the same time, this course reflects the reality that BIM is not just about practice - it is about vision. The systems we design and the processes we use directly shape our ability to confront the most urgent challenges of our time. As climate change reshapes cities and demands new approaches to resilience, adaptation, and mitigation, BIM and computational design can become critical allies. Students will be encouraged to explore ideas on how BIM and computation can go beyond traditional bounds to improve the way we deliver buildings. Some examples include, but are not limited to:

- Test urban districts and buildings against climate risks, such as flooding or extreme heat
- Integrate energy, daylight, and comfort analysis into design decisions
- Support circularity and material reuse to reduce embodied carbon and construction waste
- Address equity and access by making trade-offs at the urban scale more transparent

Throughout the semester, you will work at two interconnected scales:

- **The urban scale,** where BIM and computation allow us to evaluate massing, zoning, program, and environmental performance
- **The building scale,** where we dive deeper into geometry, structural systems, façade design, fabrication, and documentation

In both scales, emphasis will be placed on **process as much as product**. The work you present should explain not only *what* you designed, but *how* you arrived there - through diagrams, drawings, and models that make workflows legible to others.

This dual focus reflects my own practice and research. As an architect and computational designer, I work on projects where BIM is not simply a tool for documenting a finished design, but a way of testing ideas, coordinating disciplines, and optimizing performance. As an educator, I want you to see BIM as a **bridge**: between concept and delivery, between imagination and constructability, and between architectural vision and the realities of finance, policy, and climate.

By the end of the semester, you will have gained fluency in advanced BIM workflows, but more importantly, you will have developed a **critical perspective** on their potential and limitations. You will leave this course prepared to use BIM not just to make drawings, but to shape processes - processes that can produce more intelligent, sustainable, and equitable outcomes for buildings and cities.

Class Structure

- **Format:** Lectures, discussions, case studies, pin-ups, and desk crits. Online tutorial videos and follow-along documentation will also be provided.

- **Focus:** Class time together will balance “big ideas” and concepts critical to successful project execution with the nitty-gritty execution details.

- **Modules:** Students must follow along with the Rethinking BIM Modules on the GSAPP Smorgasbord learning path in tandem with the class. These assignments are **individual**, while project assignments are **group-based**.

- **Preview Smorgasbord:** Parametric Thinking for Building Modeling

- **Pin-Ups:** Scheduled in advance; each group is expected to present. Additional work is due between pin-ups.

- **Desk Crits:** Will be held several times throughout the semester.

- **Communication:** Starting after the first day, the class will communicate through Slack. All notes, changes, or modifications to the schedule are posted there. Setting up and monitoring the class Slack workspace is critical.

Project, Deliverables, and Grades

- Students must work in groups of four (4). Collaboration and workflow processes are crucial aspects of the class.

- The class will be divided into two major sections:

    1. Massing design and urban integration
    2. Technical details, refinement, and delivery

- Each progress deliverable must include at least two drawings printed on 24 × 36 sheets that explain the design solution and process. Bring all prior work to each pin-up.

- The final review will consist of a pin-up of all work to date and a comprehensive design proposal. A combination of Revit and Rhino modeling is required. *The complete project must be modeled in Revit by the final review.*

- **Smorgasbord Assignments** will be collected via Google Drive. Upload images/GIFs of progress, plus Rhino and Grasshopper files.

Optional Readings and Resources

- Chakrabarti, V., & Foster, N. (2013). *A Country of Cities: A Manifesto for an Urban America*. Metropolis Books.

- Deutsch, R. (2019). *Superusers: Design Technology Specialists and the Future of Practice*. Routledge.

- Frampton, K., & Cava, J. (2001). *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. MIT Press.

- Friedman, T. L. (2017). *Thank You for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations*. Picador.

- Jones, S. (2019). *Mass Timber: Design and Research*. ORO Editions.

- Lynn, G., Gage, M., & Nielson, S. (2011). *Composites, Surfaces, and Software: High Performance Architecture*. W.W. Norton.

- Marble, S. (2012). *Digital Workflows in Architecture: Designing Design - Designing Assembly - Designing Industry*. Birkhäuser.

- Potter, B. *Construction Physics*. Substack

- Rothfeder, J. (2015). *Driving Honda: Inside the World's Most Innovative Car Company*. Portfolio/Penguin.

- Klanten, R. (2008). *Data Flow*. Gestalten.

- Klanten, R. (2010). *Data Flow 2: Visualizing Information in Graphic Design*. Gestalten.

Software Stack

Required:

- Revit - modeling, collaboration, data management, documentation
- Rhino - modeling, documentation
- Rhino.Inside - parametrics, data management, interoperability
- Grasshopper - parametrics, data management, interoperability
- Lunchbox - data management and rationalization
- Slack - collaboration
- InDesign - presentation
- Illustrator - presentation, documentation

Optional:

- Dynamo - parametrics, data management, interoperability
- TT Toolbox - data management, interoperability
- Python / C# - parametrics, data management
- Excel - data management, interoperability
- Google Sheets - collaboration, data management
- Miro - collaboration, presentation
- BIM360 / Construction Cloud - collaboration, presentation, documentation

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Week-by-Week Schedule

Monday, September 8

- **Lecture Title:** Rethinking BIM, Software Deep Dive, and the Power of Parametrics

- **Lecture Concepts:**
  The fundamentals behind computational building delivery; how (and when) to leverage parametric design; semester overview

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Monday, September 15 (Zoom, alt time TBD)

- **Lecture Title:** Fundamentals of Building Planning
- **Smorgasbord Due (Individual):**
  Parametric Thinking for Building Modeling
    - Software Intro
    - Construction Geometry
    - How to Approach Parametric Building Modeling: Part 1
- **Semester Project Due (Group):**
  Form Groups; send UNIs and group names to Joe and TA

Monday, September 22

- **Lecture Title:** Establishing and Achieving Building Targets
- **Lecture Concepts:**
  Benchmarking against planning targets; zoning research and analysis; data exchange and data management
- **Case Studies:**
    - Belton Court, Rhode Island - BLDGWORKS
    - Hill Country Mixed Use, Austin, TX - BLDGWORKS
- **Smorgasbord Due (Individual):**
  Parametric Thinking for Building Modeling
    - How to Approach Parametric Building Modeling: Part 2

Monday, September 29

- **Lecture Title:** Understanding Geometry and How it Relates to Building Design

- **Lecture Concepts:**
  Basics of geometry (arcs, lines, splines, polylines, etc.); how they affect program, structural rules, and urban integration

- **Case Studies:**
    - One Crown Place, London - KPF
    - 28 Chidlom, Bangkok - KPF
    - 27 Wooster, NYC - KPF
    - One Island Drive, Miami - KPF
    - Aqua, Chicago - Studio Gang
    - 8 Spruce, NYC - Frank Gehry
    - Tower 36, Miami - KPF
    - One Vanderbilt, NYC - KPF
    - 55 Hudson Yards, NYC - KPF
    - 52 Lime Street, London - KPF
    - North Bund Lot 91, Shanghai - KPF
    - Waterline, Austin - KPF
    - 35 Hudson Yards, NYC - SOM
    - 270 Park Ave, NYC - Foster + Partners

- **Smorgasbord Due (Individual):**
  Establishing and Achieving Building Targets
    - Model Set-Up
    - Establishing Targets

Monday, October 6

- **Smorgasbord Due (Individual):**
  Establishing and Achieving Building Targets
    - Extracting Key Data from Model
    - Analyzing Compliance Against Targets
- **Semester Project Due (Group):**
  Desk Crit with Joe
    - **Identify the secondary workflow you are interested in exploring outside the scope of the class**
    - Present overall massing strategies validated against program
    - Present façade types (precedents and sketches)

Monday, October 13

- **Semester Project Due (Group):**
  Pin-Up with Guest Critic(s)
    - 3D views of at least 3 massing strategies, along with selected option
    - Analysis to validate your options
    - Diagrammatic plans, color coded, of at least the ground floor, major publicly accessible areas, and shared outdoor spaces
    - Rhino vignettes and sketches showing your façade strategy; elevational diagrams showing where façade types will go

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Monday, October 20

- **Lecture Title:** Advanced Visualization Techniques
- **Lecture Concepts:**
  AI in visualization; diagramming; high-quality screenshot workflow; Grasshopper methods and animations

- **Smorgasbord Due (Individual):**
  Establishing Underlying Structural Logic in Rhino/Revit
    - Establishing Levels and Grids
    - Establishing Base Grid Using Numerical Inputs

Monday, October 27

- **Lecture Title:** Geometry and Design Rationalization
- **Lecture Concepts:**
  Geometry types in Revit/Rhino; how to translate geometry; documenting complex geometry
- **Case Studies:**
    - Pudelma Pavilion, Finland - Academic project at GSAPP
    - HKUST, Hong Kong - KPF
    - Perfect Auto Center, Shenzhen - KPF
- **Smorgasbord Due (Individual):**
  Establishing Underlying Structural Logic in Rhino/Revit
    - Setting Up Cull Operations to Work on Different Massing Types
    - Creating Columns
    - Creating Beams

Monday, November 3

- **No Class - Election Day**

Monday, November 10

- **Lecture Title:** Facade Approaches

- **Lecture Concepts:**
  Facade strategies; how facade is impacted by program; analysis and performance integration; flatness vs. curvature strategies

- **Case Studies:**
    - Disney HQ, NYC - SOM
    - Manhattan West, NYC - SOM
    - Canopy Buildings - Sidewalk Labs
    - The Sphere, Las Vegas - Populous

- **Smorgasbord Due (Individual):**
  Analyzing and Constructing Complex Facade Systems
    - Creating Good Underlying Base Geometry
    - Creating Alignment with Gridlines and Floor Slabs
    - Subdividing Cleanly

Monday, November 17

- **Lecture Title:** Constructability, Documentation, and Project Refinement

- **Case Studies:**
    - Daily's Place, Jacksonville - Populous

- **Smorgasbord Due (Individual):**
  Analyzing and Constructing Complex Facade Systems
    - Running Different Types of Analysis
    - Deploying System Familes

Monday, November 24

- **Smorgasbord Due (Individual):**
  Analyzing and Constructing Complex Facade Systems
    - Deploying Adaptive Familes
    - Leveraging Direct Shapes when Needed
- **Semester Project Due (Group):**
  Draft of all material for final review
  Out of Revit:
    - At least 1 typical plan for each program type (retail, resi/hotel, office) 1/8" or 1/16" scale
    - Floor plan of ground floor and entry sequences - show street context with neighboring buildings - 1/16" or 1/32" scale
    - Elevations of each facade 1/16"
    - At least 2 sections showing the building design clearly 1/16"
    - 3D axonometrics showing the full model
      Out of Rhino or Revit:
    - Wall type drawing (isolated 3D view of each facade module, plus diagram showing where they are in the building)
    - 3D view showing stacking and program elements
    - 3D perspectives from street level showing the pedestrian experience
    - Diagrams showing any other analysis you've performed

Monday, December 1

- **No Class (Zoom Desk Crits)**

Monday, December 8

- **No Class (Zoom Desk Crits)**

Final Review - Monday, December 15

- **Semester Project Due (Group):**
  Final review
  Out of Revit:
    - At least 1 typical plan for each program type (retail, resi/hotel, office) 1/8" or 1/16" scale
    - Floor plan of ground floor and entry sequences - showing street context with neighboring buildings - 1/16" or 1/32" scale
    - Elevations of each facade 1/16"
    - At least 2 sections showing the building design clearly 1/16"
    - 3D axonometrics showing the full model
      Out of Rhino or Revit:
    - Wall type drawing (isolated 3D view of each facade module, and diagram showing where they are in the building)
    - 3D view showing stacking and program elements
    - 3D perspectives from street level showing the pedestrian experience
    - Diagrams showing any other analysis you've performed