BUILDING ENCLOSURE
DESIGN / CONSTRUCTION / PERFORMANCE

Instructors
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GEs
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Time/Place
T/Th 10:00-11:50 Hybrid In-person/Zoom in Eugene & Portland
Location TBA

Credits
4 Credit Hours, required for professional majors in Architecture

Course Content:
Shelter and protection—the fundamental essence of a building—are provided by the enclosure. As the outer skin, the enclosure also plays an integral role with building form to create architectural image. And as the layer that mediates between the exterior and interior environments—we call on it to both protect and connect—via transparency and physical openings. As design teams strive to optimize building performance, the building enclosure offers multiple opportunities to significantly reduce energy use as well as improve occupant comfort, productivity, and well-being. Because optimizing performance often requires balancing competing functions, a strong understanding of enclosure performance fundamentals allows architects to make intelligent design decisions.

In this course we will study building science fundamentals, particularly the transfer of heat, air, and moisture, and control layers functions which are critical to the creation of an effective and durable building enclosure. We’ll explore common enclosure materials and assemblies including metal and wood framing, weather control membranes, various types of insulation, a broad range of cladding materials, historic and modern mass wall assemblies, window systems, below grade assemblies, roof terraces, vegetated roofs, and standard roofing assemblies.

We will engage these topics in the context of the design and documentation process. The emphasis will be on developing assemblies and the interfaces between systems in drawings and details from initial sketches through construction drawings. We’ll also touch on rules of thumb and analysis methods that support decision-making in technical design.

Building performance and sustainable design are important factors in the design and making of buildings and will be themes that weave through the course topics. We’ll primarily focus on current best practices, but will also discuss building enclosure trends and emerging technologies.
Labs
GEs will conduct labs under the direct supervision of the instructors. This is an opportunity to get one-on-one and small group feedback on the detailing projects, and we will have some hands-on experiences as well. Attendance will be part of your lab participation grade.

Course Objectives:
1. Build on the students’ understanding of the multiple roles of the building enclosure.
2. Study the building science concepts at work in building enclosures and the control layers required to manage them.
3. Explore a range of exterior wall, roof, and foundation materials and assemblies.
4. Engage the design, analysis, and documentation process in the creation of a complete and effective building enclosure.

Course Format:
The course will include lectures, guest presentations, projects and readings. Two technical design projects will provide an opportunity to explore and apply the principles covered in the lectures and readings through design, drawing, and detailing. In addition to the projects, a midterm and a final exam will cover the content of the course. A field trip to a local construction site will also be scheduled.

Outline of Course Content

A. Fundamental Concepts:
   1. Roles of the building enclosure
      a. Shelter and protection
      b. Connections—physical and visual
      c. Form / image / design
   2. Building and enclosure performance
      a. Weather protection and building science / hygrothermal (including control layer functions)
      b. User comfort, productivity, well-being (including thermal and visual comfort)
      c. Energy performance and significance

B. Building Material Assemblies—structure and enclosure
   1. Historical bearing walls
   2. Non-bearing enclosures on steel or concrete framed buildings (non-combustible)
      a. Curtain wall systems
      b. Aluminum (and steel) framed window systems
      c. Metal-framed opaque walls
      d. Opaque walls in aluminum curtain wall
   3. Modern bearing and framed walls
      a. Metal stud frame
      b. Wood framed
      c. Mass walls
   4. Window systems
      a. Function and performance (energy, comfort, visual connections, design)
         i. Hygrothermal (control layers and transitions)
         ii. Solar heat gain management (SHGC)
         iii. Thermal transfer / insulative properties (U-value)
         iv. Daylighting (VLT or Tvis)
      b. Components
         i. Frame systems
         ii. Glazing
         iii. Interior and exterior devices for solar heat gain and daylight management
   5. Below grade enclosure assemblies
   6. Roof enclosure assemblies
      a. Steep-sloped roof systems
b. Low-slope roof systems
  c. Roof terraces
  d. Green roofs and roof gardens
7. Interior finishes (of exterior walls)
8. Sustainable design and performance objectives
   a. performance (as noted above)
   b. production implications—embodied energy, toxins
   c. indoor environment implications—VOCs

C. Design & Documentation Process: tools and techniques
   1. Programming and performance intentions
   2. Design process and media (sketches, hand drafting, CAD, computer models, physical models)
   3. Analysis process and tools
      a. Energy
      b. Daylighting
      c. Hygrothermal
   4. Material selections (including sustainable design objectives)
   5. Design development and detailing
   6. Documentation for construction (including drawings and specifications)
   7. Construction (including testing of assemblies)

Texts:
Brock, Designing the Exterior Wall, Wiley, 2005
Many of the weekly readings will be posted on Canvas
Texts and additional materials will be on hold in the library