Material / Assembly

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Today's 'material-copia' provides a broader opportunity for architectural possibility while simultaneously increasing the chances for its misappropriation. Teaching students how to take advantage of this expansion, while understanding the associated complexities, is essential to their development as future architects.

Traditionally seminar teaching of construction systems utilizes several methods to convey information: readings from established texts, topical lectures, and iconic case studies, all sequenced and formatted to follow the Construction Specification Institute's (CSI) organization of topics. While these techniques have their value, this overall method tends to arrange and prioritize information into a series of material silos; (wood, masonry, steel, etc.). This often results in an isolated, desk bound learning experience that fosters passive engagement by the student. It tends to meet the first goal of understanding, but falls short of conveying an ability to apply the new ideas encountered in building technology classes. This poster outlines an adjusted approach where information is organized and taught to expose translational learning opportunities through an applied knowledge of construction materials and methods.

In the newly re-visioned Materials and Methods sequence at one university, emphasis is placed on integrating seamless notions of material and assembly through projects and lectures that foreground and background the two issues simultaneously. In the first class of the series, Materials and Methods I, material properties are foregrounded in lectures and hands-on projects to provide a foundation for future inquiry, and are further supported by strategic industry manufacturing site visits. Assembly is deceptively foregrounded as well through the careful crafting of project statements and their requirements for success.

In the second class of the series, assembly moves to the foreground while space and its inherent qualities become the covert focus. This occurs through quasi-Albertian groupings of generalized building elements and systems; frames, floors, roofs, walls, screens, etc. Within this structure a variety of hybrid construction methods are covered providing a more accurate portrayal of assemblies encountered in practice. These subjects are investigated through in-depth team-based charrettes designed to require careful consideration of material selection and assembly methods, and thoughtfulness toward the spaces they delineate.

This poster serves to catalog and narrate the continuing efforts at this university to re-envision the methodology and delivery of application based learning criteria within the constraints of a seminar class.

LEARNING THROUGH MAKING

material assembly class format

Comparative timeline for typical class format

Week 01

MATERIAL PROPERTIES

The course begins with a focus on material properties, fundamental concepts of materials, and the topic of building as it relates to design intent.

Week 02

Week 03

MASONRY

The first material explored is masonry. The Three Little Pigs project (presented to the left) is introduced, and in this particular part of the work students meet with the ceramics department for a primer on working with clay. In contrast to the craft oriented approach found in the world of Art, students take a field trip to a local brick manufacturing facility where they experience the contrast between the craftsman and the industrial processes.

Week 04

Week 05

WOOD

The second material explored is wood. Field trips to an industrial saw mill and cabinet maker are coupled with introduction to joinery by wood shop staff.

Week 06

Week 07

Week 08

CONCRETE

The third material iteration is concrete. Students take a field trip to a local pre-cast concrete producer's factory, where they see the large scale process that they are mimicing in their class project. This porducer offer technical expertise and raw materials to be utilized by students.

Week 09

Week 10

Week 11

STEEL

Students attend a field trip to a Birmingham, Alabama steel mill. They see first-hand the industrial process utilized by the construction industry at a facility that produces 90% of its product with recycled materials.

Week 12

Week 13

GLASS AND INSULATION

Students take part in a class competition to insulate a 5" cube. They work with the department of kinesiology to test a pre-designed wood and glass box for thermal efficiency. The only requirement is that the material the cube is filled with may not typically be used as an insulation. The top three insulation materials recieve a bonus grade.

Week 14

Week 15

MATERIAL PROPERTIES

SOILS & FOUNDATIONS

WOOD/TIMBER LIGHT WOOD FRAME

MASONRY

STEEL

1 MATERIALS

FOUR LITTLE PIGS

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Four Little Pigs, (shown above) is an ongoing investigation within the building technologies sequence of classes in a Bachelor of Architecture program. In these exercises students explore how raw materials are transformed into building materials. These hands-on inquiries, in the form of four well-crafted 5" cubes (masonry, wood, concrete and insulation), are constrained in various ways and coupled with field trips to parallel manufacturing facilities where the students witness firsthand how each specific material they are working with in class is also created for the building industry. Each project is unique to the students creating them. These studies employ the method of 'learning through making' as a way of understanding of the inherent properties of the basic materials with which architects build. For masonry, students are asked to focus on the precision of each brick which are fired in the ceramics department. For wood they are required to split the cube into three distinct pieces and connect them using joints discussed in class. The concrete cube must display the plastic capabilities of the material, and for the final block, students select an atypical, everyday material and test its thermal properties in the Department of Kinesiology.

Students are required to document their design and production process. They must record the details regarding how the cubes were crafted, and produce a document that is presented to the class at the end of each investigation.

LEARNING THROUGH DRAWING

Week 16

ASSEMBLY TYPES/ OPERATIONS

Information on assemblies is presented in a quasi-Albertian format. The course approaches these topics by investigating building elements and discussing the relationships between those. Assembly types are the first topic covered.

Week 17

Week 18

Week 19

FRAMES

Frames are explored initially as the structure that supports the other building elements. Student projects include specific assignments that force engagement with structure on a detail level.

Week 20

Week 21

PLATFORMS/ FLOORS

Horizontal planes are covered after frames. Topics include relationships to structure as well as that to vertical planes.

Week 22

Week 23

WALL/ENVELOPE

Vertical planes are covered in a multitude of material assemblies. Thermal properties are covered in class through case study and conceptual lectures. These topics correspond to specific charrette topics assigned to student teams in the class.

Week24

Week 26

Week 25

Week 27

SPECIALTIES

The final portion of the class covers specific systems that allow flows through buildings. They included conveyor nd vertical circulation systems, sun-shading, and MEP. The final project requires students to synthesize the information presented throughout both classes

Week 28

Week 29

Week 30

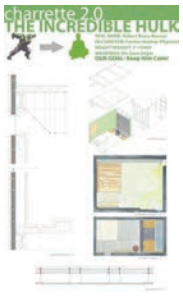
STEEL CONTINUED

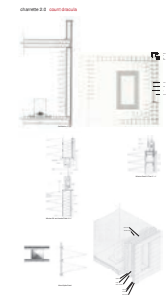
CONCRETE

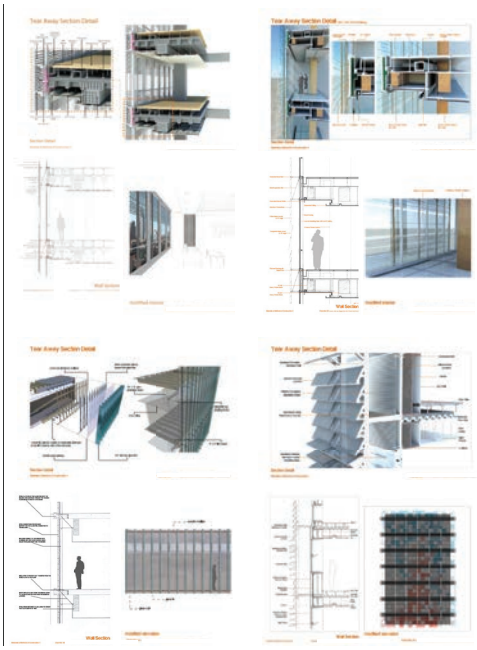
GLASS/INSULATION

HYBRID ASSEMBLIES

CASE STUDIES







2 ASSEMBLIES

HOLDING CELL FOR A SUPER HERO/RE-MATERIALIZED

In teaching material assemblies the method of 'learning through drawing' is applied. Teams of students are asked to investigate several different assigned problems and produce a set of accurate and precise details to meet each project's requirements. In a Holding Cell for a Superhero (shown above left) teams of students are asked to detail the holding cell of a designated comic book superhero/villain. Each character is assigned specific weaknesses that must be exploited through the design of the project. Superman might require kryptonite reinforcement in the structure. The Green Lantern might have to be housed in a cell comprised mostly of wood. Storm could need light spaces to emphasize her claustrophobia.

The holding cell must retro-fit into an assigned building section, and through material choices or assemblies must be able to withstand the super powers of their assigned character. At least one wall of the cell must be exterior, and must include a metal rain screen panel system that appears unassuming (so as to not alert the city dwellers to what is housed within). All solutions must describe flashing and water-proofing strategies, fire-protection, insulation, and a steel sub-structure for the rain screen system as well as any other elements required for this wall section. These must integrate with the holding cell assembly.

Re-materialized is a final assignment for the materials and methods course sequence that asks students to consider the implications of changing structural and envelope systems on canonical buildings. The projects are once again completed in small groups, and the buildings and system alterations are assigned.

Examples of investigated buildings include Torre Agbar by Ateliers Jean Nouvel, The New York Times Building by the Renzo Piano Building Workshop, The Seattle Public Library by Office for Metropolitan Architecture, and One Omotesando by Kengo Kuma. Often, the solutions to the assigned problems are irrational by nature, and this allows students crystalize the need for selecting appropriate building construction systems.

Teams are asked to describe the construction and system implications, but must examine the design consequences as well. How does an increase in the depth of a beam change the spaces below it? How is the daylighting affected by changing a screen material from ceramics to wood? Does the new system meet the design objectives better or worse than the as-built version?

Open