MATERIAL STRATEGIES
ARCH 5541: INNOVATIVE APPLICATIONS IN ARCHITECTURE
GRADUATE SEMINAR, FALL 2012

COURSE DESCRIPTION
Graduate-level seminar on emergent materials and architectural applications. Teaching format: seminar meetings with lectures, discussions, student presentations, and written and design research-based assignments with instructor- and peer-based review.

SUMMARY
With the explosion of new materials and technologies available for building construction, it is critical that architects confront this broadening palette in order to understand the implications for future structures. Moreover, the growing awareness of energy and material resource scarcity, global warming, and other environmental concerns has brought unprecedented change to how we relate to the physical environment, requiring us to re-assess conventional methods of material selection and implementation.

In this seminar, we will consider a new set of strategies for material approaches based on issues related to global material and resource flows, technological trajectories, and potential sociocultural effects. Students will gain expertise regarding material theory, building technology, and the role of material selection in the design process. Course content will include an assessment of the primary material categories and their environmental implications, as well as emerging debates concerning technical versus biological nutrient cycles, hydrocarbon versus carbohydrate-based economies, and so-called high-tech versus low-tech design approaches.

Students will be expected to read a variety of theoretical, historical, and technical sources, maintain a weekly writing journal, and come to class prepared for active discussion. A mid-term project focused on a material interrogation and a final paper focused on a material case study will be required, in addition to in-class presentations related to each.

LEARNING OBJECTIVES
This course is intended to provide students with a strong foundation of materials knowledge related to contemporary environmental, technological, and social issues in architecture. By addressing important historical milestones as well as contemporary case studies, students will develop an appreciation for the roles of disruptive technologies and disruptive applications in building design and construction.
This course will enable students to:
1. Assess the role of material innovation in design based on material strategies and effects
2. Conduct critical written analysis and hands-on synthesis
3. Present and lead discussions of findings

BACKGROUND
Architecture is born out of the shrewd alignment of concept and matter. The product of what Louis Kahn termed “the measurable and the unmeasurable,” architecture is the fulfillment of a spatial premise by way of material substance. Through history architecture has been shaped by the continual transformation of material technologies and application methods. Its course of development is inseparable from the shifting terrain of technology and the social effects that result. This intrinsic alignment with change—whether from a welcomed or critical perspective—reveals the extent to which architecture is inherently tied to material innovation.

In his assessment of canonical twentieth century works of architecture, historian Richard Weston states that “the bias has been toward those [buildings] that were innovative—stylistically, technically, or programatically—and especially those that significantly affected the course of architecture.” On one hand, new products and processes have transformed architecture by enabling alternative construction techniques and novel spatial possibilities. On the other hand, the architect’s utilization of materials in unexpected ways has demonstrated architecture’s capacity to inspire new growth in construction-related industries as well as stimulate cultural change. Both tendencies demonstrate the extent to which the innovative application of materials has been vital to the advancement of architecture.

In order to understand the nature of material innovation, we must give it more precise definition. McLuhan’s articulation of a disruptive technology—an expression further developed by technology theorist Clayton Christensen—describes a new product or material that displaces an old one unexpectedly. Disruptive technologies exhibit competitive advantages over so-called sustaining technologies that offer small, incremental growth. Although necessarily novel and unproven when first introduced, disruptive technologies often supersede existing technologies rapidly. Light-emitting diode (LED) lighting—one example of a disruptive technology—has quickly emerged as a durable, low-energy alternative to many types of incandescent and fluorescent lighting.

In a similar way, a disruptive application is an unexpected replacement of a conventional design or construction practice with a new one. While disruptive technology generally refers to a product or material, a disruptive application considers a more complex system or physical assembly—such as a building—as well as its larger cultural and environmental context. An application is not only considered disruptive in the result it produces but also in the methods used to achieve the result—such as in the robotic fabrication of brick panels instead of traditional hand-laying. Disruptive applications may employ disruptive technologies, or they may exhibit unanticipated uses of conventional technologies. Both disruptive technologies and applications are defined by the fulfillment of the unexpected: an aberration or mutation that upsets and displaces the status quo within conventional systems of praxis.

COURSE TOPICS AND STRUCTURE
The course structure is based on six elemental categories: mineral, concrete, wood, metal, glass, and plastic. These categories will be addressed in two cycles during the semester: The first cycle will occur between the beginning of class and mid-term, and will focus mainly on theoretical content and historical precedents. This phase will consist primarily of instructor-led lectures and class discussions. The second cycle will follow until the end of the term, and will focus mainly on technical considerations and case studies. This phase will consist primarily of student-led presentations and class discussions.

Each week, this three-hour seminar will include presentations, critiques, as well as general discussions. It is critical to the success of the seminar that all students participate in the discussions in an informed and thoughtful manner. Each student is expected to do all the readings for each seminar session and to come prepared with questions to engage the group in discussion.

SCHEDULE

WEEK 02* INTRODUCTION / DISRUPTIVE INNOVATION
09.10 Material strategies and the nature of design innovation
Lecture and course introduction
Discussion
READ Paola Antonelli, “Introduction,” Mutant Materials in Contemporary Design, 8-19
Sheila Kennedy, “Material Presence,” KVA: Material Misuse, 4-21
Antoine Picon, “Construction History: Between Technological and Cultural History,” Building Systems: Design Technology and Society, 13-33
DUE Material Focus

03 SKELETON TO SKIN
09.17 Minerals in architecture (loam, stone, ceramics)
Lecture
Discussion
Ronald Rael, “Introduction,” Earth Architecture, 8-15
Dan Snow, Listening to Stone (excerpts), xii-xiii, 12-15, 44-55, 60-63
Rafael Diez Barrenecha, “Ceramic Tile and Modern Technological Levity,” Moulding Assembling Designing: Ceramics in Architecture, 94-97

04 LIQUID STONE
09.24 Concrete in architecture
Lecture
Discussion
READ Jean-Louis Cohen, “Modern Architecture and the Saga of Concrete,” Liquid Stone, 20-33
Adrian Forty, “The Material Without a History,” Liquid Stone, 34-45
Sanford Kwinter, “Concrete: Dead or Alive?” Solid States: Concrete in Transition, 39-46
DUE Material Interrogation, proposed topic and detail (2-3 paragraphs, 2-3 images)

05 LIVING STRUCTURES
10.01 Wood in architecture
Lecture
Discussion
READ Manuel De Landa, “Biological History,” A Thousand Years of Nonlinear History, 103-134
Luis Fernández-Galiano, Chapter One, Fire and Memory, 2-32
Maria Argenti, “Wood in Contemporary Architecture,” Materia 36, 28-33
Dung Ngo and Eric Pfeiffer, “Introduction,” Bent Ply, 14-21

06 MATERIAL INTERROGATIONS: SET 1
10.08 Analysis of significant material details and their implications
Student presentations and discussion
DUE Material Interrogation model + drawings (presentation) [all students]
Student presentations and discussion [first half of class]

07 MATERIAL INTERROGATIONS: SET 2
10.15 Analysis of significant material details and their implications
Student presentations and discussion
DUE Student presentations and discussion [second half of class]

*Due to the Monday schedule, the first week of class is the second week of the term.
08 MAGMA TO MACHINES
10.22 Blaine out—class to be rescheduled
   Metal in architecture
   Lecture
   Discussion
   READ Erick van Egeraat, “AI is Sex,” Aluminum Architecture, 7-9
   Michael Caldwell, “Flooded at the Farnsworth House,” Strange Details, 92-136
   Annette LeCuyer, Steel and Beyond: “Metals, Machines and Modernity,” 6-15; “Optimization,” 12-15:
   Systems,” 84-87; and “The Palpable Skin,” 110-113
   DUE Material Case Study, proposed topic and outline (1 page)

09 ENGINEERED TRANSPARENCY
10.29 Glass in architecture
   Lecture
   Discussion
   Paul Scheerbart, Glass Architecture (excerpt), 32-33
   Michael Bell, “Introduction,” Engineered Transparency, 10-15
   Guy Nordenson, “Infrathin,” Engineered Transparency, 72-77
   Elizabeth Diller, “Phantom House,” Engineered Transparency, 250-255

10 THE AGE OF PLASTIC
11.05 Polymers in architecture
   Lecture
   Discussion
   READ Roland Barthes, “Plastic,” Mythologies, 97-99
   Theo van Doesburg, Towards a Plastic Architecture (excerpt), 78-80
   and “Design in Plastic,” 183-241

11 MATERIAL CASE STUDIES: SET 1
11.12 Student presentations
   Discussion
   DUE Presentation [first third of class]

12 MATERIAL CASE STUDIES: SET 2
11.19 Student presentations
   Discussion
   DUE Presentation [second third of class]

13 MATERIAL CASE STUDIES: SET 3
11.26 Student presentations
   Discussion
   DUE Presentation [final third of class]
   Case Study paper draft [first half of class]

14 MATERIAL CASE STUDIES: PAPER REVIEW PART 1
12.03 Discussion
   READ AND CRITIQUE Case Study paper drafts [first half of class]
   DUE Case Study paper draft [second half of class]

15 MATERIAL CASE STUDIES: PAPER REVIEW PART 2
12.10 Discussion
   READ AND CRITIQUE Case Study paper drafts [second half of class]

12.17 DUE Material Case Study: Paper with final layout
EXAMPLE PROJECTS FOR MATERIAL CASE STUDIES (SEE ASSIGNMENTS)

MINERAL

Precedents
Church of Christ the Worker in Atlántida, Eladio Dieste
Beinecke Rare Book and Manuscript Library, Gordon Bunshaft / SOM
Therme Vals, Peter Zumthor

Contemporary
Ningbo Historical Museum, Amateur Architecture Studio
Marble Curtain, Studio Gang
St. Puis Church, Franz Füeg
Aomori Museum of Art, Jun Aoki
Dominus Winery, Herzog & de Meuron
Chokkura Plaza & Shelter, Kengo Kuma

CONCRETE

Precedents
Sainte Marie de La Tourette, Le Corbusier
Kimbell Art Museum, Louis Kahn
Church of Light, Tadao Ando

Contemporary
RATP Bus Center, Emmanuel Combarel Dominique Marrec Architectes
Zaragoza Bridge, Zaha Hadid
0-14 Tower, Reiser + Umemoto
Celosia, MVRDV with Blanca Lleó
D Jewelry, Vaillo + Irigaray
Holy Rosary Church Complex, Trahan Architects

WOOD

Precedents
1939 Finnish Pavilion, Alvar Aalto
Jacobs House, Frank Lloyd Wright
Thorn crown Chapel, Fay Jones

Contemporary
Final Wooden House, Sou Fujimoto
Relaxation Park in Torrevieja, Toyo Ito
Stadthaus London, Waugh Thistleton
Forest of Net, Tezuka Architects
Sal burúa Nature Interpretation Centre, QVE Arquitectosproject 5
Viewing Tower, atelierreienarchitecten
METAL
Precedents

The Farnsworth House, Mies van der Rohe
Centre Pompidou, Renzo Piano and Richard Rogers
Guggenheim Museum Bilbao, Frank Gehry

Contemporary

Ar de Rio Bar Esplanade, Guedes + DeCampos
Za Koenji Public Theatre, Toyo Ito
Coven Store, Marcelo Alvarenga
Quingpu Pedestrian Bridge, CA-DESIGN
Veranda Car Park, Paul de Ruiter
Matsunoyama Natural Science Museum, Tezuka Architects

GLASS
Precedents

The Crystal Palace, Joseph Paxton
Glass House, Philip Johnson
Maison de Verre, Pierre Chareau

Contemporary

The Glass Pavilion, Toledo Museum of Art, SANAA
House Q, Vaillo + Irigaray
Nelson-Atkins Museum of Art, Steven Holl
Louis Vuitton Roppongi, Jun Aoki
K:fem Department Store, Wingardh
TKTS Booth, Perkins Eastman

PLASTIC
Precedents

Monsanto House of the Future, Albert Dietz
Wonder House, Eliot Noyes
Plastic House, Kengo Kuma

Contemporary

Windshape, nArchitects
Beijing National Aquatics Center, PTW
Seed Cathedral, Heatherwick Studio
Armani Fifth Avenue, Massimiliano & Doriana Fuksas
L House, moomoo Architects
Kunsthülle LPL, OSA
REQUIREMENTS AND POLICIES
Student work will become part of a permanent archive. All work must be clearly labeled with: student name, class name, semester, year, and instructor’s name. Electronic submission should be via file transfer or email (depending upon file size). Bibliographic references based on the Chicago Manual of Style, including complete website URL links, must be submitted with assignments.

GRADING
Written work and presentations will be evaluated according to the following criteria:
• Creativity: ideas are intriguing and important, voice is individual and appropriate
• Logic: construction of a compelling argument, flow
• Organization: overall structure, focus, and clarity
• Support: reinforcement of claims, adequate references and citations
• Mechanics: checked for grammar, spelling, and legibility

Model and drawing work will be evaluated according to the following criteria:
• Creativity: subject matter is intriguing and important, style is original and appropriate
• Logic and Organization: overall structure, clarity, focus, and flow
• Support: adequate references and citations
• Mechanics: checked for accuracy and legibility

Final grades will be based on the following grades and points:
A (90-100), B (80-89), C (70-79), D (60-69), and F (59 or below)

“A-work” = Achievement that is outstanding and excels significantly above the stated policies, objectives and requirements of the studio syllabus, project statements and exercises. Student is able to extend objectives and issues far beyond stated scope through articulate discoveries, insights, propositions and synthesis. Student demonstrates the highest level of dedication, rigor, open-mindedness and exceptional resourcefulness. Student demonstrates outstanding ability to productively engage critique, work consistently and excel independently. Student produces physical work that is exceptionally rigorous, extraordinarily well-crafted and clearly communicates breadth and depth of investigation and development.

“B-work” = Achievement that is above the stated policies, objectives and requirements of the studio syllabus, project statements and exercises. Student is able to extend objectives and issues beyond stated scope through discoveries, insights, propositions and synthesis. Student demonstrates a capable level of dedication, rigor, open-mindedness and resourcefulness. Student demonstrates developing ability to productively engage critique, work consistently and improve independently. Student produces physical work that is rigorous, well-crafted and clearly communicates breadth and depth of investigation and development.

“C-work” = Achievement meets the stated policies, objectives and requirements of the studio syllabus, project statements and exercises. Student is able to meet objectives through some discoveries, insights, propositions and synthesis. Student demonstrates a base-level ability to engage critique and work consistently. Student produces physical work that is acceptable, marginally well-crafted and adequately communicates breadth and depth of investigation and development.

“D-work” = Achievement that is worthy of credit even though it fails to meet the stated policies, objectives and requirements of the studio syllabus, project statements and exercises. Student is able to meet some objectives and issues but lacks discoveries, insights, propositions or synthesis. Student demonstrates an insufficient level of dedication, thoughtfulness and resourcefulness. Student often lacks the ability to productively engage critique and work consistently. Student produces physical work that is fragmentary, incomplete, poorly-crafted, or inadequately communicates breadth and depth of investigation and development. Student exhibits poor time-management skills and is often unable to meet deadlines.

“F-work” = Achievement that fails to meet the stated policies, objectives and requirements of the studio syllabus, project statements and exercises. This includes work that is complete but not worthy of credit. This also includes work that was not completed and no written agreement was made between instructor and student that an official incomplete would be granted. Student is clearly not able to meet stated objectives and issues. Student demonstrates little or no dedication, thoughtfulness and resourcefulness. Student lacks the ability to productively engage critique and work consistently. Student requires constant assistance for direction, development and improvement. Student produces physical work that is fragmentary, incomplete, poorly-crafted, or simply doesn’t exist and inadequately communicates investigation and development. Student exhibits poor time-management skills and is unable to meet deadlines.
LATE WORK
Late work will be accepted only at the discretion of the instructor and is subject to 1/3 grade deduction for every 24 hours past the deadline.

INCOMPLETE WORK
Incomplete work will not be accepted without instructor’s prior approval and written agreement as to revised due dates and grading policy. A grade of Incomplete can only be given if the work is substantially complete and the student has documentation of illness or extreme circumstances.

SUBJECT TO CHANGE
With the exception of the grade and attendance policies, parts of this syllabus are subject to change with advance notice, as deemed appropriate by the instructor.

STUDENTS WITH DISABILITIES
This syllabus can be made available in alternative formats upon request. Contact the School of Architecture at 612.624.7866. Students with Disabilities that affect their ability to participate fully in class or meet all course requirements are encouraged to bring this to the attention of the instructor so that appropriate accommodations can be arranged. Further information is available from Disability Services (230 McNamara). Policies can be accessed online at www.ds.umn.edu. Please inform your instructor of any specialized needs you may have at the beginning of the semester or as soon as a (potential) challenge is identified.

SCHOLASTIC CONDUCT
All students are responsible for conduct in conformance with the University of Minnesota Student Conduct Code which, among other provisions, broadly defines scholastic misconduct as “any act that violates the rights of another student in academic work or that involves misrepresentation of your own work.”

SCHOLASTIC DISHONESTY
Scholastic dishonesty is defined as: “any act that violates the right of another student in academic work or that involves misrepresentation of your own work.” Scholastic dishonesty includes, (but is not necessarily limited to): cheating on assignments or examinations; plagiarizing – which means misrepresenting as your own work any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another student of necessary course materials; or interfering with another student’s work. Scholastic dishonesty may be addressed by assigning a failing grade. If you are aware of a problem, please bring it to the attention of your instructor.

INTELLECTUAL PROPERTY
The School of Architecture has the right to retain any student project whether it be for display, accreditation, archive, documentation or any other educational or legal purpose. In addition, the College reserves the right to reproduce and publish images of any such student work in collegiate publications, printed or electronic, for the purposes of research, scholarship, teaching, publicity and outreach, giving publication credit to the creator/student.

ACADEMIC POLICIES
Academic policies for this course (including but not limited to: accommodations for students with disabilities, statements on classroom conduct, and statements regarding sexual harassment, and academic integrity) can be can be found in the University’s website at www1.umn.edu/usenate/usen/usenpol.html. Classroom misconduct, violation of academic integrity, sexual harassment and issues concerning students with disabilities should be reported to the Director of CDes Student Services and to the Department Head.

WRITING ASSISTANCE
Students who require assistance with writing may contact the Student Writing Center for help with papers. The Writing Center does not provide proofreading services. They may be contacted at 306B Lind Hall, 612.625.1893

ATTENDANCE
More than 3 unexcused absences from class may constitute grounds for a failing grade.
ASSIGNMENTS
Assignments are based on three models of practice in architecture: writing, design, and presentation. In addition to weekly readings and discussion, assignments will include a material focus (intro), a weekly journal, a material interrogation (mid-term), as well as a case study paper and related presentation (final).

- Class Participation (15%)
- Material Focus (5%)
- Weekly Journal (20%)
- Material Interrogation (20%): model (10%), drawings and presentation (10%)
- Material Case Study (40%): presentation (15%), draft paper (5%), final paper (20%)

MATERIAL FOCUS
This is an early assignment intended to introduce material-related analysis. Select a provocative work of architecture that for you demonstrates an innovative application of a particular material. Select two images of this project: one that shows the building, and one that shows the material detail you would like to discuss. Print each image on letter-sized paper, landscape format and bring the images to class. Prepare a few brief talking points (3 minutes maximum) to describe the particular significance of this material application. After class, please post your material focus as your first journal entry (see below) for week one. You will need to convert your talking points into a written description. Include both images in your post, and select one to be the feature image.

WEEKLY JOURNAL
“We need criticism that connects us to a building’s references, emotions and texture, not only its news value.” — Alexandra Lange

You will be expected to write one blog post every week as a way to practice disciplinary writing in a low-stakes format. You are to publish your posts on the course website, which may be found at http://arch5541.wordpress.com. Each post must be at least 200 words in length, but not more than 500 words (unless specified on rare occasions). Each post must also have at least one feature image, and may include several additional images. Feature images must be exactly 750 pixels wide and 380 pixels tall; all other images must be between 470 and 750 pixels on each side. Please find...
images that have at least this native resolution (rather than scaling small images up, which will produce digital artifacts). Visual literacy is one of the important goals of this class; therefore, I expect you to select your visual content as carefully as you select your words.

In terms of content, your posts should focus on innovative material applications in architecture. Your writing should extend beyond disciplinary boundaries, addressing knowledge areas such as building technology, sustainability, design, history, theory, economics, and sociocultural themes. The case studies presented in Material Strategies can serve as a basic model of writing about material applications, and we will discuss other models in class. You are welcome to choose material topics in alignment with current class discussion (concrete or plastic, for example), but this is entirely optional. The website has a basic set of material categories; please select the most appropriate category for each of your posts. Occasionally, I may introduce special writing topics throughout the semester according to the needs of the class.

This will be no conventional blog. In your weekly writing efforts, you are to employ analytical or argumentative thinking. In a description given by educator John Bean, “such writing is initiated by a problem or question and is typically characterized by a controlling thesis statement supported by a hierarchical structure of reasons and evidence.” (Bean, Engaging Ideas, p. 23.) Although you may take a less formal approach in this assignment than you would for a term paper, your writing must demonstrate active thinking and the evaluation of multiple and often opposing views. Some of your questions may be unresolved, but your position should still be clear, and your claims adequately justified. Please cite your claims appropriately and provide links to your sources.

Note: The drawback of the popular blog format is that it is not often used as a platform for critical thinking. However, unlike many websites, our blog will not be a vehicle for simple reporting (merely conveying facts), and certainly not for re-blogging (copying and pasting content). Like all assignments, your work in this exercise must adhere to the University policy for scholastic dishonesty. You must therefore do your own work and cite your references. Quoting is allowed, but must be designated as such and credited appropriately.

I will invite you to access the course website for the purposes of authoring, editing, and publishing your posts. Your post must be published prior to 8:00 am on Friday of each week. This schedule will allow me to review your post over the weekend, as I will select a few posts each week to discuss in class. In addition to your posts, you will also be expected to comment on at least five of your colleagues’ entries during the semester. Your response must meet the basic requirements for word count, citations, and critical content, but need not include any images. Because your response is expected to be critical in nature, your aim might be to undermine the author’s argument; however, you can also expand upon the author’s argument or add a new and related argument. In any case, be sure that your criticism is constructive and that you strike an appropriate, diplomatic tone. By the end of term, you should have written fifteen posts and five comments.

MATERIAL INTERROGATION
In this two-part assignment, you will 1) conduct design research on an innovative material detail using a physical model and 2) present your findings with a series of analytical drawings in class. Based on the material strategies and effects listed in the introduction to Material Strategies, select a provocative material detail of sufficient technical complexity for analysis.

1. Model
Construct a physical model of this detail between 1 1/2” = 1′-0” (1:8) scale and actual size (1:1) using materials of your choice. These materials should be either literal, representational or abstract. Your model should address an important set of intersections—such as a corner, floor, head, and/or sill detail—and should be designed to come apart to reveal internal assemblies during your in-class presentation.

2. Drawings and Presentation
Produce a series of drawings to accompany your model. You should have at least one descriptive drawing (communicate what exists) as well as at least one interpretive drawing. Interpretive drawings could represent important processes, systems, material flows, construction sequences, or precedents in science, technology, or art, for example. You may select your approaches for these drawings freely, so long as they expand the intellectual territory of your detail, allowing us to appreciate particular material strategies and effects in a new light. Consider this effort as a design problem that advances a clear argument about the way in which we should understand the deeper
meanings of your selected material application.

Create a 10-minute presentation (Keynote, PDF, or Powerpoint format) about your work to share with the class. The presentation must feature your drawings, and may include additional project images and photographs of your model (optional). In your verbal description of this effort, be sure to convey a clear argument about how we should interpret your detail.

References: Michael Caldwell’s *Strange Details* provides a good conceptual starting point for material detail selection. Look at architecture journals such as *Detail* and *The Plan* for good project sources and sufficiently descriptive technical information.

MATERIAL CASE STUDY
This two-part assignment consists of 1) the development of a research paper that investigates particular material applications that have transformed the architectural project, and 2) an in-progress presentation of your research to the class. A draft of your paper will be also required for peer review and discussion (see schedule). Like your weekly journal, this paper must exhibit analytical or argumentative thinking, with a well-developed logical structure and appropriate claims and evidence. Your goal will be to develop and explain in writing and visual documentation a well-reasoned personal position on the role of transformative technology in the built environment, including a framework for critical evaluation of the technology and design applications employed, and to defend your position while acknowledging its weaknesses and limitations.

1. Paper
Write a 3,000 word paper that satisfies this requirement and includes sufficient images and drawings to explain your analysis. You will submit this paper in two phases: a) as a 1,000 word draft for review (see schedule), and b) as a final InDesign document at the end of the semester that is formatted according to a class template (to be provided). This final submission must include a pdf version in addition to the original source InDesign document and linked image files. Please zip all of your files and submit them to me via a free transfer service like yousendit.com.

You may use one of the following models of research papers for your work, or you may feel free to develop your own model.

*Focused Case Study*
Analyze a notable disruptive material application in a single significant project. For a good set of case study precedents, please refer to Michael Caldwell’s *Strange Details*. 
Comparative Study
Compare the application of a particular material in one post-1850 modern precedent and one post-2000 project.

Trajectory Study
Compare the application of a particular material in several projects built during the modern era, tracing the application’s technological and artistic development through time.

Comparative Application Study
Compare the application of a particular material in one project with a similar application of a different material in another project, demonstrating the transference of method.

Application Proposal
Analyze a notable material application in one or more significant architectural precedents and develop your own set of original design details in the spirit of this application. In this model, only 2,000 words are required, and emphasis is shifted to the design content. (This approach may be used to connect directly with your design studio work.)

Example: Suppose you choose a trajectory study. Your category might be glass, your precedent could be Norman Foster’s Willis Faber and Dumas Headquarters, and your contemporary application might be James Carpenter’s Blue Glass Passage. The focus in this case might be the development of structural glass applications. Your charge would be to: 1) analyze the major material innovation represented by your precedent building relative to the particular technological, environmental, and social characteristics of its time; 2) analyze the material innovation represented in your contemporary building relative to the important technological, environmental, and social characteristics of our time; and 3) develop a thesis that traces the chronological development of a particular disruptive application between the two projects, highlighting the fundamental challenges and opportunities in your material category based on your findings.

2. Presentation
Create a 15-minute in-progress presentation (Keynote, PDF, or Powerpoint format) about your research to share with the class. The presentation may include photographs, drawings, diagrams, and video content as necessary to explain your work. In your verbal description of your project, be sure to convey your thesis statement and supporting structure of reasons and evidence. We will use discussion time in class to explore your chosen topic and clarify the direction of your research.

References: In addition to sources like Michael Caldwell’s Strange Details, look at academic journals such as Architectural Design, ARQ, A+U, the Journal of Architecture, the Journal of Architectural Education, and the Journal of Architectural and Planning Research for good models of scholarly research in architecture.