**Advanced Surface Tectonics:**

Methods in Materials and Enclosures

Syllabus

Thursdays 4:00 – 5:50pm, Harris 102

Mic Patterson, PhD, LEED AP (BDC)

mrpatter@usc.edu

Chase L. Leavitt

Graduate Building Science

School of Architecture

University of Southern California

**Introduction and Purpose**

Designing buildings both sustainably and beautifully using the potent leverage of the building skin.

The building skin combines attributes of appearance and performance like nothing else in architecture, making it a predominant focus for the skilled architect. The performance of the building façade will be pivotal in achieving critical resilience and sustainability goals in buildings and urban habitat over the next three decades. The *Façade Zone* is an envelope surrounding the building perimeter, and the nexus of myriad, often competing considerations that must be balanced in the unique context of each individual building project. People spend 90 percent of their time indoors. The façade zone mediates the indoor and outdoor environment to provide a safe, healthy, comfortable and productive interior environment. The quality of the indoor environment has been definitively linked to human health and productivity.

The architect is challenged with managing limited resources and meeting performance objectives in the face of escalating climate stresses and the evolving context of indeterminacy and uncertainty as the climate crisis unfolds. The need for substantial operational carbon emission reductions has already impacted the current generation of building skins. Emerging considerations of embodied carbon bring urgency to the task of developing and applying the next generation of building skin technology. The design of building envelopes has rapidly become uniquely interdisciplinary, integrating new types of expertise into the professional design process.

Active, responsive, intelligent building skins could improve performance in the face of escalating natural and manmade disasters. Architects are designing increasingly complex building skins using new materials and processes that were not imaginable just a few years ago. This course is intended to provide a solid foundation of building envelope design issues and technology while exposing students to some of the most advanced building skins today.

The basic understanding of façade system art, science and technology provided by this course will empower the student and contribute significantly to their studio work and, later, to their professional practice.

**Learning Objectives**

In this class you will:

* discover the pervasive relevance of the façade system in architecture.
* identify different types of façade systems.
* understand the materials and processes characteristic of façade system design and delivery.
* identify new materials and processes that may be applied to façade system design.
* articulate the individual components of various types of curtainwall systems.
* become acquainted with the typical design development process of a façade program.
* gain familiarity with the design, analysis and simulation tools that facilitate façade system design.
* understand the design, specification and delivery process of a complex, high-performance façade system.
* gain familiarity with strategies to improve various aspects of façade system performance.
* understand the role and importance of visual and performance mockup testing in façade system design and delivery.
* develop a deep understanding of architectural glass products as a façade system material ubiquitous in buildings and urban habitat.
* gain familiarity with the structural properties and use of glass as a building material.
* understand the basic structural behavior and physics of the façade system as it relates to thermal, solar, condensation and acoustical performance.
* discuss the critical function and importance of the façade system as an air and vapor barrier.
* understand the difference between operational carbon and embodied carbon footprint in buildings.
* discuss the importance of durability and service life in buildings and their major systems.
* address and evaluate the role of transparency in the building skin.
* become acquainted with a body of seminal texts that address various aspects of the building façade system.
* understand the contribution of buildings and their façade systems to the climate crisis, and the reciprocal impacts of climate change on buildings and their façade systems.
* recognize the potential for the façade system to act as the lynchpin in achieving critical goals for resilience and sustainability in buildings and urban habitat.

**Suggested Reading**

Books

* Aksamija, Ajla. *Sustainable facades: Design methods for high-performance building envelopes*. John Wiley & Sons, 2013.
* Boswell, Keith. *Exterior building enclosures: design process and composition for innovative façades*. John Wiley & Sons, 2013.
* Brand, Stewart. *How buildings learn: What happens after they're built*. Penguin, 1995.
* Compagno, Andrea. *Intelligent glass facades: Material, practice, design.* Birkhauser, 1999.
* Herzog, Thomas, Roland Krippner, and Werner Lang. *Facade construction manual*. Basel: Birkhauser, 2008.
* Knaack, Ulrich, Tillmann Klein, Marcel Bilow, and Thomas Auer. *Façades: principles of construction*. Birkhäuser, 2014.
* Murray, Scott, and Scott Charles Murray. *Contemporary curtain wall architecture*. Princeton Architectural Press, 2009.
* Patterson, Mic. *Structural glass facades and enclosures*. 2011. New York: Wiley, 2011.
* Robinson, Kim Stanley. *New York 2140*. Fanucci Editore, 2017.
* Schittich, Christian, Gerald Staib, Dieter Balkow, Matthias Schuler, and Werner Sobek. *Glass construction manual*. Basel: Birkhauser, 2012.
* Wigginton, Michael, and Monica Pidgeon. *Glass in architecture*. London: Phaidon, 1996.
* Wigginton, Michael, and Jude Harris. *Intelligent skins*. Routledge, 2013.

**The Class Ethos**

This is a broad-based survey course on the critically important building façade system. There is a sparsity of good textual material on this subject. A general (non-required) reading list is suggested above, but the course will rely heavily on in-class presentations by the instructor as and visiting lecturers. Class attendance and participation are, therefore, critical. The grading structure (below) reflects this. I will be looking for your active engagement and participation in the dialogue that will span this semester.

There will be assignments. I ask you to arrive at class having completed the assignment—and having thought through the significance and implications—in advance, and be prepared to discuss, ask questions, express opinions, and respond to the comments of your classmates with considered respect and intelligence. At its core, this is a class in critical thinking and creative problem solving. Not only will conventional façade design and delivery practices be reviewed, they will be challenged. I ask that we, as a class, operate under the belief that we share equality of intelligence and that all ideas deserve consideration. I ask you to be empathetic toward your peers and to acknowledge everyone’s contribution with kindness. And I encourage you to speak up for your ideas and try out new ones. Take outrageous positions. Fall on your face. Be wrong. Respectfully challenge and critique each other. Have fun!

**Course Policies**

In-Class Work

As discussed above, participation in classroom exercises is an important element of the education this class offers. These exercises will be comprised largely of critical discourse and debate. You cannot receive credit for this in-class work if you are not present. Attendance is the precondition for receiving credit for the work that we will do in class. More than three unexcused absences will result in receiving a 0 for this category. (For more information on Attendance, please see the heading below).

Formatting

Unless otherwise stated, all assignments should be double-spaced, typed in 10-point Arial font with one-inch margins. Works cited should employ Chicago format. Pages should be numbered in the upper right corner and have the following information:

Your Name

Arch 518: Spring 2020

Patterson (i.e. Professor’s Name)

Date

Assignment Name or Number (e.g. Take-Home Mid-Term)

Late Work

It is your responsibility to finish each assignment by its due date and time. I am willing to consider giving extensions, but they must be for legitimate medical emergencies, documented by a letter from a doctor indicating that you were too sick to complete the work. If you turn in a paper late without having cleared it with me first, it will be marked down 1/3 of a grade for each day it is late and will receive no written comments. (Thus, if you hand in a paper on Friday that was due on Tuesday, and it merits a B grade, you will receive, due to the lateness penalty, a C).

**Assignments**

Assignments will be made on a weekly basis.

Reading Assignments

Reading assignments will be made on a weekly basis.

In-Class Presentations

To begin developing the research skills as well as hone your oral speaking skills, you will be charged with delivering brief oral presentations of (10 minutes or less) to the class involving outside research. These presentations, which will be directed by a prompt (that can be as broadly or narrowly construed as you like), ask you to explore some aspect of a subject we are studying. Some are intended to allow you to indulge in interests that predate this course or to explore a novel area of inquiry. These presentations provide context for the class’s discussion of the topic (similar in function if not in scope to my occasional introductory lectures). The study of architecture, after all, is in no way narrowly limited to technology, but also includes cultural and political dimensions. Possible topics and sources will be suggested. In your research, you are expected to go beyond the sources provided. I am looking for critical thinking in all aspects of your work. Audiovisuals are encouraged and the graphic quality of your presentations should reflect your aspirations to a highly visual profession.

Case Study

A façade-focused case study on a building of your choice will be due at the end of Week 9. To be discussed.

Final Project

The final project will involve the development of a conceptual design for a mixed-use building in Los Angeles with a focus on the façade system. A detailed context will be defined. The deliverables for this assignment can take the form of a term paper, a narrative or a graphic novelette. To be discussed.

**Grading Timeline**

Just as you promise to turn in your papers in a timely fashion to me, I promise to return them with comments to you.

**Grading**

* Attendance; In-Class Work 30%
* Mid-Term Proposal 20%
* In-Class Presentations 20%
* Final Project 30%

**Plagiarism**

Taking the words of another author and passing them off as your own undermines both your learning process and the academic community of which you are now a member. If you are caught plagiarizing, you will receive a failing grade for this course, and you may also be dismissed from USC. Generally, to avoid plagiarism you must do the following: give credit to the proper sources for any ideas you reference that are not your own; avoid turning in papers written for another class; and be careful when you work with tutors, friends, or family members, as if the person helping you alters your work substantially, this is plagiarism as well. For a complete definition of what constitutes plagiarism, see your SCampus Student Guidebook (in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](https://policy.usc.edu/scampus-part-b/)). If you have further questions, don’t hesitate to ask me.

**Attendance**

If you find that you must miss a class, tutorial, or other deadline, please e-mail me in advance. You are allowed one absence for any reason. (You do not need to tell me the reason or obtain a doctor’s note, etc.) After three absences, not only will your in-class work grade suffer but students often find their performance in the course noticeably declines because they’ve missed so much valuable class time.

**Technology**

While I am happy to have you use laptops, tablets, and other electronic reading/writing devices in class, I ask that you please restrict your usage to only materials relevant to class and to please keep your phones silent and away for the duration of class.

Also, I do ask that you check your email every twenty-four hours of the school/work week, as I will communicate with you over it. You can email me at micpst@gmail.com at any time, though I may take 24-48 hours to respond—and if you email me on the weekend, will probably not reply until I am back in the office on Monday morning.

**Accommodations**

I want you to succeed in this course. If you need accommodations for documented medical reasons, please contact me during office hours with a letter from your doctor explaining the medical situation(s). I will work with you to plan reasonable accommodations. Please discuss with me as early as possible any other support you may need.

**Student Resources**

***Student Counseling Services (SCS)*** – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [engemannshc.usc.edu/counseling](https://engemannshc.usc.edu/counseling)

***National Suicide Prevention Lifeline*** – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org/)

***Relationship and Sexual Violence Prevention Services*** – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [engemannshc.usc.edu/rsvp](https://engemannshc.usc.edu/rsvp/)

***Sexual Assault Resource Center***

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: [sarc.usc.edu](http://sarc.usc.edu/)

***Office of Equity and Diversity (OED)/Title IX Compliance*** – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. [equity.usc.edu](http://equity.usc.edu/)

***Bias Assessment Response and Support***

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. [studentaffairs.usc.edu/bias-assessment-response-support](https://studentaffairs.usc.edu/bias-assessment-response-support/)

***Student Support and Advocacy*** – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student—personal, financial, and academic. [studentaffairs.usc.edu/ssa](https://studentaffairs.usc.edu/ssa/)

**Schedule (subject to change)**

WEEK 1 Introduction: Course review

1.16 Lecture: Introduction to Curtainwall

Reading: IPCC Special Report SR15

WEEK 2 Lecture: Introduction to Curtainwall (continued)

1.23 Reading: IPCC Special Report SR15

Assignment 1: Personal ecofootprint exercise

WEEK 3 Assignment 1 due

1.30 Class: Presentations of Assignment 1

Lecture: Structural Glass Facades, Pt.1

Assignment 2: Façade System Description

WEEK 4 Assignment 2 due

2.6 Class: Presentations of Assignment 2

Assignment 3 Favorite Facades

WEEK 5 Assignment 3 due

2.13 Lecture: Structural Glass Facades, Pt.2

Class: Presentations of Assignment 3

Reading: Durability chapter

Assignment 4: Favorite Structural Glass Facades or Structures

Assignment 5: Case Study Report

WEEK 6 Assignment 4 Due

2.20 Lecture: Durability

Class: Presentations of Assignment 4

Reading: Resilience chapter

WEEK 7 Class: Presentations of Assignment 4 (continued)

2.27 Lecture: Resilience and the Building Skin

WEEK 8 Lecture: Double-skin Facades

3.5 Assignment 5: Durability and service life

WEEK 9 Assignment 5 Case Study Report Due

3.12 Review: Durability and Resilience

Reading: Program for FTI World Congress

Assignment: Technical report from FTI World Congress

3.19 SPRING BREAK

WEEK 10 No class

3.26 Field Trip: Façade Tectonics World Congress

Assignment: Final Project

WEEK 11 Technical report from FTI World Congress due

4.2 Class: Presentations of Tech Reports from FTI WC

Reading: Guardian: [Glass Basics](https://www.guardianglass.com/eu/en/tools-and-resources/resources/glass-basics) + videos on page; IGU chapter

WEEK 12 Lecture: Is Glass Green? Reflections on Glass

4.9 Reading: Attributes of Sustainability chapter

WEEK 13 Pop Quiz: Architectural Glass

4.16 Lecture: Attributes of Façade System Sustainability

Reading: Retrofit chapter

WEEK 14 Lecture: Façade Retrofit

4.23

WEEK 15 FINAL PROJECT DUE

4.30 Review & Discussion

FINALS TBD