ARCH-6353: BUILDING PERFORMANCE ANALYSIS  
University of Utah College of Architecture + Planning  
Professor Robert A Young, FAPT, PE, LEED ap  
Spring 2014

COURSE OUTLINE

Description

This course explores various methods used for building performance analysis. The content includes an introduction to architectural forensics, building inspection and assessment methods, and evaluation techniques for building performance.

Objectives

The objectives of this course are to teach the student to understand:

- The process of architectural investigation;
- The failure mechanisms for construction systems and materials;
- The assessment methods used to analyze building performance with regards to fire & life safety, accessibility, energy use, resource consumption, and sustainability.

Teaching Philosophy

The built environment acts as the students’ own living learning laboratory and provides a means to integrate course concepts into explorations in studio and professional practice. Lectures, site visits, and readings form the foundation of the course. Projects are designed to sensitize students to the past, present, and future built world and how building performance analysis enables architects, engineers, and owners to plan for reuse or continued use of existing buildings.

Student interaction forms an important part of my teaching philosophy. The questions and the resulting discussions bring significant vitality to the course. Students are strongly encouraged to proactively ask questions to initiate discussions as well as seek clarity on materials presented in the lecture.

Outside the classroom, it is expected that students will also seek further inquiry that fosters the formation of their life-long learning skills. This includes completing class readings before each lecture, investigations at the library and other resources, working in study groups, and consultations with the instructor.

Organization

Class Hours  Lectures will be 9:10-10:30 AM, in Room 229 AAC. There will be a series of guest speakers, site visits, lectures, discussions, and project release time as indicated on the syllabus.

Instructor/Office Hours  Robert A. Young; 581-3909; young@arch.utah.edu;
Room 240 AAC, MW 10:00-11:00 AM; or by appointment.

WebSite Students should periodically consult the instructor's website www.arch.utah.edu/young for updates on assignments and other course information.


Selected readings are on the class website or on Canvas. Refer to "Supplemental Readings" section below for titles. Noted as “BP” on class reading schedule.

Other readings will be added as needed.

Decorum & Attendance Punctuality, professionalism, and leadership are valued by clients, employers, colleagues, and faculty. As such, students should be ready to begin class at the scheduled start time and be prepared to ask and answer questions. Pagers and cell phones must be turned off or set to non-audio mode. Do not eat in class.

Class begins with announcements and questions to and from the class and the resultant discussions. Participation goes beyond just coming to class and taking notes. Leaders ask questions and seek clarity to foster greater understanding for themselves and for the class. Leaders engage the class in learning course materials both inside and outside the classroom.

Due to the quantity of materials covered, it is recommended that students attend class lectures regularly, ask questions, and keep up with the reading. Students' participation and leadership qualities in class lectures, discussions, and projects will be used in consideration of their final course grade.

Projects These projects must be submitted to meet the course completion requirements:

(1) Architectural Forensics Paper
(2) Building Performance Analysis Paper
(3) Building Performance Analysis Project

Students are responsible for all in-class instructions on projects. **Unless otherwise stated, projects are due by the start of class on the day they are due.**

Project grades will be based on completeness, accuracy, technical comprehension, legibility, and originality. See grading form on the website for further information.

**Late Policy**

Late work will be penalized **one full letter grade** (e.g., an "A" will become a "B", etc.) for **any part** of the first calendar day and one full letter grade per day thereafter. All unsubmitted late work must be turned in by 5:00 PM on the last day of the regular semester classes (not finals week) to receive completion credit even though it may be too late for a letter grade.

**Grading**

Final grades will be based on the following credit:

<table>
<thead>
<tr>
<th>Item</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>200 points</td>
</tr>
<tr>
<td>Project 2</td>
<td>200 points</td>
</tr>
<tr>
<td>Participation &amp; Leadership</td>
<td>100 points</td>
</tr>
<tr>
<td>Total</td>
<td>500 points</td>
</tr>
</tbody>
</table>

Grades will be based on these cut off percentage points:

- A: 93
- A-: 90
- B+: 87
- B: 83
- B-: 80
- C+: 77
- C-: 70
- D+: 67
- D: 63
- D-: 60
- E: <60

**Accessibility**

The University of Utah College of Architecture + Planning seeks to provide equal access to its programs, services, and activities for people with disabilities. Reasonable prior notice is needed to arrange accommodations.

**University Curriculum**

Last day to drop (delete) classes: January 12, 2014

**Administration Notes**

Last day to add classes: January 15, 2014
### CLASS SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Tu</td>
<td>Introduction</td>
<td>R: 1-2</td>
</tr>
<tr>
<td>9 Th</td>
<td>Architectural Forensics &amp; Investigation</td>
<td>BP: 1-2</td>
</tr>
<tr>
<td>14 Tu</td>
<td>Architectural Forensics &amp; Investigation</td>
<td>BP: 3-5</td>
</tr>
<tr>
<td>16 Th</td>
<td>Guest Speaker—Myron Willson</td>
<td>R: 3-5</td>
</tr>
<tr>
<td>21 Tu</td>
<td>Architectural Forensics &amp; Investigation</td>
<td></td>
</tr>
<tr>
<td>23 Th</td>
<td>Guest Speaker—Mike Halligan</td>
<td></td>
</tr>
<tr>
<td>28 Tu</td>
<td>Guest Speaker—Roger Borgenicht</td>
<td></td>
</tr>
<tr>
<td>30 Th</td>
<td>Guest Speaker—Susie Petheram</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Tu</td>
<td>Project 1 Presentations</td>
<td></td>
</tr>
<tr>
<td>6 Th</td>
<td>Project 1 Presentations</td>
<td></td>
</tr>
<tr>
<td>11 Tu</td>
<td>Project 1 Presentations</td>
<td></td>
</tr>
<tr>
<td>13 Th</td>
<td>Project 1 Presentations</td>
<td></td>
</tr>
<tr>
<td>18 Tu</td>
<td>Project 1 Presentations</td>
<td></td>
</tr>
<tr>
<td>20 Th</td>
<td>Project 1 Presentations Project 1 Due at 10:30 AM</td>
<td></td>
</tr>
<tr>
<td>25 Tu</td>
<td>Evaluation Methods—Energy Modelling</td>
<td></td>
</tr>
<tr>
<td>27 Th</td>
<td>Evaluation Methods—EQUEST</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Tu</td>
<td>Field Work—</td>
<td></td>
</tr>
<tr>
<td>6 Th</td>
<td>Field Work—</td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>Spring Break – No Class</td>
<td></td>
</tr>
<tr>
<td>18 Tu</td>
<td>Evaluation Methods</td>
<td>R: 6-8</td>
</tr>
<tr>
<td>20 Th</td>
<td>Project 2 Coordination &amp; Consultation</td>
<td></td>
</tr>
<tr>
<td>25 Tu</td>
<td>Evaluation Methods</td>
<td></td>
</tr>
<tr>
<td>27 Th</td>
<td>Project 2 Coordination &amp; Consultation</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Tu</td>
<td>Evaluation Methods</td>
<td></td>
</tr>
<tr>
<td>3 Th</td>
<td>Project 2 Coordination &amp; Consultation</td>
<td></td>
</tr>
<tr>
<td>8 Tu</td>
<td>Project 2 Coordination &amp; Consultation</td>
<td></td>
</tr>
<tr>
<td>10 Th</td>
<td>Project 2 Coordination &amp; Consultation</td>
<td></td>
</tr>
</tbody>
</table>
SUPPLEMENTAL READINGS


REFERENCE LIST (SELECTED)


PROJECT #1: ARCHITECTURAL FORENSICS

Introduction

Architectural forensics deals with material and structural failure or lack of optimum performance. In the contemporary environment, issues of poor performance, whether they involve material failures, questionable sustainability impacts, or threats to health and life safety can significantly affect continued use of an existing building. This paper is an opportunity to explore a specific aspect of problems and issues found in the existing built environment and report it to the class.

Objectives

• To explore methods of architectural forensics
• To encourage development of student research skills.
• To encourage development of student oral presentation skills.
• To encourage development of student writing skills.

Architectural Forensics Case Study

The paper will describe one aspect of architectural forensics and performance analysis as it affects the built environment. The subject area is to be one of topics given below or students may develop one of their own with the consent of the instructor:

- Materials (choose 1)
  o Cladding and enclosure systems
  o Glazing
  o Roofing
  o Insulation
  o Moisture control
  o Infiltration control
  o Acoustic control
- Structural (choose 1)
  o Structural collapse
  o Seismic upgrades—base isolation
  o Seismic upgrades—emerging technologies
- MEP systems (choose 1)
  o Mechanical systems: energy efficiency in existing buildings
  o Electrical energy reduction enhancements for existing buildings
  o Water reduction enhancements for existing buildings
- Fire & Life Safety and Accessibility (choose 1)
  o Issues for existing buildings: smoke control
  o Issues for existing buildings: life safety and egress
  o Issues for existing buildings: accessibility
ARCH-6353: BUILDING PERFORMANCE ANALYSIS
University of Utah College of Architecture + Planning
Professor Robert A Young, FAPT, PE, LEED ap Spring 2014

- Issues for existing buildings: contaminant abatement (lead, asbestos, mold, PCBs, radon)
  - Building codes/smart codes and their impact on existing building reuse
  - Urban heat island mitigation
  - Life-cycle analysis
  - Life Cycle Cost Analysis
  - Non-destructive testing/non-destructive evaluation
  - Architectural materials testing and analysis

Products

Paper: Using the writing format template, and based on the research findings, each student will prepare a 3000-3500 word paper (approximately 12-14, 8 ½” x 11” pages of double spaced text, 12 point font with 1” margins). Graphics should be integrated within the text to highlight key points. Graphics will not be included in the page count. All graphics or images not originally developed by the students must be given proper bibliographic credit. All graphics and images must be called out in the text and have captions. Students should use the Chicago Manual of Style as the basis of their writing. All assertions and conclusions should be based on existing factual evidence and not just opinion or conjecture.

In writing the paper, keep the following criteria in mind:

1. **Proofread** manually. Spellchecker is not a proofreader.
2. Use **only** third person voice (e.g., he, she, they).
3. Use **active** voice.
4. **Avoid contractions** (e.g., “do not” instead of “don’t”).
5. Use **headings** to delineate major areas of the paper (e.g., introduction of research question or issues, case studies, discussion, and conclusion).
6. **Call out** figures in text (e.g., “see Figure 1”)
7. Include **captioned** graphics (e.g., “Figure 1: Front façade of XYZ building”) within the body of the text for visual interest and to clarify a point of discussion.
8. **Cite sources** of images and quotes.
9. **Include a bibliography** at the end (note: the text for this is not included in the word count).
10. **Use appendices** where appropriate to maintain flow within the main body of the paper. Use call outs (e.g., “see Appendix A”) where appropriate.

The paper should use a minimum of five resources (e.g., books, journal articles, web resources) but **do not use the text book, course readings, or Wikimedia.**

Presentation: Each student will make an oral presentation to convey an overview of the subject including the major findings and expected trends of the particular topic being presented. The length of the presentation time will be determined
once the class size has been finalized. Audio-visual aids (e.g. computer/projection equipment) will be the responsibility of the student.

The paper is due on the date shown on the syllabus. The students will submit one printed copy of the paper and upload a digital copy of all files associated with the paper and final presentation to Canvas that includes the paper (in a .DOC formatted file); and the presentation (in a .ppt formatted file).

**Grading Criteria**

The paper and presentation will be graded based on completeness, accuracy, technical comprehension, legibility, and originality.
PROJECT #2: BUILDING PERFORMANCE ANALYSIS PROJECT

Introduction

Building performance analysis deals with several parameters in assessing how well a building meets the needs of its occupants. In the contemporary environment, issues of poor performance, whether they involve construction defects, sustainability impacts, occupant thermal, visual and acoustical comfort or threats to health and life safety can significantly affect continued use of an existing building. This project provides an opportunity to explore these issues found in the existing built environment and report it to the class.

Objectives

• To explore methods of building performance analysis.
• To encourage development of student research skills.
• To encourage development of student oral presentation skills.
• To encourage development of student writing skills.

Building Performance Case Study

The project will be done as a class with smaller teams of students working on specific issues that may include existing construction assessment, sustainability, health & safety, lighting, acoustics, and thermal conditions. The sub-areas for the project will include:

• History
  o Original design intentions
  o Changes through time
  o Existing and future use intentions
• Materials
  o Cladding and enclosure systems
  o Glazing
  o Roofing
  o Insulation
  o Moisture control
  o Infiltration control
  o Acoustic control
• Structural
  o Seismic upgrades
  o Structural assessment
• MEP systems
  o Mechanical systems energy efficiency enhancements
  o Electrical energy reduction opportunities
  o Water reduction enhancements
• Fire & Life Safety and Accessibility
  o Life safety and egress
ARCH-6353: BUILDING PERFORMANCE ANALYSIS  
University of Utah College of Architecture + Planning  
Professor Robert A Young, FAPT, PE, LEED ap  
Spring 2014

- Accessibility
- Contaminant abatement (lead, asbestos, mold, PCBs, radon)

**Products**

**Report:** Based on onsite and archival research findings, the class will prepare a report that will demonstrate the performance assessment of the parameters listed above. Graphics should be integrated within the text to highlight key points. All graphics or images not originally developed by the students must be given proper bibliographic credit. All graphics and images must be called out in the text and have captions. Students should use the *Chicago Manual of Style* as the basis of their writing. All assertions and conclusions should be based on existing factual evidence and not just opinion or conjecture.

In writing the report, keep the following criteria in mind:

11. **Proofread** manually. Spellchecker is not a proofreader.
12. Use *only* third person voice (e.g., he, she, they).
13. Use **active** voice.
14. **Avoid contractions** (e.g., “do not” instead of “don’t”).
15. Use **headings** to delineate major areas of the paper (e.g., introduction of research question or issues, case studies, discussion, and conclusion).
16. **Call out** figures in text (e.g., “see Figure 1”)
17. Include **captioned** graphics (e.g., “Figure 1: Front façade of XYZ building”) within the body of the text for visual interest and to clarify a point of discussion.
18. **Cite sources** of images and quotes.
19. **Include a bibliography** at the end (note: the text for this is not included in the word count).
20. **Use appendices** where appropriate to maintain flow within the main body of the paper. Use call outs (e.g., “see Appendix A”) where appropriate.

The report should draw upon field investigations, conversations with tenant and building operations & management staff, and integrate them into a comprehensive analysis of the existing conditions.

**Presentation:** As the report findings are discerned through the course of the semester, each student or pair will be given the responsibility of preparing a section of the final presentation. The oral presentation will convey an overview of the major findings and expected trends that need to be addressed for the continued (and enhanced) use of the building. The length of the presentation time will be determined once the class size has been finalized.
The project is due on the date shown on the syllabus. The class will submit a printed copy of the paper and upload the report (in a .DOC formatted file) and the presentation (in a .ppt formatted file) to Canvas.

**Grading Criteria**

The report and presentation will be graded based on completeness, accuracy, technical comprehension, legibility, and originality.