

## **HSPV 739-301 SEMINAR IN ARCHITECTURAL CONSERVATION: MASONRY**

Graduate Program in Historic Preservation/Weitzman School of Design/University of Pennsylvania  
Fall 2024 / Wednesday 8:30 am-11:30 am EST/ MEY B6 & Various

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Office hours: Virtually by Appointment

### **Introduction**

Masonry has commonly been used to construct buildings in North America since the early era of colonization. It was used to construct both vernacular and polite architecture because of local accessibility, material durability, and its association – engendering a sense of monumentality, strength, longevity, and connection with significant masonry structures of the ancient world. First stone, brick, and adobe were utilized until the Industrial Revolution, in which new masonry materials were developed to produce cheaper imitations of ornamental stone construction. Due to its use in significant public and private buildings as well as its superior durability, many of today's existing heritage buildings are constructed entirely or partially of masonry materials. However, masonry cannot perform into perpetuity without maintenance or repair and has a host of material conditions caused by intrinsic and extrinsic deterioration mechanisms. With proper project preparation, condition assessment, development of well-tailored preservation maintenance and repair plans, and treatment execution by skilled craftworkers, these buildings can be preserved for generations to come.

### **Course Summary**

The primary goals of this course are for students to strengthen their critical thinking skills through technical application, and to encourage and hone their ability to observe. These skills will be developed through the practice of identifying masonry materials and systems, analyzing and recording properties and conditions, selecting instrumental and field methods to evaluate deterioration, developing strategies for treatment repair and recognizing potential project parameters. In addition, students will be further introduced to the role of conservator within a larger project structure, when they implement treatments, and how they communicate with consultants, design professionals, and masonry craftworkers.

The first half of this course offers an in-depth review of masonry materials, quarrying and manufacturing practices over time, construction technologies, unit and system deterioration, and methods of instrumental analysis. Attention will be paid to a variety of masonry and related materials such as stone, brick, terra cotta, cast stone, and mortars. The second half of the course will focus on treatment repair of masonry buildings and monuments as well as post-treatment analysis. Lab and field exercises along with a semester long site project will be offered to supplement lectures and to provide more practical experience for students.

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### Course Requirements

#### *Attendance*

Attendance is required for all scheduled classes, mid-term and final presentation sessions, unless permission for absence has been granted by the instructor in advance. In the event a student cannot attend, students are **required** to notify both instructors of their anticipated absence as soon as possible. More than three unexcused absences will result in a reduction of a student's overall grade by one letter. An absence will be excused for personal/family emergency, injury, illness, or attendance to another sanctioned university obligation. In-class lectures and working sessions will not be recorded in any capacity, and therefore will not be distributed to absentees.

#### *Lateness*

If a student anticipates being more than 5 minutes late from the official start time of class, they are **required** to notify both instructors, and to provide an estimated time of arrival. If students are more than 20 minutes late from the official start time of class, it will be counted as an absence. Being late (between 5-20 minutes) three times will be counted as one unexcused absence.

#### *Participation*

As a seminar, all students are expected to participate equally beginning with class attendance, discussion participation, and contributions of individual and/or group assignments. All work must follow the universities standards for academic integrity listed at the following link:

<https://catalog.upenn.edu/pennbook/code-of-academic-integrity/>

#### *Classroom Etiquette*

- Technology
  - Computers/Laptops/Tablets, Cell Phones, Ear Buds: these items are **not permitted** to be used during class time unless specified by the instructors. These items are expected to be put away, out of sight, during the active class period. If an exercise is planned that will require a laptop, students will be notified in advance. Students may take handwritten notes in class.
  - Use of AI: students may use AI to assist research and finding scholarly sources. Students are encouraged to vet those sources once they are collected through AI, to make sure they are indeed scholarly. Oppositely, students are **discouraged** from using AI to edit or generate written text, as it is often incorrect and uncontextualized in its technical terminology and phrasing. AI also often draws from unconventional and non-scholarly sources. The instructors may ask students to rewrite and resubmit assignments if it is clear AI has produced or edited their work.
- Professionalism
  - While in class, students are encouraged to behave as if the class is a workplace. The instructors will encourage a professional and polite working environment. When a lecture is

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in session, students are expected to give their full attention to the speaker. If students display rude or disrespectful behavior toward others while in class, the instructors may ask them to leave the class or their final grade may be lowered.

### *Lab Assignments*

Analytical and treatment labs have been developed to support the lecture component of the course. Labs will require coordination and use of the architectural conservation lab with various materials and with other courses. Please be respectful of others working in the lab, both from a safety and logistical standpoint. All proper lab safety, personal protective equipment (PPE) protocol, and material handling and disposal must be followed. You will be evaluated based on your compliance with these safety standards. If it is discovered that such protocol is not being followed, action will be taken and a reduction in grading may occur.

### *Site Project*

One site with multiple structures, distinct features, and materials has been pre-selected for this project. Each student will prepare and conduct:

- Brief Archival Research – Conservation research and testing programs should always begin with a brief overview of the site, including construction, treatment, and maintenance history. However, this is not a course on historic documentation, therefore it is important to keep this section of the report concise and relevant to the specific monument or structure. Each student will be required to provide this archival context for their assigned portion of the site. (No more than 500 words).
- Materials Characterization – At the beginning of this project students will be asked to identify and describe all the types of masonry materials that are incorporated into their assigned structure and using published research to support their findings and descriptions. This information will provide context for further discussion of these materials (and their deterioration phenomenon) throughout the report.
- Drawing Set w/ Ortho-Rectified Photo-Elevations – Each student will be required to prepare an initial CAD drawing set with elevations, plan (& roof plan if applicable), along with orthorectified photographic elevations.
- Gravimetric Mortar Analysis – Each student will perform at least one (1) gravimetric mortar analysis on samples taken from their site project. Each structure is likely to have multiple types of masonry, and/or repointing campaigns. Therefore, each student will, with the assistance of the instructors, try to identify and extract samples of the earliest bedding and/or pointing campaigns for analysis. Based on the findings, students will provide a recommended repair formulation supported by the knowledge gained through the Treatment Assignment #2.
- Graphic Condition Survey Drawings Set. – Students will use their established drawing set to document and graphically represent conditions layers.
- Graphic Conditions Glossary – In addition to the condition drawings a conditions glossary should be created for the project. This may include reviewing resources such as the ISC glossary and others found in the distribution folder. The glossary should at least include a photograph of each typical

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condition (with a scale card), a written description of the condition, and the graphic used to indicate that condition on the condition drawing set.

- Prioritized Conditions Report – This portion of the report should begin with both a brief listing of the overall conditions and their sources with a priority level assigned to each, as well as definitions of priority criteria. Typically, priorities may fall within these categories, however each site might have unique or extenuating circumstances which elevate certain conditions to higher or lower condition levels:
  - Priority 1 – (High) Conditions pose potential risk to public safety or immediate loss of historic fabric. Repairs should be implemented within 1 year.
  - Priority 2 – (Moderate) Conditions pose continued deterioration of historic fabric. Repairs should be implemented within 2-5 years.
  - Priority 3 – (Low) Conditions pose very little loss of historic fabric. Repairs should be implemented within 5-10 years (or not at all)

This brief conditions summary should be followed by a more in-depth narrative description of the major site issues and material conditions and phenomenon. Students should discuss the overall site issues surrounding their individual structures that might affect the performance/preservation of the structure (site drainage, site vegetation, etc). From there students should discuss the building system conditions (i.e. foundation, walls, etc.) and then move into a more in-depth discussion of the masonry material conditions.

- Treatment Recommendations & Treatment Testing Program with preferred treatment options should be outlined in the final section. Treatments and intervention approaches must be backed up by a literature review that cites other case studies or research relevant to the issues and prospective treatments. It must be clear in student's reports why certain treatments have been selected for testing.
- Cleaning Test Report & Mortar Formulations (Where applicable)

### ***Course Submissions***

All assignments should be submitted to the corresponding folders on **PennBox** in PDF format compressed to the lowest possible file size without resulting in reduced legibility. All assignments are due by Midnight (11:59 PM) on the specified date, unless otherwise noted by the instructors.

Assignments submitted late (after 11:59 PM on the specified date) will receive an automatic reduction of a third of a letter grade for each day thereafter. If a student anticipates in advance the need for an extension, for a legitimate reason (personal/family emergency, injury, illness, or attendance to another sanctioned university obligation) they are required to notify both instructors as soon as possible and receive approval.

There are several benchmark deadlines for site projects and lab assignments throughout the course of the semester. Students are expected to look at the schedule and plan their time accordingly to ensure these deadlines are met.

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All written assignments submitted are expected to be complete, utilizing an expository writing style, with correct spelling, proper grammar, appropriate tense, and professional formatting.

### ***Final Presentation & Paper***

The Final Presentations & Papers are to be fully documented with illustrations, citations and bibliography. (Examples of previous student work can be found in the course folder and should be used as reference only). Documentation and report for each student project should be unique to the selected site and project requirements. With the exception of sickness, injury, or family emergency, all late papers will be penalized by an automatic reduction of a half of a letter grade for each day thereafter.

### ***Sources and Citation***

Students are expected to seek out scholarly sources that consist of primary or secondary research written by technical experts or academics within the preservation field or a related field of study. It is stressed that students find sources that are current but also published from a reputable source. Sources can consist of books, archival research, and scholarly and/or peer-reviewed articles. Sources should be cited in Chicago or APA style. You can learn more about Citation Style through [Penn Libraries](#).

### ***Grading***

General	Class Attendance/Participation/Quizzes	10%
Site Project Submission #SP1	Archival Research & Material Characterization	5%
Site Project Submission #SP2	Drawing Set w/ Orthorectified Photography	5%
Site Project Submission #SP3	50% Draft & Presentation w/ Condition Drawing Set & Conditions Glossary	15%
Site Project Submission #SP4	Gravimetric Mortar Analysis	5%
Site Project Submission #SP5	Prioritized Conditions Report	10%
Site Project Submission #SP6	100% Final Draft – w/ Treatment Recommendations & Testing Program	30%
Site Project Submission #SP7	Final Report & Presentation	10%
Treatment Assignment #TA1	Masonry Cleaning	5%
Treatment Assignment #TA2	Mortar Formulation	5%

Grading will be in accordance with general academic policies: a grade of A/A- will represent exceptional work, B/B+ will represent good work that meets the academic standard set for the course, and B- will represent work that is just under the established standard. C and C+ are barely passing for graduate courses and will indicate work that is less than satisfactory. Failure to meet the minimum requirements will result in an F. All work is to be delivered on the dates described in the syllabus or agreed upon in class if changed. (It is generally assumed that graduate students devote a minimum of 2 hours of study for every hour of class- time per week. We would suggest reserving 6 hours of non-class time each week for the seminar.)

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### Course Schedule

<b>Class 1</b> (8/28)	<b>Course Introduction, Historic Masonry Building Technology &amp; Deterioration Mechanisms</b> Instructors: Casey Weisdock & Roy Ingraffia
<u>Location:</u> Laurel Hill Cemetery – Gate House 3822 Ridge Ave, Philadelphia, PA 19132	This session we will meet at the Laurel Hill Gate House. We will provide an overview of the course and students will be introduced to the course site projects and site representatives. Review of historic masonry building technology and masonry deterioration mechanisms.
<b>Class 2</b> (9/4)	<b>Review of Brick &amp; Terra Cotta Masonry Materials &amp; Conditions</b> Instructors: <b>Casey Weisdock</b> & Roy Ingraffia
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	This session will offer a review and more in-depth discussion on brick masonry materials and conditions. Case studies will be offered for conservation context. Hand samples will be reviewed.
<b>Deadline</b> (9/10)	Site Project Submission #SP1: Archival Research & Material Characterization
<b>Class 3</b> (9/11)	<b>Review of Stone Masonry Material &amp; Material Conditions</b> Instructors: Casey Weisdock & <b>Roy Ingraffia</b>
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	This session will provide an overview of natural stone materials along with conditions and stone conservation case studies. Case studies will be offered for conservation context. Hand samples and unique conditions will be reviewed.
<b>Deadline</b> (9/17)	Site Project Submission #SP2: Drawing Set w/ Orthorectified Photography
<b>Class 4</b> (9/18)	<b>Mortar Material Properties &amp; Formulations</b> Instructor: Roy Ingraffia & <b>Casey Weisdock</b>
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	This session will provide a brief review of mortar materials and technology timeline as well as an in-depth discussion of contemporary mortar materials and formulations. Specific attention will be paid to the role of mortar within wall assemblies.
<b>Class 5</b> (9/25)	<b>Masonry System Conditions, Project Site Working Session</b> Instructor: Casey Weisdock & <b>Roy Ingraffia</b>
<u>Location:</u> Laurel Hill Cemetery – Gate House 3822 Ridge Ave, Philadelphia, PA 19132	All masonry materials experience similar deterioration phenomenon and either due to inherent characteristics, environmental factors or secondary materials within the wall assembly. This session will provide an overview of these types of general and specific conditions and ways in which deterioration in particular can affect building performance as a whole. Time will be spent reviewing deterioration phenomenon.
<b>Recorded Lecture</b> – Field & Lab Analysis, Masonry System Conditions	<b>Introduction to Treatment Assignment #1: Masonry Cleaning</b> Students are required to view a recorded sessions that showcase both field and laboratory analysis techniques and instrumentation. This session will focus on effective methodologies for assessment

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	and repair of masonry facades. Through project case studies, the presenters demonstrate best practices for a successful approach to masonry repair, emphasizing the implementation of a project methodology that establishes general parameters for the project in the investigation and design phases that are refined during construction.
<b>Deadline – Quiz #1</b> (10/1)	After viewing the above recording, students will be required to complete and submit the quiz to the course instructors no later than 5 pm on Tuesday 10/1.
<b>Class 6</b> (10/2)	<b>Project Site Working Session</b> Identification and Documentation of Conditions Instructor: Roy Ingraffia & Casey Weisdock
<u>Location:</u> Laurel Hill Cemetery – Gate House 3822 Ridge Ave, Philadelphia, PA 19132	This will be an onsite class to allow each student group to further identify and document conditions. Instructors will be available to meet with each group at their individual site to assist in the process. This will also be your opportunity to retrieve mortar samples for SP4.
<b>Class 7</b> (10/9)	<b>Mid-Term Project Presentations</b> Instructors: Casey Weisdock & Roy Ingraffia
<u>Location:</u> Fisher-Bennett Hall / BENN24	Students will offer a brief overview of the site history, materials, material properties, and conditions. Feedback will be provided by the instructor, fellow students, and invited guests to be incorporated into the final report.
<b>Class 8</b> (10/16)	<b>Masonry Cleaning</b> Instructor: <b>Casey Weisdock</b>
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	This session presents the rationale and methodology for addressing cleaning of masonry substrates in both interior and exterior applications. Understanding how to approach and develop a proper testing program is the first step in determining which technique will clean the masonry while promoting long-term performance. This session will introduce current cleaning systems and describe their general performance and applications. Specific attention will be paid to chemical, micro-abrasive, and laser systems. Students will begin TA #1 - Masonry Cleaning Assignment.
<b>Deadline</b> (10/22)	Site Project Submission #SP3: 50% Draft w/ Condition Survey Drawing Set & Conditions Glossary
<b>Class 9</b> (10/23)	<b>Formulating Repair Mortars</b> Instructor: <b>Roy Ingraffia &amp; Casey Weisdock</b>
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	This session will build upon the information gathered from survey work, gravimetric, chemical, and instrumental analysis to develop repair mortar formulations. Mixing, application, protection, and

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	curing methods will be introduced.  <b>Introduction to Treatment Assignment #2: Mortar Formulation</b>
<b>Laser Cleaning Workshop</b> 10/25 – Friday 9am – 4pm	Laser Ablation Guest Instructor: Adam Jenkins
<b>Deadline</b> (10/29)	Site Project Submission #SP4: Gravimetric Mortar Analysis
<b>Class 10</b> (10/30)	<b>Mechanical Pinning, Grouting, &amp; Unit Repairs, Composite Repairs, Repointing Techniques.</b> Instructor: Casey Weisdock & Roy Ingraffia
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	In many instances historic masonry walls or materials require redesign or reinforcing to either stabilize or strengthen the materials or systems. These situations may arise from any number of reasons including poor original design or construction, damage due to seismic activity, or just general weathering and/or deterioration. This course will outline some of the most common scenarios and present a variety of current methods available to address the causes as well as the symptoms. Particular attention will be paid to pinning and grouting, & crack repair systems which have been designed for structural and non-structural applications.
<b>Class 11 – Hands-on Workshop</b> (11/06)	<b>Mortar Removal, Mortar Mixing, Repointing, Traditional Bricklaying, &amp; Composite Repairs</b> Instructor: Casey Weisdock & Roy Ingraffia
<u>Location:</u> <a href="#">IMI/BAC Training Center, 2702 Black Lake Pl, Philadelphia, PA 19154</a>  <u>Note:</u> Training center is the building located at the end of the cul-de-sac	This session is designed to provide the participants with practical experience in mortar removal, mortar mixing, repointing, traditional bricklaying, & composite repairs.
<b>Deadline</b> (11/12)	Site Project Submission #SP5: Prioritized Conditions Report
<b>Class 12 – Recorded Class</b> (11/13)	<b>Masonry System Repairs, Moisture Management, &amp; Thermal Upgrades</b>
	This session will focus on the necessary repairs moisture management such as flashing to address critical conditions and/or design flaws. Additional information will be provided on considerations for attempting thermal upgrades to historic masonry structures.
<b>Deadline – Quiz #2</b> (11/19)	After viewing the above recording, students will be required to complete and submit the quiz to the course instructors no later than 5 pm on Tuesday 11/19.



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<b>Deadline</b> (11/19)	Treatment Assignment #TA1: Masonry Cleaning
<b>Class 13</b> (11/20)	<b>Masonry Coatings &amp; Surface Treatments</b> Instructor: <b>Casey Weisdock &amp; Roy Ingrassia</b>
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	There are any number of traditional and contemporary coatings that can be used to address performance and aesthetic issues surrounding historic and existing masonry structures. These products range anywhere from hydrophobic coatings used to minimize water infiltration, to consolidants used to strengthen the surface of weathered masonry; brick, terra cotta, & natural stone. This session will introduce general types of coatings, their properties/chemical composition, methods of application, and performance. Particular attention will be paid to the processes which cause conditions that may warrant the use of a surface coating as well as when these types of products should and should not be used.
<b>Deadline</b> (12/3)	Treatment Assignment #TA2: Mortar Formulation
<b>Class 14</b> (12/4)	<b>Final Site Project Presentations</b> Instructors: Casey Weisdock & Roy Ingrassia
<u>Location:</u> Architectural Conservation Lab Duhring Wing 051	Students will offer a brief overview of the site history and conditions as well as on the treatment recommendations and testing program that has been developed. Feedback will be provided by the instructor, fellow students, and invited guests to be incorporated into the final report.
<b>Deadline</b> (12/11)	Site Project Submission #SP6: 100% Draft Reports (These documents will be reviewed and returned by 12/15 with suggestions and comments which should be incorporate into your Final Reports).
<b>Deadline</b> (12/19)	Site Project Submission #SP7: 100% Final Reports

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### **Textbooks:**

There are no mandatory books for you to purchase for this course however, the reserved books listed below will be primary resources for the course and invaluable in your careers.

### **Reserved Reference (Fisher Fine Arts):**

- Henry, Alison. Stone Conservation, Principles and Practice. Dorset: Donhead, 2006.
- Henry, Alison, and John D Stewart. Earth, Brick & Terracotta. Practical Building Conservation. Farnham: Ashgate Publishing, 2012
- Henry, Alison, and John D Stewart. Mortars, Renders & Plasters. Practical Building Conservation. Farnham: Ashgate Publishing, 2012
- Odgers, David, and Catherine Croft. Concrete. Practical Building Conservation. Farnham: Ashgate Publishing, 2012
- Odgers, David, and Alison Henry. Stone. Practical Building Conservation. Farnham: Ashgate, 2012.
- Siegesmund, Siegfried, and Rolf Snethlage. "Stone in Architecture: Properties, Durability". Springer 2014

### **Digital Reference:**

#### **Websites:**

Pennsylvania Department of Conservation and Natural Resources  
Bureau of Topographic and Geological Survey  
<http://www.denr.state.pa.us/denr/deputate/topogeo/default.htm>

Geological Society of America  
<http://www.geosociety.org/>

Natural Stone Home Page for the Stone Industry  
<http://www.natural-stone.com/>

Mineralogy and Petrology Research on the Web  
<http://www.udayton.edu/%7Egeology/resminpet.html>

US Geological Survey-Geological Information  
<http://geology.usgs.gov/>

Building Stone of the United States: the NIST Test Wall  
<http://stonewall.nist.gov/>

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Stone Quarries and Beyond

<http://www.cagenweb.com/quarries/index.html>

### **A Glossary of Historic Masonry Deterioration Problems and Preservation Treatments:**

<https://npshistory.com/publications/preservation/masonry-glossary.pdf>

### **Publications:**

- Doehne, Eric. and Price, Clifford. Stone Conservation, An Overview of Current Research. Los Angeles: Getty Conservation Institute, 2010.

[http://www.getty.edu/conservation/publications\\_resources/pdf\\_publications/pdf/stoneconservation.pdf](http://www.getty.edu/conservation/publications_resources/pdf_publications/pdf/stoneconservation.pdf)

- Twentieth-Century Building Materials: History and Conservation  
[https://www.getty.edu/conservation/publications\\_resources/books/20th\\_cent\\_building\\_materials.html](https://www.getty.edu/conservation/publications_resources/books/20th_cent_building_materials.html)

- ICOMOS-ISCS :Illustrated glossary on stone deterioration patterns:

[http://www.icomos.org/publications/monuments\\_and\\_sites/15/pdf/Monuments\\_and\\_Sites\\_15\\_ISCS\\_Glossary\\_Stone.pdf](http://www.icomos.org/publications/monuments_and_sites/15/pdf/Monuments_and_Sites_15_ISCS_Glossary_Stone.pdf)

- NYC Buildings – FAÇADE CONDITIONS: An Illustrated Glossary of Visual Symptoms

<https://www1.nyc.gov/assets/buildings/images/content/misc/FacadePresentation.pdf>

### **Bibliography:**

A fairly comprehensive masonry bibliography will also be provided at the beginning of the course.

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### **PROJECT SITES**

#### LAUREL HILL CEMETERY

Address: 3822 Ridge Ave, Philadelphia, PA 19132

Phone #: (215) 228-8200

#### **Site Access:**

Site Manger: Bill Doran ([pjd@forever-care.com](mailto:pjd@forever-care.com))

Cell: 610-960-4899

#### **Archival Information:**

Beth Savastana ([bsavastana@laurelhillphl.com](mailto:bsavastana@laurelhillphl.com))