

HSPV 739-301 SEMINAR IN ARCHITECTURAL CONSERVATION: MASONRY

Graduate Program in Historic Preservation/University of Pennsylvania

Fall 2021 / Wednesday 8:30 am-11:30 pm EST/ Meyerson B6

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Course Description & Approach

This course will focus on understanding in greater detail the conditions associated with masonry materials and system deterioration and the current methods of analysis and treatment repair. Particular attention will be paid to a variety of masonry (stone, brick, terra cotta, mortar, tile, and terrazzo) and its use as a material (architectural and sculptural) and building envelope wall systems (structural/performance) (*Note: Concrete will not be covered in Fall 2021 as Frank Matero will be offering a springtime elective on Concrete Conservation*). Specific types of instrumental/field analysis and intervention methods/materials will be discussed within the context of conservation problem solving. The concept of craft will also be discussed as it relates to both original construction and repair techniques.

There are several factors that have aided in the large quantity of masonry used in building construction, particularly within the latter half of the 19th century and early 20th Century in the United States. The abundant variety of masonry materials, the ability to manufacture and transport that material efficiently, coupled with a skilled labor force, allowed masonry to be an economical and aesthetic choice for architects and builders.

The historic context in which masonry has been used is relevant to the behavior of individual materials and the manifestation of conditions over time. Much of what is considered visible deterioration can be attributed to any number of intrinsic and extrinsic factors including the ways in which the masonry was formed/manufactured, method/placement during installation, associated building materials/features, and interaction with the environment. All of these factors must be taken into account when understanding behavior of masonry and developing a strategy for conservation.

Aside from understanding the properties of masonry, basic principles of deterioration, and the methodology behind developing an analysis & treatment program, it is essential to recognize that each conservation project comes with a set of parameters. These parameters may come in the form of physical restrictions or limited project resources, however, in many cases what appear to be constraints can aid in guiding the project approach.

The first half of the course will offer a more in-depth introduction to masonry materials, quarrying/manufacturing, construction technologies, deterioration, and methods of instrumental analysis. The second half of the course will focus on treatment and repair of masonry buildings and monuments as well as post-treatment analysis. Lab and field exercises along with individual and group projects will be offered to supplement the lectures and to provide more practical experience for the students.

At the end of the course, students should have a grasp on how to identify, analyze, and record masonry conditions, select methods to evaluate level of deterioration, develop strategies for repair and recognize

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potential project parameters. In addition, students will be further introduced to the role of conservator within a larger project structure, implementing treatments, and communicating with consultants, design professionals, and masonry craftworkers.

Course Requirements

Attendance

Attendance is required for all scheduled classes, mid-term and final presentation sessions, unless permission for missing a class has been granted by the instructor in advance.

Recordings

In order to maximize in-person class time and offer praxis exercises, students will be provided access to recordings of past lectures. Students will be required to watch these 3-hour lectures to better engage in the material. Recordings of each class session will be made available for all enrolled students within a week of the regularly schedule class time.

Participation

As a seminar, all students are expected to participate equally beginning with class attendance, discussion participation, and contributions of individual and 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/>

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 PPE protocol and material handling/disposal must be followed and you will be evaluated based on your compliance. 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 distinct features and materials has been pre-selected for this project. Each student will prepare and conduct (***Note: all assignments should be submitted to the corresponding folders on JUNO in PDF format compressed to the lowest possible file size without resulting in reduced legibility***)

- Brief archival research on construction and treatment/maintenance history on their assigned portion of the structure.
- Drawing Set w/ Ortho-rectified photo-elevations – Initial CAD drawing set w/ elevations, plan (& roof plan if applicable), along with orthorectified photographic elevations.
- Gravimetric mortar analysis w/ recommended repair formulation (Mortar Lab).
- Graphic condition survey drawings set. – Drawing set with conditions layers.

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- Graphic conditions glossary using ISC glossary (following the aforementioned group standards).
- Materials characterization (including decay phenomena).
- Prioritized conditions report (narrative of deterioration).
- Treatment recommendations & potential treatment testing program with preferred treatment options. (Treatments and intervention approaches must be backed up by a literature review that cites other case studies or research relevant to the issues. It must be clear in your report why certain treatments have been selected for testing.)

Mid-Course Submissions

There are several benchmark deadlines for site projects and lab assignments throughout the course of the semester. Take a close look at the schedule and plan your time accordingly to ensure these deadlines are met.

Final Presentation, Paper & Project Sheet

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 or personal death, all late papers will be penalized by an automatic incremental drop in a half grade for each day late.

Grading

Class Attendance/Participation		10%
Site Project Submission #SP1	Archival Research & Drawing Set w/ Orthorectified photography	5%
Site Project Submission #SP2	Material Characterization	5%
Site Project Submission #SP3	Gravimetric Mortar Analysis	5%
Site Project Submission #SP4	Condition Drawing Set & Conditions Glossary	5%
Site Project Submission #SP5	50% Draft & Presentation	10%
Site Project Submission #SP6	Prioritized Conditions Report	10%
Site Project Submission #SP7	100% Final Draft – w/ Treatment Recommendations & Testing Program	30%
Site Project Submission #SP8	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

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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. This would suggest reserving 6 hours of non-class time each week for the seminar.)

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Course Schedule

Class 1 - Off Campus Class/Site-Visit (9/1)	Course Introduction & Review of Stone Masonry Materials
<p>Location: West Laurel Hill Cemetery 225 Belmont Ave, Bala Cynwyd, PA 19004</p> <p>Google Maps Link: https://goo.gl/maps/VkoghgP68q92</p> <p>Directions to Conservatory: Enter Main Gate on Belmont Avenue (immediately across from softball field) Proceed straight through 2 sets of gates After 2nd set of gates, continue another approx. 150 yards to T-intersection. Turn left at T-intersection and follow signs and red reflectors to Conservatory!</p>	<p>This session will provide an overview of the course and offer a review and more in-depth discussion on stone masonry materials. Case studies will be offered for conservation context. Students will be introduced to their individual site projects.</p>
Class 2 (9/8)	Review of Fired Clay Masonry Material & Historic Masonry Building Technology
Meyerson B6	This session will build upon the previous class discussion to include a review of historic brick and terra cotta materials as well as their incorporation into historic building technologies. Case studies will be offered for conservation context.
Deadline (9/14)	Site Project Submission #SP1: Archival Research & CAD Drawing Set
Class 3 (9/15)	Masonry Material Conditions & Analysis
Meyerson B6	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 as well as analytical techniques.
Class 4 - Off Campus Class/Site-Visit (9/22)	Laurel Hill Working Session Identification and Documentation of Conditions
<p>Location: Laurel Hill Cemetery Gatehouse 3822 Ridge Ave, Philadelphia, PA 19132</p> <p>Google Maps Link: https://rb.gy/kt9rim</p>	<p>This will be an onsite class to allow each student to begin identifying and documenting conditions. We will review some other sites as examples and then each student will go to their individual site. I will be available to meet with you one-on-one to assist you in the process. This will also be your opportunity to retrieve mortar samples for SP3.</p>
Class 5 - Prep Pre Recorded Session (to be viewed prior to 9/29)	Mortar Material Properties & Conditions
	This session will provide a brief review of mortar materials and

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	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 and ways in which mortar deterioration can occur and effect building performance as a whole.
Deadline (9/28)	Site Project Submission #SP2: Material Characterization
Class 5 (9/29)	Instrumental & Chemical Analysis of Mortars & Cast Stone Guest Instructor: George Wheeler
Architectural Conservation Lab	Building on the petrography performed in conservation science, this class explores the texture and composition of mortars and cast stone. Employing a polarizing light microscope and using basic optical properties, students will learn to identify and describe aggregates and binders that will help to place the material in an historical context and assess the performance of the material.
Deadline (10/05)	Site Project Submission #SP3: Gravimetric Mortar Analysis/Characterization
Class 6 (10/6)	Masonry System Conditions & Analysis Guest Instructors: Rachel Will and Ed Gerns. WJE
Meyerson B6	This session will focus on effective methodologies for assessment 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.
Deadline (10/12)	Site Project Submission #SP4: Condition Survey Drawing Set & Conditions Glossary
Class 7 (10/13)	Mid-Term Site Project Presentations
Meyerson B6	This session is dedicated to providing mid-term support and guidance as it relates to the individual site projects. Students will offer a brief presentation showcasing their research, documentation, & analysis to-date. While these are informal presentations, it is highly recommended that the presentations and information be formatted in a professional manner. Feedback will be provided by the instructor, fellow students, and invited guests.
Deadline (10/19)	Site Project Submission #SP5: 50% Draft
Class 8 (10/20)	Masonry Cleaning
Meyerson B6	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

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	<p>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.</p> <p>Introduction to Treatment Assignment #1: Masonry Cleaning</p>
Class 9 (10/27)	Masonry Coatings & Surface Treatments
Meyerson B6	<p>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, & concrete. 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.</p>
Deadline (11/02)	Treatment Assignment #TA1: Masonry Cleaning
Class 10 (11/03)	Formulating Repair Mortars & Grouts, & Repointing
Meyerson B6	<p>This session will build upon the information gathered from survey work, gravimetric, chemical, and instrumental analysis to develop repair mortar formulations. Given the similarity of materials, proprietary and custom composite repair materials will also be discussed as well as grout material. Mixing, application, protection, and curing methods will be introduced.</p> <p>Introduction to Treatment Assignment #2: Mortar Formulation</p>
Deadline (11/9)	Site Project Submission #SP6: Prioritized Conditions Report
Class 11 (11/10)	Masonry System Repairs, Flashing & Detailing, Mechanical Pinning, & Unit Repairs Guest Instructors: Rachel Will and Ed Gerns. WJE
Meyerson B6	<p>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</p>

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	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.
Class 12 (11/17)	Tile & Terrazzo – Conservation and Repair Guest Instructor: Casey Weisdock, IMI
Meyerson B6	Ceramic tile and cementitious terrazzo have served both decorative and functional purposes for centuries. We will discuss history of manufacture, installation, performance, deterioration, and restoration of these materials. Since floor and wall materials typically experience the most wear in a building, a particular focus will be on the unique maintenance and repair practices of tile and terrazzo.
Deadline (11/30)	Treatment Assignment #TA2: Mortar Formulation
Class 13 (12/01)	Laser Ablation Workshop Guest Instructor: Adam Jenkins
Architectural Conservation Lab	Half-day workshop on the use of Nd:YAG laser systems to clean architectural materials. Includes a lecture on how laser cleaning works and descriptions of both low frequency (fixed optic) and high frequency (scanning optic) systems. This will be followed by a short practicum where students can test both types of system on sample materials.
Class 14 (12/8)	Final Site Project Presentations
Meyerson B6	Students will offer a brief overview of the conditions that they presented at the mid-term to refresh the class on the major issues at play. The presentation, however, should focus specifically 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.
Deadline (12/15)	Site Project Submission #SP7: 100% Draft Reports (These documents will be reviewed and returned by 12/18 with suggestions and comments which should be incorporate into your Final Reports).
Deadline (12/21)	Site Project Submission #SP8: 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:

- 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
- 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
- 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.