



PHYSICAL STRATEGIES – NON STRUCTURAL INTERVENTIONS FABRIC INTERVENTIONS

This session was created by Mike Taylor and modified by Claudia Cancino.

ABSTRACT

There are a variety of methods that can be used to stabilize and preserve earthen walls. It is common practice to use similar/compatible material to reintegrate or structurally stabilize wall bases deteriorated by capillarity action or vegetation, or upper parts of walls deteriorated from the effects of rain or snow. There is also the possibility of applying consolidants to the earthen surfaces or placing sacrificial layers to protect entire elements.

All of these types of fabric interventions first require a preliminary condition assessment before applying any of them. It is important to point out that it is better to mitigate the cause of deterioration on site than to apply a method to mitigate its consequences. Even further, sometimes it is not necessary to intervene at all, considering that any kind of action can have a negative side effect on the condition of the treated earthen element or an indirect impact on other aspects of the site. On the other hand, sometimes more than one intervention and complementary treatments are necessary.

There is an extensive body of literature regarding the different techniques for fabric interventions for the preservation of earthen sites. There is no need for detailed explanation of each technique for this class, however there are a few theoretical points that are important to emphasize:

- While deciding on an intervention, it is important to also look into the many traditional techniques that have been applied in different regions of the world
- The use of a material with similar physical and chemical characteristics is preferable to assure material compatibility.
- The use of new materials is allowed when enough research and testing have proved no future damage to the original material results.
- The sustainability of any treatment should be considered as well as the proper maintenance and monitoring program.

For the purpose of this session, capping and sacrificial rendering will be further detailed. Capping techniques are interventions used to protect the tops of exposed earthen walls at archaeological sites. Sacrificial renders of earthen plasters or amended earthen plasters are intended to protect original vertical wall surfaces, which undergo weathering from rain and wind.

OBJECTIVES

As a result of this session, the participant should be able to:

Classroom Lecture:

- Identify and understand the various interventions that can be implemented on an earthen archaeological site or historic building that directly impact the site's physical fabric
- Present the positive and negative impacts for each type of intervention
- Understand the effect of environmental conditions while using different techniques
- Understand the field of expertise needed for each type of intervention



- Understand the principles involved with capping techniques and sacrificial renders used to retard the erosion of exposed earthen walls at archaeological sites

Field Exercise:

- Gain familiarity with materials and techniques used for capping and the use of sacrificial layers in the preservation of archaeological sites

CONTENT

Classroom Lecture:

The material presented in this session will illustrate the potential interventions available to preserve the physical fabric of an earthen building or structure as a response to the analysis of its needs.

It will be stressed that there is not a proscriptive response that can be used across the board for preservation. Each situation must be evaluated individually as to the positive and negative impacts of any response considered.

It will also be stressed that environmental conditions, such as local precipitation and temperatures can have different effects on how a particular intervention performs over the short and long term.

Technical expertise, knowledge, and experience of the persons implementing the response will also be discussed in terms of efficacy of various interventions.

The numbers of interventions that can be used are endless. The intent of this session is to present examples of the various response techniques available and to focus mainly on capping and the use of sacrificial renders.

The instructor will present information and stimulate discussions on the following topics:

Archaeological sites

- Overview of resource and types of problems
- Illustrated survey of problems and treatments
 - Bases
 - Caps
 - Vertical surfaces
- Structural integration
- Sacrificial surface treatments
- Emergency stabilization/protection
 - Sandbagging
 - Reburial
 - Shoring
 - Temporary shelters

Historic Structures

- Overview of resource and problem types
- Illustrated survey of resource types
- Illustrated survey of problems and treatments



- Settlement
- Incomplete building envelope
- Inappropriate use
- Differentially loaded walls
- Overturning
- Inappropriate alterations
- Emergency measures
- Chemical treatment for consolidation
- Natural or traditional treatment for consolidation

Capping techniques for exposed earthen walls

- Explain, phenomena of softer sacrificial caps versus harder impervious caps.
- Explain effects of caps with overhangs and drip edges versus those flush with the vertical surface of the wall
- Capping material options
 - Un-amended mud plaster in successive layers
 - Amended mud plaster in successive layers
 - Un-amended mud brick caps
 - Stabilized mud brick caps
 - Brush or straw secured in place with mud on top
- Concepts:
 - Aesthetics
 - Maintenance

Sacrificial renders

- Explain and demonstrate the benefits (and any negative impacts) of applying sacrificial renders
- Issues of aesthetics and philosophy of hiding the original fabric from view, if the protection justifies hiding of the resource?
- Sacrificial render options:
 - Unamended earth plaster (various types)
 - High clay (benefits, drawbacks)
 - Types of clay, types of aggregates
 - Naturally amended earth plasters
 - Lime water
 - Calcium carbonate rich
 - Plant mucilage
 - Addition of vegetal material (ie. straw)
- Maintenance cycles based on types of renders

Field Exercise:

This is a workshop activity with demonstrations by the instructor and assistants, followed by hands-on exercises by the participants who will be divided into teams. The exercise will last four hours. The first half of the exercise will involve demonstrations and participant installation of capping systems. The second half of the exercise will involve demonstration and installation of sacrificial renders systems. Capping applications and sacrificial renders are two independent preservation options and do not necessarily have to be covered together in this exercise. The exercise can easily be split into two separate sessions, based on the desire of the instructor and the goals of the curriculum.



Participants should be made aware that the systems installed during the exercises should be used on archaeological sites only if deemed appropriate after the requisite analysis and condition assessments. The instructor should emphasize throughout the exercises that any technique used will need to be based on previous sound planning and analysis of the conditions at any given site.

In support of these objectives, the instructor will lead the exercises in a way that builds on the earlier classroom lecture describing the various uses of, and reasoning for, capping and sacrificial render techniques used at various sites regionally and internationally.

The field exercise will be undertaken at new test walls built for this exercise. Through practical exercises, participants will install various capping and sacrificial render systems in order to gain a familiarity with materials used, implementation techniques, and positive and negative aspects of each type of intervention.

If a test wall plot is used as the venue for the exercises, such a plot should have dimensions large enough to accommodate five teams of participants with at least ten small walls. However, if exposed historic walls at archaeological sites have been identified through analysis and proper planning and are in need of a particular capping or sacrificial plaster intervention, then these types of walls can be considered for testing. Any disturbance to archaeological fill material in association with the walls will need to be mitigated by a qualified archaeologist. Likewise, if a garden or corral earthen wall in association with an historic site has been identified as a potential resource for applying the systems, these walls can be used as well.

Capping exercise:

Eight adobe brick walls, each 6 meters in length by two meters in height, will be needed for this exercise.

Demonstration

A flip chart will be available to illustrate any points of the demonstration to the whole group.

A demonstration of six capping techniques will be provided to the group on two demo walls, each 6 meters long, by two meters high. Each individual capping technique used will be two meters in length. The caps will be the following:

- Un-amended mud plaster cap
- Un-amended mud brick cap
- Stabilized brick cap
- Pitched roof cap
- Ceramic tile cap with overhang
- Brush and straw cap

One demo wall will have already had the caps applied to it two weeks earlier so that the caps will have fully cured. Each cap will be explained. Water will be introduced to the tops of the walls by way of a horizontally suspended hose that will apply water evenly to the tops of the walls in order to demonstrate the efficacy of the capping systems. At the end of the accelerated weathering, differential erosion patterns will be noted and discussed.



Figure 5.2.1 (left) and 5.2.2 (right)
Left: View of demonstration walls for capping and rendering
Right: Capping demonstration wall after accelerated weathering
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Hands-on exercise

Participants will be divided into five groups of four participants each, with an assistant instructor for each group.

The instructor, with the help of the assistants, will install the six capping techniques on another six meter long demonstration wall, explaining the methodology for each system. Each group will rotate to each of the six walls, working on a specific capping technique on each wall. The six capping techniques to be applied are those listed above.



Figure 5.2.3 (left) and 5.2.4 (right)
PAT students capping test walls with different methods
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Sacrificial renders exercise:

Demonstration

One demonstration wall, 6 meters long and 2 meters high, will have already had the renders applied to it two weeks earlier so that the renders will have fully cured. Each render will be explained. Water will then be sprayed evenly to the entire vertical



surfaces of the wall by way of three hoses mounted on a bracket five feet in front of the wall, and equidistant apart in order to demonstrate the efficacy of the render applications. By the end of the accelerated weathering, differential erosion patterns will be noted and discussed.

A demonstration of the six sacrificial renders will then be applied by assistant instructors with the help of participants to another demonstration wall, 6 meters long and 2 meters high. The renders to be applied are the following:

- Un-amended earth plaster high in clay (with straw on one side, without on the other)
- Un-amended earth plaster high in sand, (with straw on one side, without on the other)
- Earth plaster amended with calcium carbonate (high ratio on one side, weaker ratio on the other)
- Acrylic modified earth plaster (high ratio on one side, weaker ratio on the other)
- Lime plaster (high in aggregate on one side, high in fines on the other)
- Earth plaster amended with cactus mucilage (high ratio on one side, weaker ratio on the other)

Note: the instructor has the option to choose whatever type of amended plaster is deemed appropriate to demonstrate.



Figure 5.2.5 (left) and 5.2.6 (right)

Right: Partial view of demonstration wall for rendering exercise
Right: PAT students observing the performance of sacrificial renders under weather acceleration
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Teaching Tips

It is important to be flexible with this exercise. If the instructor feels that other capping and sacrificial render systems that are used in the region would be more applicable for the exercises, then they can be added to, or substituted with, the exercises presented here.

It is also important to have all the supplies, materials, and tools needed for the exercises close at hand so that there is minimal down time for the participants. The water drip system for the capping wall and the vertical spray hoses for the tests on the sacrificial plasters should be fully installed and tested before the exercise begins.





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