The radical transformation of the palette of materials available to the popular classes after the Second World War implied a long learning process to handle these materials, given specific sociocultural constraints. This provoked ruptures with existing vernacular practices, further modified by new urban and territorial realities. In many cases, especially in the global south, there were attempts to reinterpret vernacular form in the new technique, while former material traditions were frequently lapsed or forgotten, and existing and potential heritage buildings fell into disrepair. Thus, urban and rural habitats were grossly modified even when emplacements and lot distributions remained, but iterations of both modernity and tradition transformed many places beyond recognition. In this presentation, examples taken from practices in Puerto Rico will be used to demonstrate the attempts in postwar popular building to reinterpret traditional vernacular spatial patterns, especially the balcony or veranda which is the most significant visual presence of domestic Puerto Rican architecture, as well as the multiple-door layout in commercial construction. Roofs and building silhouettes were, though, more altered because of the pragmatic imperative of using flat roofs, which has a more complex justification than what is generally admitted. The substantial transformation of builders, from artisans with near-total control of the process of materials handling from source to finished product, into bricoleurs of industrialized components, has also affected the practice of vernacular building, especially with windows and doors. Finally, the advent of affordable climate-modifying equipment allowed popular builders to disregard climatic imperatives to some degree. The inherent nomadism of peasantry was also curtailed by the widespread distribution of small landholdings and a virtual urbanization of daily life. The conversion of former landless peasants into petty, sessile landholders had an effect in the symbolic vocabulary of houses and shops: ornamentation was massively introduced as part of vernacular construction practice. These transformations of vernacular have had posterior impact on managed historic districts (outside San Juan’s walled city, which was designated before it could be massively transformed) that have been created from 1986 onwards. The search for an adequate harmonization of newer, noncontributing structures or new infills has been fraught with difficult decisions while the recovery of older traditional technique - to save older building stock - has started haltingly. Summing up, the possibilities of a newer vernacular tradition in Puerto Rican building (which mirrors much of what happens elsewhere in the Caribbean and parts of Latin America) are in a very tentative stage with timid attempts at formal reinterpretation which cannot be discussed without pondering the socioeconomic transformation of the last two-thirds of a century.

The holistic paradigm for a robust vision plan is grounded in the process of defining values that are considerably broader and more dynamic than those traditionally used. Moreover, the paradigm can help produce a number of important outcomes. For example, it can help generate community consensus by enabling the extended preservation team to determine and tell the stories of change about the property - stories that will engage the audiences that visit these site. It can also help us test assumptions rigorously by fostering a deeper understanding of authenticity. And, ultimately, it can help preservation teams design and deliver a more comprehensive approach to preservation activities and thus, in the end, this paradigm can encourage long-term sustainability. The proposed presentation will model the new paradigm by describing three historic vernacular sites where the extended preservation team—the owners, funders, community members, and professionals—all embraced a vision that enabled them to plan effectively for the future despite tough economic times. The three sites are a Tavern in the rural Pinelands of southern New Jersey, a lighthouse station on a remote island off the coast of Maine, and a vernacular historic house set in a highly suburban area of northern New Jersey. In each of these three cases, the stakeholders—the property stewards, the community members, and professional preservation team—built an engaging yet practical vision plan for the long-term as well as the near-term. Specifically, this presentation will describe the project road maps created and the tools used for each site. For example, in all three cases, the extended group of stakeholders used the Management Guidelines for World Cultural Heritage Sites to ask and answer important questions regarding authenticity, the timeline of historic and physical change, and the dominant values of the property. In addition, they leveraged creative approaches to activities like brainstorming, designing surveys and questionnaires, encouraging community involvement, and fostering good collaboration with the multi-disciplinary professional teams. Some of the professional teams included—along with preservation architects, structural engineers, and material conservators—some “non-traditional” but highly effective members: oral historians, market researchers, museum and educational consultants, and so on.
Between 1900 and 1930, Cleveland, Ohio grew to become the 5th largest city in the United States, with over 900,000 residents. The rapid influx of immigrants migrating to the city combined with the substantial wealth of founding families, had a lasting effect on the food, culture, heritage and architecture of the Cleveland area. Today, residents of the city celebrate this heritage, and embrace the legacy left behind from the immigrants and captains of industry that so heavily influenced the culture. Along the streets of Cleveland, you will find superb architectural examples of turn of the century housing styles built during the city’s boom, alongside vernacular homes. Worker’s cottages and the Cleveland Double are sprinkled among the Italianates and Victorians on Cleveland’s west side. The east side boasts strong examples of revival style architecture alongside Western Reserve farm houses and even more Cleveland Doubles. The Cleveland Double may be the most significant reminder of the immigrant population of the past and is also a vernacular housing style developed in the region. In later years, the post-war housing boom took hold of suburbs outside the city, and large communities of tract homes, mid century ranch homes and split levels were built and remain intact communities. In order to help maintain this diverse housing stock, create neighborhood identity, and provide homeowners with the tools for repairing older homes, the Cleveland Restoration Society developed the Heritage Home Program (HHP). A goal of the HHP is to foster an appreciation of neighborhood history as told by its architecture whether the building be an aluminum sided bungalow or a high style Gothic revival. This program began 24 years ago in two historic districts and has grown to 42 communities across the region. Using a preservation approach, combined with financing tools and impartial technical advice, the program has helped over 10,000 homeowners with projects valued at $214M and financed over $5M loans to over 1,300 homes. Economic studies generated by Cleveland State University have now proven the value of the program, and documented how homes that utilized the program had 1/10th of the foreclosure rate compared to homes across the county. The HHP seeks to find compatible exterior building materials and approved preservation products that will maintain architectural integrity, while solving maintenance and repair problems. This presentation aims to share our success in preserving residential structures and neighborhoods, with a focus on the vernacular, while discussing the challenges of renovating these homes with contemporary materials. The presentation will take a close look at the residential rehabilitation of worker’s cottages, Cleveland Doubles and the Western Reserve farm houses that have participated in the program and how they have been adapted for modern living.

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<tr>
<th>CS5.1</th>
<th>With Soft-Woven Spanish Names: Assessing Historic Preservation Programs In South Texas Border Towns</th>
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Border towns along the Rio Grande have been neglected in preservation studies and implementation, which generally focus on resources in urban areas. Because many of the tools used by the preservation community were first developed for use in cities (for example, historic district designation) these techniques have the greatest impact in communities with municipal governments, access to diverse financial resources, and high population density. Rural communities of the South Texas border region possess conditions that hinder implementation and support of these traditional historic preservation programs. In some cases, unincorporated, small, or rural communities lack the local regulatory authority required to enact and enforce preservation ordinances and zoning. Furthermore, communities with low population densities may not possess adequate budgetary or technical resources to support preservation programs. Many of these impediments result from the unique geography, culture, and settlement patterns of Texas expressed through class, ethnicity, and economics. In particular, the rural characteristics of the region present barriers for evaluating historic preservation strategies using traditional methods developed for urban environments. Consequently, the problems encountered by preservationists in South Texas will remain ill defined and difficult to solve until applicable techniques for identifying them are established. An examination of historic preservation activities in four South Texas border towns with historic districts reveals a range of accomplishments although they have similar characteristics—low population, mostly Latino; high poverty; and between 72 and 83 percent farmland. Despite competition for financial resources from other priorities—funding police and fire departments, street maintenance, waste collection, and parks and recreation—even economically disadvantaged communities conduct effective preservation programs beyond identifying historic resources. Towns with a combined infrastructure of county and municipal preservation commissions working alongside private preservation societies are most productive. Collaboration with conservation and parks supporters also benefits historic preservation. Programs empowering local preservationists, such as implementing a university-sponsored, preservation extension service that provides expertise and educational programs, are recommended over sole reliance on transitory outside experts. Research reveals that the most successful local preservation programs utilize outside funding to catalyze local preservation initiatives. Outside funding sources include state and federal grants and private donations, sometimes coupled with matching funds generated by sales tax revenue or permit fees. Soliciting and managing these funds requires local leaders who apply for grants, seek donations, and lobby for historic preservation programs. Among the most effective of these leaders are city managers and local and county economic development corporations because they promote public-private partnerships and provide financial support and expertise for a variety of projects from commissioning preservation plans to purchasing and restoring historic buildings.

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<td>CS5.2</td>
<td>Characterization and Comparative Analysis of Earthen Plasters from the American Southwest</td>
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<td>Characterization and Comparative Analysis of Earthen Plasters from the American Southwest</td>
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The Pueblo people of the southwestern United States have traditionally used earthen materials for building and architectural embellishment. Structures over a thousand years old built and decorated with earth are likely to have been constructed using some of the same materials and practices still in use today. This paper focuses on the characterization of ancient earthen plasters/renders at three Puebloan sites associated with the Sinagua, Cedar Mesa, and Hohokam peoples. The sites include a defensive, multi-room alcove structure at Montezuma Castle (AZ); a kiva used for textile production at Bare Ladder Ruin in Natural Bridges National Monument (UT); and a multi-story puddled earth structure, possibly intended for ceremonial use, at Casa Grande National Monument (AZ). Primary periods of occupation were between the 11th and 14th centuries. In addition to presenting the results of plaster characterization at each of the sites, this paper will discuss the analytical techniques used to examine small samples, the range of results that can be obtained, and evaluate the benefits/limitations associated with each. Earthen plasters and mortars were used extensively in the construction of ancient southwestern masonry architecture, including for leveling and finishing walls; as the closing courses for embedded roof frame elements; for pointing unit masonry in the margins at the tops of walls and around niches and recesses; as chinking between primary vigas (beams) used in roof construction; as a multi-coat floor surfaces; as a final finish for roofs; as colored washes; and as a ground for incised and painted embellishments. Though these plasters differ in terms of material components and the contexts in which they were used, they share characteristics that provide clues as to how materials were selected, processed, and applied. Analysis of plasters and mortars typically requires combining petrographic analysis with aggregate characterization following acid digestion of binder constituents in a bulk sample (ASTM C 1324-05). Aggregate characterization includes determination of aggregate type and proportion, particle morphology, size distribution, mineralogy, chemical reactivity, and source. Obtaining bulk samples of ancient building materials is often impossible. Combining microscopy with computer-assisted image analysis allows for a fairly detailed characterization of ancient plasters and mortars based on relatively small samples. In these circumstances, image analysis of photomicrographs can yield important information on volumetric proportions of aggregates, matrix, void space, grain size and pore distribution, and particle morphology. In these Ancestral Pueblo sites, sample sizes were small to limit impacts on integrity. Analysis made maximum use of optical microscopy, X-ray diffraction, SEM/EDS, and image analysis, and included investigation of multi-coat plaster systems; application methods; clay mineralogy, soluble salts, and other components; physical characteristics affecting performance; deterioration conditions; surface accretions (soot and biological growth); and surface embellishment.

CS5.2  Historic Preservation, Self-Determination, and the Cultural Resiliency of Traditional Pueblo Villages

The living cultures of the Pueblo tribes of the American southwest maintain the oldest traditions of architecture in the United States. Many of the villages have been in their current locations since time immemorial, with several known to have been occupied for more than 1,000 years. The homes have undergone countless cycles of growth, contraction, and alteration. Maintenance of their earthen walls and roofs was woven into the tribal traditions, and the homes were understood to be of the living earth. When a structure outlived its usefulness, it returned to the earth and was built anew. Over the last half-century two distinct changes in place and material have had a significant impact on the use and condition of the traditional adobe homes—the provision of HUD housing and the application of Portland cement, which have resulted in increasing deterioration and abandonment. Advances in self-determination policy have recently enabled the Pueblos to develop plans to renew their historic villages according to their own heritage values. Some Pueblos are renowned for resistance to change, while other view preservation with great skepticism. What most tribes seek is revitalization, not “preservation” as defined by the federal government. Most seek to extend the palpbility of the past, but many are just as, if not more, interested in meeting the needs of modern life in these ancient places. This paper summarizes the results of a two-year study of the physical conditions and place-based revitalization approaches of the Pueblos, as well as the completion of a decade-long preservation planning and rehabilitation project at Ohkay Owingeh. Seen through the lenses of “traditional cultural place” and values-based preservation approaches, these various (and conflicting) responses to the dilemmas of preserving a vernacular tradition of impermanent materials have much to teach the outside world.

CS5.2  Last Chance Saloon? Attempts to Conserve Cement-mortared Adobe Walls in Marfa, Texas.

The late minimalist artist, Donald Judd (1928-1994), established his Texas home, artwork studios and exhibition spaces in former military buildings and a railroad warehouse in Marfa in the 1980s. There, he built high boundary walls around some of his properties using salvaged and new adobe blocks. But the adobe blocks were erected with cement-based mortar and they have now differentially weathered to a point where structural stability could soon be jeopardized. Ironically, however, the adobe’s preferential decay next to the cement joints has created an aesthetic not dissimilar to Judd’s famous and very valuable artwork. Therefore, on behalf of the Judd Foundation, the authors were tasked by engineers, Simpson Gumpertz and Heger Inc., to devise remedial treatments based upon pioneering preservation and restoration techniques. Various technologies were deployed ranging from the latest elastomeric consolidants to acrylic latex and other amended adobe plasters, the latter based on experience gleaned from the 1985 adobe treatment trials at Fort Selden, NM (executed by the Getty Conservation Institute in association with the Museum of New Mexico). The authors will describe the decay processes involved and will explain the various treatment trials that were deployed in association with master adobero, Pat Taylor. Many months of monitoring have now ensued and the authors can report on the most promising treatments for what is seen by most authorities in the field as a most intractable problem: surely the “Last Chance Saloon” for Judd’s adobe walls.

11/1/16  Technical Vernacular (LU: 1.5 Hrs)  3:15pm - 4:45pm

CS5.3  Canvassing the Window and Door Caps

Gregory  MacNeil
Throughout history most buildings have been the product of local building traditions that rely upon working with materials at hand to achieve sophisticated levels of comfort and water management. To the once prosperous east coast communities and fishing fleets, canvas cloth was more than the material from which their sails were constructed. It was used for roof surfaces of very slight pitch subjected to severe weather, lining valleys and gutters, and for window and door flashings. Canvas is a strong, coarse, unbleached cloth that is light in weight, easy to lay, durable, clean and resistant to decay. It will not crack like sheet metal nor tear like felt. A coat of linseed oil paint or traditional fish oil paint can easily recondition it. The flexibility of canvas made it suitable for the decks of boats, roofing railway cars, and the covering of early aircraft fuselages and wings, all subject to vibration in use. Although the importance of canvas for global trade and transport has diminished many of its former uses and applications are still viable and cost effective today. Unlike the roll formed metal and plastic sheet goods that replaced it as a building material on traditional framed buildings, canvas does not require annealing, descaling, temper rolling, brake forming, roll forming, press forming, or thermal forming. Canvas is not subject to thermal expansion, thermal conductivity, corrosion, electrolytic action, and is compatible with most traditional materials. The basic ingredients of canvas are hemp, flax, and yarns, all of which are sustainable materials in their own right, naturally biodegradable, not petroleum-based or prone to obsolescence. New materials while often held out to be “better than anything ever seen before” frequently prove to be “not quite as good as anything ever seen before”. Canvas membranes are a timely reminder that traditional materials will often outlast many newer more advanced ones. Canvas window and door flashings have a proven service life in excess of 150 years in harsh coastal climates. This paper will focus on the use of canvas flashings over windows and doors in combination with traditional shingles and beveled siding. It will provide the basic knowledge for a wide variety of canvas membrane applications and a general knowledge of the material for conservation purposes. Topics addressed will include but not be limited to the traditional wood shingle “kerfing” procedures for window and door canvas cap flashing, selection and preparation of 16 oz to 24 oz canvas, material layout, tools, traditional and modern fasteners, and traditional paints including locally obtained fish oil paint and the onsite preparation of the paint itself. The Author has researched and installed canvas window and door flashings with tools traditionally used along the Nova Scotia coastline.

### CS5.3 Capitol Ideas in Cast Iron Restoration and High Performance Coatings: The Project Team Returns After 25 Years

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<th>Ronald</th>
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<td><strong>Historic Preservation actions taken by the design and construction team are planned and implemented with the impression that they are the permanent solution to preserving a building. Seldom does a project team have the opportunity to come back to “revisit” a project after a quarter century and review the decisions made in their early careers and truly analyze their success or failure in those decisions. The lessons learned and knowledge transfer from this opportunity have a huge impact to the long-term continued care of a historic resource. The Michigan State Capitol Restoration implemented from 1988-1992 in Lansing, Michigan included a comprehensive multi-phase restoration of the National Landmark’s exterior Berea sandstone exterior and a substantial structural intervention to the cast iron and sheet metal clad exterior iconic dome structure. Called the 1990 Restoration, the project team had addressed three main factors during the dome restoration: 1. The structural repair of the underlying cast iron structural members which failed due to thermal movement. 2. The removal of multiple layers of lead paint and application of a “contemporary” high performance epoxy coating. 3. The modification of the dome to address moisture migration due to condensation and other pathways of moisture transmission. After 25 years, in 2015, with the exterior surface coating of the dome showing signs of deterioration, the original restoration team was brought back by the State of Michigan, Michigan Capitol Commission, to investigate the conditions which were being observed and correct them. The same design team and construction manager, with staff leaders from the 1990 project, were able to review the condition after 25 extreme weather cycles and determine, in detail, how the preservation interventions had performed. In addition, continued and expanded preservation efforts for issues not within the budget of 1990 were considered and implemented in 2015 which further enhanced the restoration of the dome structure. In 2015 the three main restoration issues which were reviewed and addressed by the team included: 1. Determination and correction of rust staining observed on the dome. 2. Application of a new coating layer to the dome. 3. Restoration of extensive decorative ornament which was slowing falling from the dome or had been lost over a century of exposure to the weather. Although several key members of the design team had passed since the 1990 Restoration, much of the design and implementation of construction information remained with the State and project team members. Detailed analysis of the investigation process, comprehensive scaffold and access system, product testing, unique craftsmanship to replicate the missing ornament, and final application of a new coating system which was compatible with the existing coating will be presented and contrasted to the 1990 project team’s goals.</strong></td>
<td>Ronald</td>
<td>Staley</td>
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### CS5.3 Design, Simulation, and Construction of a Physical Test Cell for Interstitial Monitoring of Replacement Infill Panels for Historic Timber-Frame Buildings

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<td><strong>This presentation will focus on the design, simulation and construction of a physical test cell, the construction of which has been made possible by the Martin Weaver Scholarship. As we aim to improve the energy efficiency of our historic building stock, great care must be taken to minimize the negative impacts on the existing building fabric. An appropriate balance must be achieved between conservation and improved efficiency to avoid damage to the buildings significance, character and fabric (English Heritage., 2012). Research to date has focused on the retrofit of solid masonry wall construction (Scott and Rye, 2014, Didem Aktas et al., 2015, Gandhi et al., 2012), whilst little has been written on timber-framed buildings. Timber-framing is a traditional construction technique in the UK, with surviving examples dating back to the 9th Century AD (Brusnkill, 1994). These generally consist of timber structural frames with a panel infill. Typical traditional infill materials include wattle and daub, lath and plaster, and brick. Where complete renewal of this material is required due to extensive damage, decay, repair of surrounding timbers or the removal of inappropriate modern materials, there exists the opportunity to retrofit an alternative panel with a higher thermal resistance (Ogley, 2010). It is however critical to understand the hygrothermal implications of the introduction of alternative infill materials. Failure to do so could result in increased moisture content, interstitial condensation and the creation of ideal conditions for fungal decay and insect infestation. Initial simulations with WUFI Pro5 of replacement infill details proposed by UK conservation bodies have not identified any detail that creates hygrothermal conditions that pose a major threat to the surrounding timber-framed construction (Whitman et al., 2015). However, it should be noted that these simulations only represent the moisture movement between idealized, homogenous, continuous layers of the infill materials. They do not reflect the moisture movement and potential accumulation at the junction with the timber frame, nor the reality of heterogeneous and non-continuous layers present in actual constructions. At the same time, interstitial monitoring in case study buildings is problematic due to the necessary invasive, destructive testing and the loss of historic fabric. This paper therefore presents the design, simulation and construction of a physical test cell that will enable the monitoring of the interstitial hygrothermal conditions within proposed replacement infill panels. By doing so, it is hoped to compare real measured data with WUFI simulations to better identify potentially inappropriate solutions and help define best practice to ensure the ongoing use and conservation of historic timber-frame buildings in the UK.</strong></td>
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### CS5.3 Natural Hair Binders in Historic Texas Vernacular Mortars

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<th>Jarrett Nasta</th>
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<td><strong>Throughout history most buildings have been the product of local building traditions that rely upon working with materials at hand to achieve sophisticated levels of comfort and water management. To the once prosperous east coast communities and fishing fleets, canvas cloth was more than the material from which their sails were constructed. It was used for roof surfaces of very slight pitch subjected to severe weather, lining valleys and gutters, and for window and door flashings. Canvas is a strong, coarse, unbleached cloth that is light in weight, easy to lay, durable, clean and resistant to decay. It will not crack like sheet metal nor tear like felt. A coat of linseed oil paint or traditional fish oil paint can easily recondition it. The flexibility of canvas made it suitable for the decks of boats, roofing railway cars, and the covering of early aircraft fuselages and wings, all subject to vibration in use. Although the importance of canvas for global trade and transport has diminished many of its former uses and applications are still viable and cost effective today. Unlike the roll formed metal and plastic sheet goods that replaced it as a building material on traditional framed buildings, canvas does not require annealing, descaling, temper rolling, brake forming, roll forming, press forming, or thermal forming. Canvas is not subject to thermal expansion, thermal conductivity, corrosion, electrolytic action, and is compatible with most traditional materials. The basic ingredients of canvas are hemp, flax, and yarns, all of which are sustainable materials in their own right, naturally biodegradable, not petroleum-based or prone to obsolescence. New materials while often held out to be “better than anything ever seen before” frequently prove to be “not quite as good as anything ever seen before”. Canvas membranes are a timely reminder that traditional materials will often outlast many newer more advanced ones. Canvas window and door flashings have a proven service life in excess of 150 years in harsh coastal climates. This paper will focus on the use of canvas flashings over windows and doors in combination with traditional shingles and beveled siding. It will provide the basic knowledge for a wide variety of canvas membrane applications and a general knowledge of the material for conservation purposes. Topics addressed will include but not be limited to the traditional wood shingle “kerfing” procedures for window and door canvas cap flashing, selection and preparation of 16 oz to 24 oz canvas, material layout, tools, traditional and modern fasteners, and traditional paints including locally obtained fish oil paint and the onsite preparation of the paint itself. The Author has researched and installed canvas window and door flashings with tools traditionally used along the Nova Scotia coastline.</strong></td>
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The Bluebonnet House is a stone home located along US 183 just north of Marble Falls, Texas. The house was built in three stages from the mid 1800s until the early 20th century. Nestled among a vast field of bluebonnets, this home is a Texas icon, appearing in numerous photos, both personal and commercial over the decades. The present owners of the house requested the assistance of the University of Texas School of Austin’s Materials Conservation Class in the spring of 2016. Under the direction of Professor and Architectural Conservator Fran Gale, a group of five graduate students conducted a field study of the house collecting material samples for lab analysis of the components and history of each material. Materials were divided among the five team members for testing and evaluation. In part result of the temporal differences in the construction of the house, the interior mortars of this structure varied both from room to room and within each room. During collection of samples, the presence of hair was found in mortars of the most recent building addition. The variety of samples containing hair were located in and around windows. Lab studies were conducted to evaluate the components of the mortar and to identify the species of animal hair present in the mortar. Hypotheses were made regarding the type of hair present based on the known and supposed history of the farm animals present on the farm. Microscopic hair analysis was conducted and samples were compared to several forensic hair databases to determine the species of animal from which the hair was taken. Final results were gathered with the work of the other team members and provided to the owner with recommendations for replacement of materials and restoration of the house.

### 11/2/16

| CS5.4 | Technical Upgrades (LU: 1.75 Hrs) | 8:30am - 10:15am |  

A Computational Simulation Methodology for Reconstructing and Analyzing the Environmental Behavior of Naturally Ventilated Historic Structures and the Role of Adaptive Comfort Strategies in Preservation Design

Evan Oskierko-Jeznacki

The increasing availability and affordability of climate control during the last century has reached a technological apex today, but the significance of adaptive comfort has been relegated solely to the discussion of sustainable, new construction, with little effort made to apply this methodology to historic structures. What is lost is the understanding that the thermal function of a building was just as an essential element of the initial architectural design and operation as it can be for its preservation design and operation today. By focusing on a climatically-adapted vernacular building typology that has thrived prior to the advent of mechanical heating and cooling, specifically the raised creole cottage, which is located in a climate region that experiences both significant moisture and heating loads, it is possible to demonstrate and visualize the systematic behavior of a building type designed explicitly to take advantage of its climatic context. Even passive behavior, however, is predicated on active input. By understanding both the climate and the historic operation of the building it is then possible to apply the use of new technology, namely computational fluid dynamics (CFD) software as well as other performance simulation methods to model, simulate, and predict multiple environmental operational scenarios for this building typology and visualize its effect on indoor thermal comfort. Also, by integrating hygrothermal simulation methods, it is also possible to visualize the micro-scale behavior of the building fabric with regard to the flow of heat and moisture through the envelope, which will shed light on issues of deterioration and lifespan in the context of overall sustainability. The use of energy and CFD simulation tools make it possible to not only recreate a case study building to its initial typological form but also reinstate the historical operation of the building and test for the optimum configuration of the dynamic elements of the building as an integrated component of modern preservation design. If successful, the outcome will inform not only an annual interior thermal comfort index for the spaces, but more importantly give an empirical context for the integration of an optimized hybrid conditioning methodology for application in building reuse and restoration today. By relying on a well-informed simulation methodology the sizing of these systems can then be minimized for the building, saving energy and preserving historical fabric. This methodology can easily be replicated on other building typologies with minimal resources required given the appropriate historical and architectural documentation as well meteorological data.

### 5

| CS5.4 | Considering Current and Future Insulation Materials for Traditional and other Historic Buildings | Marilyn Kaplan

[Note: suggested relevance to tracks A,B,E] Energy codes, energy and operational costs, and environmental sustainability have forced a focus on tightening of the building thermal envelope, ultimately with the envelope being a prime component in the work required to meet the goals of state and federal governments, and advocacy organizations, in achieving zero energy buildings within the next 3 decades. When selecting insulation for any existing building, variables include the building’s location (climate zone), exterior and interior appearance and conditions, cost, constructability, and the goals of the owner. When working on the historic building, additional variables must be considered that address the impact on historic materials, reversibility, and potential damage due to unintended conditions that create condensation within wall, ceiling and wall assemblies. Materials must be carefully selected and specified, details developed and implemented, and both must be all coordinated with other rehabilitation measures ranging from mechanical and electrical installations to finishes. While there is no universal, perfect insulation material, most projects can follow a consistent process for considering and selecting insulation. This presentation will address the strengths and weaknesses of varying insulation types, including applicability by location; available analyses methods for selection and inspection; and new materials under development with promising applications in historic structures.

### 5

| CS5.4 | Preparing Traditional Buildings for Climate Change | Jessica Hunnisett Snow

Over the last century climate change in Scotland has been characterised by overall warming with wetter winters, drier summers and increased frequency of extreme and unpredictable weather including heavy rain and storm events. The changing weather patterns, particularly the higher levels of winter precipitation, are a significant threat to traditional and historic buildings, increasing the risk of water penetration, accelerated stone decay and structural damage. Scotland has always had to contend with extreme weather, and buildings were designed to cope with the climate. Many vernacular building details were developed to specifically enhance the ability of buildings to shed water and can often be decorative as well, such as drip details, string courses, cornices, chimney copes and skew putts. Such details have in the past been removed or altered during repair or alterations and their function overlooked. Moreover, buildings that were not robustly detailed may now become vulnerable to the current and future effects of climate change, despite having survived for long periods in less challenging climatic conditions. Well maintained buildings with adequate heating and ventilation have better resilience, but buildings that have been poorly maintained are particularly vulnerable to the effects of climate change. Bringing buildings back into a state of good repair should be the first stage in increasing the resilience of the historic built environment before investing in radical adaptation or alterations. However, while many traditional buildings in Scotland can be resilient to extreme weather events without requiring any modifications, in some cases adaptation and alterations will be required if the structure is to continue to perform its function over time and for maintenance to remain affordable. The incorporation of well specified traditional detailing is often still the best solution, whilst sensitive adaptation to increase a building’s resistance to the effects of climate change can be still carried out using traditional materials and techniques. This paper considers how external details on traditional buildings can be improved, adapted or altered to increase their resilience to the effects of climate change and extreme weather events. It presents several case studies commissioned by Historic Environment Scotland of traditional and historic buildings where improvements and adaptation have allowed the building continue to perform its function effectively, without adversely affecting the historic character and appearance. This subject is considered in detail in the forthcoming Historic Environment Publication, ‘Adapting Traditional Buildings for Climate Change’, of which the author is a co-contributor, and was the subject of a recent submission to the APT journal from Historic Environment Scotland.
Since 2012, ASHRAE has been working to develop GPC 34P, its first major publication focused on energy efficiency in historic buildings. Most existing energy efficiency standards— including ASHRAE’s Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, and Standard 100, Energy Efficiency in Existing Buildings— provide an exemption for historic buildings. GPC 34P is intended to help design teams on historic building projects move beyond these exemptions, and improve a building’s energy efficiency while successfully balancing the impact to its historic character. Given that many of a building’s character-defining features are also inherent energy efficient features— providing passive heating, cooling, ventilation, and daylighting— that evolved in response to local climatic conditions, ASHRAE GPC 34 provides essential, consensus-based guidance on the sustainable preservation of vernacular buildings, as well as historic ones. This presentation provides an overview of the GCP 34P committee’s work to date. The scope and content of ASHRAE’s guideline will be briefly reviewed, and recommendations will be highlighted. The guideline development process will be discussed, including engagement with key stakeholder groups like the APT. ASHRAE’s guideline joins a growing group of guidance on this topic from other professional, nonprofit, and governmental organizations, and this presentation will also contextualize ASHRAE’s efforts within this broader field of work. This presentation provides an opportunity to introduce the GPC 34P committee’s work to the APT in a formal setting, as well as enhance dialogue within the APT on energy efficiency and preservation.

CS5.4

The Development and use of ASHRAE’s GPC 34P, Energy Guideline for Historical Buildings

Amanda Webb

CS5.4

Thermal Upgrade of Historic Metal Windows: Balancing Sustainability and Preservation Goals

Matthew Haberling

This presentation is the second part to a presentation given at the APTi 2013 Conference in New York City which addressed sustainability and preservation goals of wood windows. This presentation will review those same issues when attempting to improve the thermal performance of historic metal windows. We will present one case study which involved in-situ testing, long term monitoring, and computer modeling of historic bronze windows in a National Landmark high-rise building in Midtown Manhattan, New York City. The windows in this building are original, 1928, bronze double-hung units. The windows were found to be in relatively good condition despite the fact they’ve had little to no maintenance. Our client wanted to mitigate air and water infiltration and improve the thermal performance of the windows. As far as the client was concerned, one viable option includes replacement of the historic bronze windows with thermally broken, IGU glazed, aluminum windows. WJE was tasked with the challenge of finding viable options for retaining the existing historic windows and proposing viable options for improving their performance. Our approach involved initial air and water infiltration testing on a select number of windows, in order to get an idea of the performance of the existing units. The diagnostic testing was performed to identify the components of the window system that most significantly contributed to air and water leakage. Areas of leakage were identified and improvements were designed and installed. The testing was repeated so that quantitative comparative data could be collected. Following the testing, interior storm windows were installed and each glass and metal surface was instrumented to collect surface temperature. The air spaces were also instrumented to collect dew point data. The areas of increased risk for condensation or thermal stress induced glass breakage were documented and graphed. Computer modeling using THERM software was also completed in order to compare modeled surface temperature information with collected in-situ surface temperature data. It became evident from the onset that the software had limited capability to accurately model in-situ performance of historic metal windows. For instance, THERM does not account for air infiltration, a component found to meaningfully affect surface temperatures at various locations on the window; and the 2-D heat-transfer software could not predict moisture contents within the cavity between the historic window and the storm window. Our presentation will show the step-by-step approach to in-situ investigation/testing and compare actual data to virtual data developed using THERM. We will show that pinpointing specific points of weakness makes it possible to improve the performance of historic metal windows. Restoration and thermal improvement of historic windows helps to preserve historic fabric, improves energy efficiency, and keeps material out of landfills; providing a sustainable option to window replacement.

CS5.5

A Vernacular Farm Home in the Connecticut Western Reserve of Ohio: The John and Elsa Johnson Home in Hiram, Ohio

Dr. Elwin Robison

The Johnson Home was constructed from 1828-29 in Hiram, Ohio by settlers traveling west from New England. The home was restored in 2000 by the Church of Jesus Christ of Latter-day Saints because the church’s founder, Joseph Smith, was in residence in the home for a year as a guest of the Johnson family. The physical building fabric of the home is remarkable for three elements: decorative folk art painting on architectural woodwork, an internal water supply provided by a cistern, and a cheese production area in the home’s basement. The residence features a two story main structure with a central chimney and stair, and a story and a half rear wing that was constructed integral with the home. The rear wing had a summer kitchen, open wagon bays, and a tack room. The home was professionally constructed. The foundation has a 32 inch wide stone footing and dressed stones with mason’s marks. Bricks were produced in separate firings with two different molds, suggesting a construction which extended over two building seasons. Fireplace mantelpieces have delicate moldings and reeding which indicate a high level of craftsmanship. The decorative painting was discovered during the restoration process. Removal of the many paint layers from interior woodwork revealed “fancy painting” folk art. The painting is similar to New England interiors depicted in the backgrounds of limner portraits, and to painted New England and Pennsylvania furniture from the early 1800s. It is presumed that an itinerant painter installed the folk art motifs which feature traditional elements such as the ‘sands of time’ and the ‘tree of life.’ The home was constructed with a cistern constructed into the foundation of the summer kitchen. A ¾ inch channel was cut into the stone box set into to the cap of the cistern which would accommodate a draw pipe for a small wall mounted pump. The cistern is positioned so that a downspout can drain into the cistern on the exterior of the home, while the draw pipe leads into the home interior. On the east side of the home there is a small ‘doghouse’ which covers an entryway into the basement of the home. Adjacent to the entry the stone footing for the home is left above the floor level, providing a constant temperature thermal mass on which to ripen cheeses. Tax documents show that the Johnsons owned up to 25 cows, and cheese production in the region was one of the cash crops favored by farmers. The home was uniquely organized to support production on the farm with a minimum of traffic in the living quarters above.

CS5.5

Making the Old Look Old While Protecting the Artifact: Historic African-American Villages Near Charleston

Ralph Muldrow

My abstract is to present a presentation relevant especially to address theme E: Vernacular Architecture: Honoring the Ordinary. In this case what was “ordinary” for Charleston area Plantations are now extraordinary remains of the slave housing and post-bellum African-American tenant structures. As such these vanishing buildings should be preserved and carefully documented as an important yet often neglected component of our built history as a nation. The innovative aspect of my study is to test and recommend a clear coating that would allow for the weathered and alligating paint (or whitewash) arrested in that state but protected from the weather. That special approach would allow the structures to look normative for their time as historic photographs indicate that they were usually in that weathered state.
The Getty Conservation Institute (GCI) initiated the Seismic Retrofitting Project (SRP) in 2009 with the objective of developing low-tech, easy-to-implement seismic strengthening techniques for historic earthen buildings in Peru using traditional and local materials, equipment, and locally available technical skills. The SRP was developed in response to the Getty Seismic Adobe Project (GSAP) carried out by the GCI in the 1990s which developed a number of effective retrofitting methods but found to be too heavily reliant on high-tech materials and professional expertise, which prevented its widespread use in many countries. As part of the SRP, a number of techniques using traditional and local materials and practices in Peru have been tested by engineers, used in the new seismic strengthening designs, validated through numerical modeling, and will soon be implemented at two (of four) prototype buildings: 1) The Cathedral of Ica, an 18th century ecclesiastical building constructed of a timber frame structure and adobe walls with quincha pillars and vaults, and brick façade, damaged during the 2007 earthquake, and 2) The Church of Kuño Tambo, a 17th century building constructed of adobe walls and timber truss roof with mural paintings at the interior. The four prototype buildings selected in the SRP will serve as model projects, and their seismic retrofitting designs for potential application in other Latin American countries. This paper will provide an overview of the SRP as part of GCI’s Earthen Architectural Initiative (EAI), the phases of the project including laboratory testing of key buildings elements, the use of locally available materials and traditional techniques coupled with more contemporary materials and technologies and improved details in the proposed seismic strengthening design for the two buildings, the use of numerical modeling to evaluate existing building conditions and validate proposed designs, and the importance of collaboration between all key stakeholders to develop retrofitting techniques that could be easily implemented during construction. SRP Project team: • Claudia Cancino, Sr. Project Specialist, Getty Conservation Institute • Daniel Torrealva Dávila, Professor & Erika Vicente, Research Assistant, Departamento de Ingeniería Civil, Pontificia Universidad Católica del Perú • José García Bryce & Mirna Soto, Professors, Faculty of Architecture, Universidad Peruana de Ciencias Aplicadas • Etel Cruz, Architect, Dirección Desconcentrada de Cultura de Cusco, Ministerio de Cultura, Peru