Session Track: Special Topics
Session Code: CS15a

Paper: Restoration and Base Isolation of the Utah State Capitol

Presented by
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Speaker(s) Biography
Charles Shepherd is a registered architect with MJSA and served as Historical Architect for the full duration of the planning and restoration of the Utah State Capitol. Previously worked as an architect with the Utah State Historic Preservation Office. Also worked as an intern architect with HNTB on restoration planning for the Pentagon and Old Executive Office Building. A member of APT for about 20 years.

Abstract
The restoration and seismic upgrade/base isolation of the historic Utah State Capitol culminated with its rededication on 4 January 2008. The planning, design and restoration process provided a number of examples of the Conference themes.

An interdisciplinary approach to heritage conservation&

After years of independent studies revealing structural and other deficiencies, a full HSR was completed in 2000. Expanding on its findings, a Master Plan was then completed for the entire Capitol Hill complex. As part of that Plan, detailed Guidelines and Imperatives were developed that identified dozens of specific features, relationships, systems and needs to successfully restore the historic Capitol. Preservation standards were fully applied and extensive pre-planning directives established.

Upon selection of the Construction Manager/General Contractor and restoration design team in 2002, a series of seventeen restoration workshops were convened to explore solutions to building needs while adhering to the directives. The workshops ranged from one-half to two days in length and active participants included the owner s representative; CM/GC; restoration/architecture team; specialty consultants; craftsmen, suppliers, fabricators and installers; and experienced restoration professionals acting as a conscience to the entire process. Challenges and opportunities explored, solutions identified and preliminary restoration plans developed. Consensus was established across the entire project team and identified solutions immediately placed into the cost estimating process to maintain this critical target.

As the restoration planning/design process continued, the workshops formed the foundation for a range of critical decisions. With the experience of cooperative problem identification and resolution, relationships and goals were well established and allowed the extensive seismic upgrade and restoration to proceed successfully on a very brisk timeframe.

The interface between the technical and philosophical challenges of conserving built heritage&

Base isolating the Capitol involved the installation of 265 large, steel and rubber isolators as part of a complicated load transfer process to allow the construction of completely new footings and foundation systems. But while seismic forces are greatly reduced, base isolation presents a new set of challenges: how to accommodate the 24 in. of lateral movement (in any direction, or 48 in. total) during a M7.5 earthquake. The resulting displacement zone also needed to be concealed from visitors. A solution was found in the original building design that included a large granite-clad terrace surrounding the Capitol. Although it was included in the winning design and even priced during construction, it was never built. The modern realization of the Terrace creates a 24+ in. dry moat that is concealed by a continuous cover cantilevered off the building and clad in granite salvaged from the lower foundation.

Investigations also revealed structural challenges with the tall drum (dome). Seismic forces accumulate in such tall elements and while base isolation reduces the forces by 75%, the heavy concrete drum remained a serious concern. The historic concrete in the drum was found to be of very poor quality and contained only a minimal amount of reinforcing steel. Again, unrealized historic designs provided the needed opportunity. Originally several masonry materials were considered and priced, including cladding in terra cotta and granite. For budgetary reasons, the drum and colonnade were executed in stucco applied to the concrete. However, the ornate cornices, balustrades and column capitals were completed in terra cotta and the stucco was originally scored and painted to simulate terra cotta. Modern shotcrete was applied to the concealed interior surface of the drum; many improvements were made to structural connections; a significant amount of poor, historic concrete was removed including the twenty-four columns; and matching terra cotta cladding was installed, including new column segments threaded over steel tube columns lifted into position.7

Session Track: Special Topics
Session Code: CS15b

Paper: The Preservation of Ransome's Hollow Core Reinforced Concrete System at the Old Nassau County Courthouse in Mineola, NY

Presented by
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Speaker(s) Biography
Nancy A. Rankin, AIA, is an associate with John G. Waite Associates, Architects and has been an integral part of the firm since 1999. She currently oversees the firm s New York City office, which is located in downtown Manhattan. Ms. Rankin is a graduate of the Rensselaer Polytechnic Institute with degrees in both Architecture and Building Science. She is a registered architect in New York State and is a LEED Accredited Professional. Ms. Rankin has contributed to the fields of architecture and historic preservation through lectures and publications, such as "Tweed Courthouse Restoration: A New Approach to Life-Safety Management in a Landmark Public Building" an article she co-authored for the Association for Preservation Technology International Bulletin. She is also the co-author of Tweed Courthouse: A Model Restoration. Ms. Rankin is an active member of the APTI Technical Committee on Sustainable Preservation, and has given several local presentations entitled Historic Preservation is Sustainable Design .

Abstract
The restoration of the Old Nassau County Courthouse is one of the most complex preservation projects including a significant, early reinforced concrete public building that has been carried out in the United States. Listed in the National Register of Historic Places in 1978, the courthouse was designed by William B. Tubby and constructed in 1901. Tubby utilized an innovative hollow-core, reinforced concrete construction system patented by Ernest L. Ransome. Later additions made in 1916 by the same architect were constructed of monolithic concrete and cast stone trim finished to resemble the original building.

The merits of the hollow-core Ransome system included ease and speed of construction, structural strength combined with an economic use of materials, and improved characteristics of fire resistance for the completed building. Cold-twisted iron bars created an irregular surface that would improve bond strength between the reinforcement bars and the concrete.

The Old Courthouse is a rare and unusually well preserved example of Ransome s hollow-core reinforced concrete building technology; only three buildings were erected using this same system on the east coast of the United States. Details of the building s unique construction were published in the December 1901 issue of Engineering Record. Today, the hollow wall, floor, and roof construction is perhaps the Old Courthouse s most distinctive and significant characteristic.

In 2002, John G. Waite Associates, Architects was engaged to investigate, document, and provide recommendations for the restoration of the Old Courthouse. State-of-the-art building conservation philosophies and techniques were used to preserve the original concrete structure. A thorough investigation of archival records and original plans and details was undertaken while non-destructive testing was employed to determine joist and reinforcement orientation and spacing within wall and floor surfaces. Structural calculations were then confirmed for floor loading purposes, and the distribution of new building systems was planned to avoid impact to the Ransome system.

Selective supplemental repairs on the building s interior were necessary to preserve the integrity of the Ransome system. The floor slabs, composed of a top slab, joists with twisted reinforcement bars, and a ceiling slab, had no ceiling slab reinforcement and exhibited extensive cracking. A through-floor rod and plate system was installed to stabilize the entire original 1901 floor structure. Original reinforced concrete rafters that showed signs of

overstress and insufficient reinforcement cover were preserved in place with the installation of a steel plate and through-bolt system.

The exterior walls of the Old Courthouse are predominantly a tan concrete matrix with New York State trap-rock aggregate; cornice and window trim provide highlights with white limestone aggregate. All surfaces were originally bush-hammered to expose the two different aggregates for aesthetic effect.

The entire exterior was chemically cleaned to remove stains and surface pollutants. A laboratory analysis of the original concrete was undertaken, and a contemporary cement and sand mix similar to the material composition of the original concrete was developed for patch repairs. Exterior facade repairs were then undertaken to address reinforcement corrosion, surface spalling failures, and prior inappropriate repair campaigns in order to bring the courthouse back to its original appearance. Active and inactive structural cracks were either filled with cement or injected with epoxy. Cast stone dutchmen that matched the color and texture of the original exposed-aggregate concrete surfaces were installed to replace missing decorative elements.

The Old Nassau County Courthouse was successfully restored for another century of use by the County while preserving a significant example of early reinforced concrete construction technology. Re-opened in early 2008 and renamed the Theodore Roosevelt Executive and Legislative Building, the Old Courthouse will continue as a historic and dignified symbol of Nassau County government.

Session Track: Special Topics
Session Code: CS15c

Paper: Back, Forward, and Down: A Three-Pronged Look at Geothermal Wells in Heritage Preservation

Presented by
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Speaker(s) Biography
Carl A. Jay
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Carl Jay has made a lifelong study of historic buildings, the construction methods and the tools used to build them. Over the years, Carl has worked on many prominent New England restoration projects including Trinity Church in the City of Boston, Cochran Chapel at Phillips Academy, The Class of 1945 Library at Phillips Exeter Academy, Memorial Hall Tower Spire Restoration at Harvard University, and the Ayer Mansion in Back Bay. Carl is a frequent speaker and guest lecturer both in the local and national arena. Carl has a degree in Wood Science and Technology from the University of Massachusetts.

Thomas Perry, LEED® AP
Director of Engineering Services
Shawmut Design and Construction

Tom has more than 27 years of construction experience, including 22 years of mechanical systems experience. In his role as Director of Engineering Services for Shawmut Design and Construction, Tom oversees mechanical coordination, reviews drawings, and assists with scope definition and procurement. Knowledgeable in the areas of environmental and energy design, Tom works closely with architectural and engineering teams to work toward green building designs that are in compliance with LEED® specifications. Tom is an active member of ASHRAE and is also engaged as an instructor in Shawmut s in-house training program. In addition to his Bachelor of Science degree in Mechanical Engineering from Northeastern University, Tom holds a license in Electrical Power Distribution and Control Circuits, an Associates Degree in Mechanical Engineering from the Franklin Institute of Boston, and a Certified Graduate in Design of Heating Systems.

Abstract
One of the most difficult pieces of preservation and heritage preservation is making the necessary upgrades for the building to sustain use in the 21st century. The biggest challenge comes in updating mechanical systems, especially heating and cooling systems. In a typical building, this means the addition of large air handling units, but this is not an optimal solution when dealing with a historic property can you imagine a large piece of machinery on the roof of the historic Trinity Church of Boston? A building must not only think outside the box to solve this issue, but must keep in mind the impact a historic building will make in the future, not only culturally, but environmentally.

The marriage of these two future concerns has, in recent years, developed into an innovate solution: geothermal wells as a heating and cooling source for historic properties. While not just used for historic buildings, the geothermal well and the geothermal heat pump system is an environmentally sustainable, virtually undetectable way to regulate the air temperature. While the technology behind Geothermal Heat Pump systems, also known as Ground Source Heat Pumps (GSHP), has been around for decades, institutions are only now beginning to

seriously explore and embrace this renewable energy source as a way to not only limit their environmental impact but save money by cutting operational and maintenance costs associated with the heating and cooling of their buildings.

The geothermal heat pump system typically uses a standing column well design to tap into the relatively constant temperature of the earth which averages between 45-65 degrees Fahrenheit. The wells are typically drilled to a depth of 1,500 feet below the earth s surface. At Byerly Hall, five standing columns have been drilled to that depth, each horizontally separated approximately 50 to 75 feet from an adjacent standing column.

A submersible pump installed in each standing column draws water from the bottom of the well and delivers it via a piping loop to the heat pump units within the building. The well water is then returned to the top of the well below the static ground water level. The water-to-air or water-to-water heat pumps convert the energy from the well water to meet the heating and cooling demands of the building.

Ground Source Heat Pumps installed within the building are connected to the standing column wells with underground piping. The deep vertical standing columns act as a heat exchanger using the ground as a heat source in the winter and a heat sink in the summer. Building heat pumps have electric driven compressors that concentrate the energy absorbed from the ground and release it at a higher temperature in winter and a lower temperature in summer into the building.

A benefit of a geothermal heating and cooling plant is an aesthetic one for historic properties - a manhole cover installed at grade level for each standing column is the only item seen outside the building. Therefore, outside HVAC equipment such as air cooled chillers or cooling towers are not required.

While the finished system is based on a refreshingly simple concept, these wells require careful planning and experienced construction managers and engineers. Part of project planning involves a long-term cost versus benefit analysis of the building systems. The drilling and installation of these wells does add initial cost to a project, however, energy savings due to system efficiency will typically pay back the investment within five to ten years.

Shawmut Design and Construction, a Boston-based construction management firm, along with Goody Clancy, a Boston architecture firm, has been involved in the installation of several New England geothermal heat pumps in many culturally significant buildings and historic campuses, including H. H. Richardson s Trinity Church in the middle of Copley Square in Boston and most recently, the Radcliffe Institute for Advanced Study at Harvard University in Cambridge, Massachusetts. Over the course of numerous projects, the installation and commissioning of the geothermal well and ground source heat pump has become increasingly less difficult and more advance through the years Shawmut has been constructing them. Past issues with well sizes, piping materials and machinery have all been ironed out, but it is important that we learn form these experiences to ensure that the technology keep progressing and that we save future project teams from running into similar problems.

Appropriate planning can result in dramatic cost savings with geothermal systems. Heat from the ground is free - and the only electricity needed is for moving that heat between the building and the ground. Although there is an initial cost to drill and install the system, that investment can be paid back in less than 10 years. Best of all, ground-source heat is a naturally renewable thermal source and friendly to the environment. With these benefits, we are sure to see more geothermal wells being installed at institutions across the U.S.

The panel will present the long-term benefits and challenges of digging the geothermal wells, installing ground source heat pump heating/cooling systems, lessons learned from several projects completed over the past decade, including Trinity Church and Harvard University, and advice for institutions looking to protect and improve their facilities in this environmentally sustainable way.