Abstract
Perpetuity or the idea of permanence characterizes a main intention in the design of structures within the built environment. Preservation has focused primarily on the conservation, preservation, and rehabilitation of these types of structures. However, many extant structures do not follow that intention of perpetuity. Instead, this subset of structures was designed and built to provide a singular purpose, and with the expiration of that purpose, the buildings would face demolition. Buildings remnant from World’s Fairs or structures for military war posts exemplify this typology of temporary structures. However, many of the buildings with this interim intention exist today, and preservationists now are faced with the challenges of restoring a structure built of provisional materials to a stabilized state of permanence.

One successful case of restoration and translation from temporary to permanent comes from Nashville, Tennessee. In 1897, Tennessee hosted its Centennial Exhibition to celebrate the centennial of its statehood, by creating a fairground to be populated with temporary exhibit halls. Nashville, as the “Athens of the South,” sponsored the construction of a full scale replica of the Athenian Parthenon. Although slated for demolition at the exhibition’s completion, the Parthenon was saved from that fate. However, as the original brick, plaster, and wood materials were not intended to last more than ten years and the construction plan was executed under the expectation of eventual demolition, the Parthenon rapidly deteriorated. It has since received a full restoration, returning the building to operational status.

This paper will outline the procedure, techniques, and materials used in the transformation of this temporary structure to a permanent and functional exhibition space. It will evaluate each step of the restoration process; specifically, the project will target the condition assessment, the development of a three phase plan, and the execution of the phase plan. Within the evaluation of the plan execution, the project will feature a thorough analysis and justification of material changes from provisional to lasting materials. Through the evaluation, this case study will highlight the distinct processes and techniques required for successful restoration of transitory structures.

Outline

I. Introduction
   A. Temporary Architecture
   B. Monumental Architecture

II. Site Overview
   A. Centennial Exposition of 1897
   B. Original design, materials and functions of Parthenon
   C. Status and condition of the structure from the close of the Exhibition

III. Temporary to Permanent
   A. Structural Evaluation
      1. Construction of basement level
      2. Reinforcement of steps and column bases
   B. Column Reconstruction
1. Process for creating column drums
2. Addition of reinforced concrete

C. Exterior Treatment
   1. John C. Earley concrete treatment

D. Stylistic Changes
   1. Exterior pediment sculptures
   2. Interior plan
      a) addition of naos and treasure
      b) interior colonnade
      c) interior ceiling

IV. Continued Maintenance
   A. 1986 Repairs
   B. 1991 Restoration

V. Concluding Remarks
   A. Impact of original restoration
   B. Do temporary structures require a different standard of evaluation for authenticity?
Rideau Hall Palmhouse Rehabilitation: Integrated Revival Strategies

Presenter: Ralph Wiesbrock

Abstract
By 2001 the Lord and Burnham tropical greenhouse at Rideau Hall – the official residence of Canada’s Governor General - had fallen into an advanced state of disrepair and had to be closed to both the public and staff for safety reasons. The 1926 square shaped structure, superimposed over the foundations of an earlier 1906 octagonal configuration, had fallen prey to structural damage through corrosion, glass breakage, and lead contamination. By this point the suspended floor slab over the basement was at risk of collapse.

A variety of inter-related contributing factors led to the Palmhouse’ eventual closure and a careful reconsideration of the program for its renewal was required. The desire to complete a top to bottom restoration had to be balanced by contemporary operational and regulatory requirements. Older heating, ventilation, and shading strategies were no longer practical and building code requirements had changed drastically since the days of its origin. Universal accessibility, durability, and maintenance factors also had to be thrown into the mix.

Its historical role as tropical greenhouse was the key driver for the restoration program. It was also a key factor in the advanced state of decay of the underlying foundation and floor structure of the building, and this meant that any restoration program would require a complete disassembly of the superstructure in order to provide access to repair the sub-structure.

Careful cataloguing and GPS mapping prior to the disassembly and removal of the superstructure was utilized to ensure accurate repositioning after the restoration and upgrade of the cast iron frames was completed. Contemporary building codes required the use of laminated glass which doubled the weight and thickness of this component. Current seismic and wind loading requirements also had to be accommodated without undermining the character and configuration of the original greenhouse. The superstructure frame was test assembled offsite after restoration and reinforcement to ensure precise fit prior to delivery back to site.

The old growth cypress used for the original glazing bars necessary for durability in a tropical environment is no longer available and was therefore substituted with aluminum profiles carefully selected to emulate the original appearance. Each piece of glass, including the curved eave profiles, was replicated to match their original sizes.

The scale of the required intervention meant that each aspect of the Palmhouse’ reconstruction had to be carefully considered and integrated into a historically appropriate set of restoration and modernization decisions.

Through the cooperative efforts of a comprehensive team of professionals – including historical researchers, architects, landscape architects, engineers, horticulturalists, lighting designers, and contracting team – new heating, ventilation, shading, misting, irrigation, lighting, and control systems, were able to be seamlessly integrated into the restored greenhouse.

Outline
I. Historical Overview
   A. Governor General’s Residence
      1. classified heritage landscape
      2. classified heritage building
   B. Overview of site configuration
   C. Evolutions and historical role of the tropical greenhouse
      1. 1906 duo-decagonal glass house establishes location and foundation footprint
      2. 1926 square Lord & Burnham superstructure overlaid
II. Pre-Rehabilitation Conditions
A. Advanced state of deterioration
   1. structural failure
   2. lead contamination
   3. breaking glass
B. Tightly engineered (close tolerance) glasshouse system

III. Rehabilitation Program
A. Protect heritage value of the asset
   1. Stabilize and rehabilitate (restore and repair) the structure
   2. Re-establish original internal ordering strategy and relationship to gardens
   3. Restoration of interior tropical planting
B. Contemporary code compliance requirements
   1. Overhead glazing for publicly accessible buildings
   2. Universal (barrier-free) access
C. Modernize building systems
D. Improve energy performance
E. Reduced maintenance requirements

IV. Project Team and Procurement Strategy
A. Broad based design team and integrated design process with fully engaged client group
   1. Architects; structural engineers; mechanical and electrical engineers; greenhouse engineers; lighting designers; landscape architects; horticulturalist; geotechnical engineers; environmental engineers; historical researchers
B. Pre-qualification of general contractors and greenhouse contractors

V. Design and Implementation Strategies
A. Sampling and cataloguing of plant materials
B. Detailed measured drawings
C. Integrated project team collaboration
D. Plan and planting strategy that optimized use of central height
E. Re-establishment of a clear interior-exterior line between basement and greenhouse
F. Discrete integration and placement of structural reinforcement and building systems
G. Use of mock-ups and CAD fabrication techniques
H. GPS recording and positioning allowed for accurate restoration tolerance control
I. Barrier-free ramp access integrated into landscape

VI. Conclusion: A committed, cooperative, and motivated project team operating in an integrated manner was able to deliver a successful project recognized with a City of Ottawa Architectural Conservation Award of Excellence and a Plantscape Industry Alliance Award of Excellence.
A Comparative Analysis of Unreinforced Masonry and Reinforced Concrete Churches Affected By the 2013 Bohol Earthquake

Presenter: Stephen J. Kelley, AIA, SE, FAPT

Abstract
In December of 2013 and again in February of 2014 the presenter visited the areas of the Philippines that were affected by the 2013 Bohol Earthquake and Typhoon Haiyun/Yolanda. The purpose of the UNESCO-led mission was to assess the damage caused to historic buildings and develop treatment strategies. Damage was caused by wind, water and seismic tremors and the damage viewed varied from minor to excessive damage.

The building type that predominated in this assessment was the Roman Catholic cruciform church and thee churches fell into two categories: those constructed during the “Spanish-era: and those constructed during the “American and post-American-eras.” Spanish-era churches dated from the 18th and 19th Centuries and had walls composed of rubble masonry that was faced on both sides with dressed coral stone. The American-era churches dated from the early 20th Centuries with walls composed of an archaic reinforced concrete. These church structures behaved in a fashion that was distinct to the materials from which they were constructed.

The presenter will present findings from this unique opportunity to compare these building types and will also discuss seismic retrofit techniques that are under consideration. Due to the still emerging issues surrounding this topic the presenter may also present findings and conclusions that are not being considered at the time of the writing of this abstract.

Outline
I. Introduction
   A. UNESCO Mission
   B. UNESCO Mission team
   C. Places visited

II. Context
   A. Philippine history and built cultural heritage
      1. “Spanish era” (18th-19th C) - typical construction techniques URM and wood
      2. “American era” (early 20th C) - typical construction techniques
      3. Typical alterations to built heritage over time
   B. Similar trends in other colonialized areas of the World – Haiti, Bhutan

III. Primer on the 2014 Bohol Earthquake

IV. Visual observations at the churches on the island of Bohol
   A. Church of San Pedro Apostol, Loboc - URM
   B. Santissima Trinidad Parish Church, Loay - URM
   C. Santo Nino Parish Church, Cortes - URM
   D. Santa Monica Paris Church, Alburquerque - URM
   E. La Nuestra Senora del Villar Church, Corella - RC
   F. St. Anthony of Padua, Sikatuna – RC

V. Lessons Learned and seismic retrofit strategies
Abstract
The West Block Parliament Building in Ottawa is undergoing major rehabilitation and expansion. The building was built in three construction phases from 1860 to 1909, and has undergone a series of changes and partial rebuilding. The last significant renovation was completed in the 1960s. Each of the first three phases of building construction used similar wall composition and structural assembly. Heavy cut stone faced rubble core masonry walls together with inner double wythe brick walls form the main vertical load bearing system. The two are connected – keyed together at windows. They are separated by a 2 to 4 inch wide air cavity. The original floors consisted of brick or terracotta arches on iron beams and Fox and Barret system.

A number of problems are typical for this type of construction: in-plane shear in walls, pier rocking, out of plane bending, separation of wythes of rubble core walls, diaphragm connection between walls and floors, masonry wall corners, masonry cracks, windows surrounds and tracery, water table construction, projecting elements, including chimneys and gable walls. West block specific issues are big, heavy and tall MacKenzie Tower and resulting separation, pounding and catchment, and existing floors upgrade. Seismic analysis of such combination of structural elements was not discussed in technical literature. Experimental investigation of similar wall systems was sparse and inconclusive.

The linear static analysis was performed manually using Excel and National Building Code specifications for period calculation. The linear dynamic analysis was performed using SAP2000 program. This program was preferred over simpler Etabs, which is more popular and widespread in engineering companies. SAP2000 can account for the mass source at the location of mass, ie. wall mass is distributed along the height of the wall, and not lumped at the floor levels. The computer model was tested until the engineers were satisfied with its integrity and behavior. The two analyses were constantly compared.

Material characteristics used in analysis were based on experimental in-situ investigation of building walls performed several years ago by one of the authors. Material characteristics of floors were assumed and varied in order to bracket the likely behavior of the structure. Parametric analyses were performed as well. The results of the seismic analysis were subjected to a peer review of Canadian experts in the fields of masonry, heritage and seismic engineering during a two day conference in Ottawa. The peer review committee endorsed all conclusions of the authors and recommended future research.

A number of typical seismic strengthening details were developed and tested on two pilot projects, South East Tower, and North Towers. The South East Tower restoration project received the Preservation of a Heritage Building Award from the Canadian Association of Heritage Professionals in 2010.

Outline
I. Introduction
   A. Unreinforced stone masonry walls – outside
   B. And inside view

II. Analyse This
   A. Walls
      1. Wall fabric
      2. Wall connectivity
3. Quality of construction
4. Stone shape
5. Weathering and maintenance

B. Floors
1. Fox and Barrett
2. Brick arch
3. Combination with contemporary

C. Irregularities
1. Towers
2. Corners
3. Slender piers

III. Analyse That
A. Problems
1. In-plane shear in walls
2. Pier rocking
3. Out of plane bending
4. Separation of wythes of rubble core walls
5. Diaphragm connection between walls and floors
6. Masonry wall corners
7. Masonry cracks
8. Window surrounds and tracery
9. Water table construction
10. Projecting elements including chimneys and gable walls

B. Solutions?
1. Traditional equivalent static analysis using Excel
2. Linear dynamic analysis – SAP2000
3. Future: Performance based design – Pushover analysis
4. What level of analysis is appropriate?

IV. What’s next?
A. Connection of two wythes in rubble core masonry wall
B. Modelling – simplified pushover?
C. Material characteristics database – in-situ and laboratory controlled experiments

V. Discussion
Abstract

Vibration limits to prevent damage to typical buildings are relatively well known. However, vibration limits to protect historic buildings are debated, and vibration limits to protect artwork and other fragile objects within historic buildings such as museums are generally not addressed in the literature. This lack of information is particularly problematic for operators of historic museums who are undertaking rehabilitations, expansions or other activities that could expose the buildings and collections to vibrations. As vibration control experts on several large construction projects involving historic museums over the past decade, the authors undertook to review the art conservation literature on vibrations that artwork experiences during transit and shipment between museums. The results were surprising and very instructive. Vibration levels that art objects commonly experience during shipment are several times higher than vibration limits often used to protect historic museum collections in situ, yet damage to art during shipment rarely occurs. In other words, commonly used vibration limits appear over-conservative. On the other hand, the authors’ experience monitoring vibrations during museum construction projects has shown that significant, case-specific risks for damage to fragile building contents exist. These include the possibility of damage from resonance of objects with natural frequencies similar to sustained vibrations like sheet pile driving; walking of unrestrained light objects on smooth surfaces; and vibratory motion of extremely fragile objects or those with serious pre-existing weaknesses.

The goals of this presentation will be threefold: to give the audience a general understanding of building vibrations; to summarize the latest information on vibration limits and measurement methods for the protection of historic buildings; and to provide guidance for protecting artwork and other fragile building contents from vibrations. The presentation will begin with a short primer on the effects of vibrations on humans, buildings, and objects. Then, vibration limits will be recommended for avoiding human disturbance, protecting historic buildings, and protecting artwork and other similar fragile building contents. Recent research will be cited and project examples highlighted. The presentation will conclude with a live demonstration of vibrations using a table-top-size, computer-actuated vibration simulator. A close-up view of the device and vibration output signal will be projected onto the screen for audience viewing. A volunteer will be called up to feel vibrations of different magnitudes (barely perceptible, common protection limits, and damage levels) and describe them to the audience. Then, objects will be placed on the simulator and subjected to vibrations that cause phenomenon such as resonance and walking. After the session, attendees will be invited to come up and feel vibrations of different levels; this is a very valuable experience for people who may need to judge the approximate magnitude of vibrations in buildings and to know whether those vibrations could be problematic.

Outline

I. Introduction
   A. Vibration limits to prevent damage to typical buildings are relatively well known.
   B. However, vibration limits to protect historic buildings are debated (and sometimes over- or under-conservative in practice).
   C. Vibration limits for protection of artwork, and other similar fragile objects often found within historic buildings, are generally not addressed in the literature.
   D. Based on their project experience and research into these subjects, the authors will seek to shed light on these lesser known technical subjects for the audience.

II. Short primer on the effects of vibrations on:
   A. Humans
   B. Buildings
   C. Artwork and other similar fragile objects
III. Background and recommendations for vibration limits to use for:
   A. Avoiding human disturbance
   B. Protecting typical buildings and historic buildings
   C. Protecting artwork and other similar fragile objects

IV. Examples of implementation:
   A. Historic buildings
      1. Art Institute of Chicago (Shepley, Rutan and Coolidge, c. 1893)
      2. Chicago Stock Exchange Arch - architectural art object outside the Art Institute building (Louis Sullivan, c. 1893)
      3. Saint Louis Art Museum (Cass Gilbert, c. 1903)
      4. Taft Museum of Art (aka, Baum-Taft House), Cincinnati, OH (c. 1820)
   B. Artwork
      1. Art Institute of Chicago
      2. Saint Louis Art Museum
      3. Sterling and Francine Clark Art Institute, Williamstown, MA
      4. Oriental Institute Museum, University of Chicago, IL
      5. Taft Museum of Art, Cincinnati, OH
      6. Pulitzer Foundation for the Arts, St. Louis, MO

V. Live demonstration
   A. The presentation will conclude with a live demonstration of vibrations using a table-top-size, computer-actuated vibration simulator designed and constructed by the authors. The simulator (which measures approximately 3 ft long by 1 ft wide by 2 ft high and weighs about 80 lbs.) will be placed on a table on the stage for audience viewing.
   B. Volunteers will be called up from the audience to place their hands on the simulator and “feel” vibrations of different magnitudes (human perception threshold, common protection limits, and damage levels) and describe them to the audience.
   C. The simulator will also be used to illustrate: 1) walking and 2) resonance of small objects subjected to vibrations.

VI. “After party”
   A. After the session, any attendees who wish to are welcome to come up and feel vibrations of different levels (human perception threshold, common protection limits, and damage levels); this is a very valuable experience for people who may need to judge the approximate magnitude of vibrations in buildings and to know whether those vibrations could be problematic.