CS 2.2 Unique Structures, Unique Challenges

Session Synopsis

Session Chair: John Cooke

Heritage conservation is often a unique process that goes beyond “new build” construction techniques. Conservation often involves a variety of standards and guidelines that stretch beyond basic modern building codes. That said, one often comes across unique projects where the restoration of a structure doesn’t fit into a typical format. In these cases, it requires the conservation team to think outside the box and look for creative solutions in design and implementation which may be challenging to execute. In this session there will be four unusual projects examined where the conservation teams did not have a set game plan to follow and had to come up with a unique approach to handle a difficult project. Lessons can be learned in these projects from design approach chosen by the team, engineering and architectural concepts utilized and ultimately execution on site.

Completing a 19th century vision in the 21st century - Design, fabricating and installing Monumental Portal Gates on Philadelphia City Hall, Philadelphia, PA, USA.

Speakers/Conférencier: Nan Gutterman – Architect, Project Manager, VITETTA
Speakers/Conférencier: Scott Howell – Vice President and General Manager, Robinson Iron

In 1992 while working on a Master Plan for Philadelphia City Hall, Vitetta located John McArthur’s 1869 design competition drawings in the City Archives. McArthur’s original competition design drawings which became the basis for the building’s construction also included a concept design for monumental portal gates. Unfortunately, the design of the portal gates was never executed and probably forgotten during the original building’s extended construction window followed by the construction of the two subway lines. Instead of ornamental gates, chain link fences were installed in the 1970’s to keep the public out of the courtyard at night.

In 2001, Vitetta was hired by the City to lead a design team of Robinson Iron and Keast & Hood Co. to design new monumental portal gates. But once again, the project was not implemented and the chain link gates remained on this monumental building. In March 2015, Mayor Nutter decided to make the fabrication and installation of new monumental portal gates his legacy project and we were authorized to design the gates.

As part of the 2001 concept report, the team needed to translate McArthur’s original concept design into a gate constructed of “modern” materials. The concepts that were finalized included the overall design of the gates and columns, design of ornamental features, material selection and determining

the operation of the gates. Design challenges were the weight of the portal gates which is almost 13,000 lbs and the requirement that the gate assembly be supported from the original stone masonry bearing walls. Dimensional differences at each portal required that each gate assembly be customized to a specific portal. Each gate leaf installed on the project measures 7'-6" wide and varies in height from 17' to 22'-6" due to the curve at the top of each gate leaf. The gate columns which are 26 feet tall are anchored to the marble and granite "veneer", measured to be at least 24 inches thick. Each gate leaf weighs about 2500 lbs and swings on four pivot hinges. Each gate leaf takes approximately 10 lbs of force to open and close as it was a design objective that the gates require neither a motorized assembly or electricity to operate.

In order to minimize the weight and maintenance of the gates and the columns, the gates were fabricated of stainless steel and aluminum. The stainless steel is used for all the structural components and the decorative elements close to the ground while the aluminum, both cast and extruded was used for the remaining decorative elements. The selection of materials allowed the weight of the gate leafs to be reduced.

The schedule was very aggressive ensuring that the project was completed December 2015.

New Light on Baltimore's Cathedral of Books – Part 2: Reversible Strengthening and Designing for Construction

Speaker Contact: John Matteo – Principal, 1200 Architectural Engineers, PLLC
Speakers/Conférencier: Nicole Ferran, P.E.

The George Peabody Library of Johns Hopkins University opened in 1878 and has continuously served the public as a premier research library for the University and City of Baltimore. The main stack room's five tiers of ornamental cast iron balconies are fed light from the atrium lay light, above which a parallel history of building technology is embodied in the spectacular Phoenix Iron trusses that span the atrium. The owners sought to replace a failing skylight with new panels that, in addition to creating a waterproof exterior envelope, would provide improved insulation and light transmission properties. Another goal was to create improved access above the lay light for various maintenance functions. The changes resulted in an increase in load on the historic structure that was found to require strengthening (presented at the 2014 APT conference in Quebec). 2017 marked the culmination of a collaborative effort which included the development of retrofit strengthening designs by1200AE, skylight design by Ziger/Snead Architects from Baltimore, and construction by Grunley from Rockville, MD.

1200AE developed a retrofit strengthening system that minimized damage to the historic truss

members while accommodating the very challenging requirements of construction above the library space.
The reinforcement employs an innovative approach of “reversible” detailing, where connections between new and old are implemented without drilled holes for bolts or welding between steel and iron. Working with the complex, historic geometries and connections required adjustability to be a fundamental principle of the strengthening details. The reinforcement components are short-length, steel members to facilitate access and lifting requirements. A range of construction-specific load cases was evaluated to maximize the strength of the iron trusses as the contractor aimed to install a work platform, supported by the bottom chord of the trusses, as early in construction as possible. This would serve the dual purpose of allowing safe access to install the truss reinforcement, but also provide protection for the lay light. However, having a full work platform over the lay light with construction loadings was found to be among the highest load scenarios the structure would be subjected to, and beyond the unreinforced truss capacity. The solution hinged on the installation of the permanent catwalks and their support of the work platform. Graphical representation, from concept sketch to precise detailing, were fundamental to collaborative design and construction.

Normal operations of the library were ongoing throughout construction. The work produced a new, more thermal-efficient skylight with transmittance appropriate to the historic space, a high-capacity, hybrid iron and steel roof truss assembly, and an accessible attic space allowing for MEP maintenance and preservation of the historic lay light. 1200AE is currently providing structural integration of a new fire suppression system within the main atrium.

Tuning a historic stone box

Speakers/Conférencier: Chris Warden, OAA MRAIC CAHP LEED AP BC+C – Senior Associate Architect, MTBA Associates Inc

From conception to completion, the Sir John A. Macdonald Building (SJAMB) Rehabilitation addressed multiple technical challenges to adaptively reuse the award-winning former Bank of Montreal (1929-31) in the Parliamentary Precinct, Ottawa, Canada. It is now a conference centre for the House of Commons.

One significant challenge was inverting the former banking hall's acoustic performance. Originally designed for high reverb for speech privacy, the new use instead required speech intelligibility to accommodate presentations, plus performance and music. At 18 metres wide, 40 metres long and 17 metres high, the Main Hall is an impressive volume. Adding to the space's scale, the inherent, heavily-ordered geometries and multiple noble hard surface materials (including marble, Benedict stone, large bronze and glass windows, terrazzo and a fine plaster coffered ceiling), essentially

make the room a “stone box”. This palette was considered “untouchable” since it contributed to the space's heritage character. As the primary event space, the Main Hall had to adapt to challenging technical and performance requirements, while maintaining heritage value. Challenges and design evolution continued through construction.

To address these challenges, the integrated project team explored countless intervention options, eventually developing a multi-pronged hybrid approach that responded to existing design character and considered different approaches for different locations. Throughout development, the room's performance and the benefits associated with various intervention strategies were evaluated to tailor and maximize their contribution. To satisfy the functional requirements, the team employed a holistic design approach, beyond acoustics, including mechanical, lighting, daylight control, multimedia, security and sustainability requirements. Each of these considerations was evaluated by matrix throughout the process, with the evolving goals of employing multi-function interventions, maximizing reversibility and minimizing heritage impact.

Acoustic solutions affected almost all Main Hall surfaces. Ceiling interventions included acoustic panels that integrated concealed sprinklers and air returns suspended through existing holes, also returning visual solidity to the ceiling. Wall interventions included retractable banners, acoustic entry doors and acoustic curtains. To enhance sound dispersion, "speaker benches" with line array and bass speakers were designed. These also accommodate significant air delivery and in-floor heating manifolds. In the end, the final design required a bit of acoustic performance compromise, to balance protection of the heritage character, a key raison d'etre for the adaptive reuse.

This presentation will review the SJAMB Main Hall's heritage character, the challenges for the acoustic and other requirements, the design evolution for acoustical enhancement, the intervention integration, the importance of exploiting previous interventions, and the variable integrated solutions proposed and executed, including the successes and failures. The audience will learn the processes, approaches and solutions to the challenge of extensive interventions into high-heritage interiors. This will maximize relevance to other projects for this often underrepresented, but impactful area of historic preservation.

Wrigley Field: Engineering for the Next 100 Years

Speakers/Conférencier: Elaine Shapiro, S.E. – Senior Engineer, Thornton Tomasetti

In 2016, the Chicago Cubs played their 100th season at Wrigley Field and began the third of five years of proposed renovations to the stadium. This talk will highlight a few of the structural challenges, faced by Thornton Tomasetti (TT) as the structural engineer of record, associated with

the evaluation of the design and condition of the stadium, the interface between the new construction and existing structure, and the balance of priorities between the Commission on Chicago Landmarks and the owner.

The stadium is a steel-framed structure with concrete seating bowl. Eight years after its initial construction, the ballpark's footprint was expanded by slicing the structure into three pieces, spreading the sections apart, and infilling with a similar structural system. Five years later, the upper seating level and a new roof were added on top of the existing trussed roof structure. These initial expansions, followed by a century of intermittent maintenance, left the ballpark a patchwork of structural systems, all in need of repair.

The initial renovation plan, approved in 2013, called for a $575-million, privately funded rehabilitation of the stadium to be completed in phases during the baseball off-seasons. The proposal included improvements to the stadium's façade, infrastructure, concourses, suites, press box, bullpens, and clubhouses, as well as the addition of a rooftop deck, restaurants, batting tunnels, and the stadium's first videoboards.

After a brief overview of the structural challenges, the discussion will focus on the reinforcement of the main trusses that support the upper seating bowl and the unification of the existing concrete seating bowl elements into a lateral system for the ballpark.

TT began the design process by creating the first comprehensive analytical model of the full structure as shown in existing drawings and documented in field observations. TT developed structural repairs and modifications based on the deficiencies identified by the model, due to the age of the structure and increased demands by the new programming and modern wind loads.

At the roof trusses, new gusset plates were installed using a process honed through collaboration between TT, the construction manager, and the ironworkers. Temporary welds were added at the existing gusset plates to allow the rivets to be removed, and then new plates were bolted on at the abandoned holes. In addition, truss members were reinforced as required. All of these new plates are visible from the seats below and suites that sit within the trusses, so care was taken to minimize their visual impact.

To create a continuous concrete diaphragm to serve as the lateral system, TT developed a solution that allowed the original concrete material of the seating bowl to remain once material testing established that it still had many decades of useful life remaining.