BUILDING RESILIENCE
PRACTICAL GUIDELINES FOR THE SUSTAINABLE REHABILITATION OF BUILDINGS IN CANADA

FEDERAL PROVINCIAL TERRITORIAL HISTORIC PLACES COLLABORATION (FPTHPC)

NATIONAL TRUST FOR CANADA CONFERENCE
HERITAGE POLICY IN A CHANGING WORLD:
CALGARY, ALBERTA, OCTOBER 2015
INTENSIFICATION AND SUSTAINABILITY

National Trust for Canada
“HERITAGE CONSERVATION CONTRIBUTES TO CREATING A SUSTAINABLE BUILT ENVIRONMENT & RESILIENT COMMUNITIES.”

Federal, Provincial, and Territorial Directors of Culture and Heritage in Canada have endorsed the above statement to underpin the development of a document that provides pan-Canadian guidelines for responsible and sustainable stewardship of built heritage.
PART 1 INTRODUCTION AND CONTEXT

• “How to” for sustainable rehab of existing buildings
• Primary focus: upgrading, rehabilitating, adapting and retrofitting historic buildings to increase energy efficiency & reduce carbon
• Illustrated, practical guidelines; precedents
• Conservation: Best practices for all existing buildings
“IMPROVING ENERGY EFFICIENCY IN EXISTING BUILDINGS ENCOMPASSES THE MOST DIVERSE, LARGEST AND MOST COST-EFFECTIVE MITIGATION OPPORTUNITIES IN BUILDINGS TO COMBAT CLIMATE CHANGE.”

IPCC
GLOBAL IMPACT  ENVIRONMENTAL, ECONOMIC, SOCIAL

Heritage buildings
- Job creation and cultural tourism;
- Sense of place and stronger social connections
- LCA durability and inherent sustainability

Perkins + Will and Google Images
Prior to any major intervention, crucial to gain a comprehensive understanding of both its:

**Heritage value:**
- integrity & evolution
- past/current importance

**Physical properties & relationships:**
- materials & assemblies
- planning logistics
- original design intents
- root causes of degradation
UNDERSTANDING CHECKLIST

1. Determine heritage value & character-defining elements;
2. Assemble an integrated design and rehab construction team;
3. Thoroughly investigate & document all existing conditions, past interventions, design intent and construction means & methods;
4. Ascertain current resource consumption for baseline measurement;

10 Adelaide Street, Toronto Ontario Heritage Trust
EVALUATION TOOLS

- LCA
- Energy Modeling & Audits
- Air Pressurization
- Enviro-data Logging
- Daylight Modeling
- Thermal Modeling and Comfort Simulation
- Thermography
INHERENTLY SUSTAINABLE ELEMENTS

- Embodied Energy & Carbon
- Flex Layout / Variety of Uses
- Passive, Localized “HVAC” i.e. ventilation
- Breathable, Repairable & Compatible Assemblies
- Indigenous, Durable & Recyclable Materials
OTHER ISSUES

- Energy Performance as part of Overall Building Resilience
- Integrated and Behaviour-based Management Strategies
- Maintenance & Heritage Value
- District-wide Infrastructure
- Unique Challenge of Modern Heritage
PART 3 BUILDING COMPONENT GUIDELINES

- Regardless of project size/type: common considerations for rehabilitation projects, particularly those including energy retrofits and enviro-objectives > best practices

- Core guidelines address building component - by - component
COMPONENTS ADDRESSED

1. Building/District Context
2. Project Objectives
3. Site
4. Exterior Form
5. Structural Systems
6. Roofs
7. Exterior Walls
8. Windows, Doors, Storefronts
9. Entrances, Porches, Balconies
10. Interior Arrangement
11. Mechanical & Electrical Systems
12. Interior Features
13. Materials
14. Operations & Maintenance
Each Component Section is made up of:

1. Section Introduction
2. Inherently Sustainable Elements
3. Sustainability Challenges
4. Interrelationships
5. Component-specific Guidelines
   • New Guidelines
   • Base Guidelines from SGCHPC
COMPONENT EXAMPLE  EXTERIOR WALLS

- New high-performance insulation with thermal break
- New shading and glare control devices
- Restore heritage operable windows
- New high-performance operable windows
- New high-performance mechanical system next to windows for occupant comfort
- New high-performance insulation with thermal break

SAB Magazine

MTBA
**Component Example: Exterior Walls**

### Sustainable Rehabilitation Project Guidelines for Exterior Walls

<table>
<thead>
<tr>
<th>RECOMMENDED</th>
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<tbody>
<tr>
<td>1. <strong>Researching</strong> original design intent to determine intended envelope performance and removed elements (for instance, shading devices) and installing or reinstating these items where they are integral to performance and/or beneficial.</td>
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<tr>
<td>2. <strong>Researching</strong> contemporary wall assemblies to determine vulnerabilities in an exterior wall assembly.</td>
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<tr>
<td>3. <strong>Adding</strong> wall assembly components that are compatible with heritage character and material assembly components (material and life span).</td>
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<tr>
<td>4. <strong>Installing</strong> new building envelope components in locations that are appropriate to the climate, building occupancy and where impact to a building’s heritage character is fully mitigated.</td>
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### Standards and Guidelines for the Conservation of Historic Places in Canada: Sustainability Considerations (Page 151)

<table>
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<tr>
<td>25. <strong>Complying</strong> with energy efficiency objectives in upgrades to exterior wall assemblies in a manner that respects the building’s character-defining elements, and considers the energy efficiency of the building envelope and systems as a whole.</td>
<td>Changing the composition or materials of the exterior wall assembly in a manner that compromises the building’s character-defining elements and the durability of its materials. Replacing single pane glazing with sealed thermal units, without considering the impact on interrelated elements, such as curtain wall connections.</td>
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<td>26. <strong>Assessing</strong> the potential impacts of adding insulation to the building envelope, such as displacing the dew point and creating thermal bridges.</td>
<td>Inserting thermal insulation in exterior wall cavities, in attics, and in unheated cellars and crawl spaces that might adversely affect the building’s envelope and character-defining elements. Installing insulation on the inside of exterior walls without considering the effect on character-defining interior mouldings or detailing.</td>
</tr>
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<td>27. <strong>Working</strong> with energy efficiency specialists to determine the most appropriate solution to energy efficiency requirements with the least impact on the character-defining elements and overall heritage value of the historic building.</td>
<td>Making changes to the exterior walls without first exploring alternative energy efficiency solutions that may be less damaging to the character-defining elements and overall heritage value of the historic building.</td>
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Component Example: M & E Systems

Introductory sections discuss Mechanical, Electrical & Plumbing individually, and Interrelationships with 9 other building components, emphasizing the importance of integration with existing systems, cavities, and other heritage and inherently sustainable elements.
COMPONENT EXAMPLE
OPERATIONS & MAINTENANCE

- Practical actions for heritage value
- Pre-intervention opportunities
- Stewardship
- User & management awareness/behaviour
PART 4 FURTHER INFORMATION

- Bibliography
- Glossary
- “Sustainable rehabilitation fights climate change”
- “How we stopped designing for sustainability post WWII”
- Case Studies
**SIR JOHN A. MACDONALD BLDG**

Wellington Street elevation with addition shown in context. Existing Heritage windows and addition openings allow significant amounts of daylight into building. Source: NORR/MTBA

**Location**
- 144 Wellington Street, Ottawa, ON
- NORR Architects & Associates Inc
- MTBA Architects & Associates Inc
- J. G. Cooke & Associates Ltd.
- Halsall Associates

**Project Team**
- 1930 - 1932 (Designed by F. J. Barrott)
- 2011 - 2015
- Original Use: Bank of Montreal Ottawa Head Office
- Intended New Use: House of Commons Hall of State

The adaptive reuse and addition of the FHBRO Classified, RAIC Gold Medal winning former Bank of Montreal building repurposes this work of "Canadian architectural accomplishment" (FHBRO Character Statement) and its large banking hall to serve as an educational, ceremonial and celebratory event facility on Parliament Hill. The rehabilitated Main Hall and other primary heritage spaces are supported by repurposed secondary and tertiary spaces and a new addition to provide the House of Commons with a state-of-the-art

Left to right: Rehabilitated bronze windows with silicone gasket on inner window; restored chandelier with new LED lighting.

**SUSTAINABILITY CHALLENGES**
- Improving building envelope while protecting important heritage fabric interior and exterior.
- Integrating high efficiency components with Heritage areas.
- High degree of heritage material integrity.
- Early mechanical system design with "sealed" envelope.
- Integrating new Main Hall radiant floor heating
- Designated substances

**KEY SUSTAINABILITY STRATEGIES/TECHNIQUES**
- Reduced landfill via high percentage of retained materials.
- Augmenting building envelope behaviour.
- Rehabilitating large bronze and steel windows.
- Retaining durable, natural exterior and interior materials.
- Energy efficient customized M&E systems.
- Automated building control systems.
- Water conserving fixtures.
- Installing radiant floor systems.
- High albedo roofing materials.

**INHERENT SUSTAINABLE ELEMENTS**
- Thermal mass from triple wythe masonry walls.
- Durable, robust materials.
- Daylighting; Passive Resilience.
- Embodied energy of building elements.
- Prime downtown location, close to public transit.

Section illustrating sustainable strategies applied to Main Hall area. To reduce heating/cooling loads, the Hall is only regulated at the "Conditioned Zone" area, avoiding unnecessary energy use.

NORR/MTBA
CASE STUDIES - STRATEGIES

Original System: Teller Counter + HVAC

Rehabilitation System:
1. New “Speaker Bench” + HVAC
2. New Radiant Floor System
3. Reused Heritage System

MTBA/NORR

BUILDING RESILIENCE
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NEXT EDITION UPGRADES

- Industry evolution upgrades
- Additional consultation & case studies:
  - Share knowledge
  - Demonstrate inter-connectivity: building components and systems
  - Recognize Canadian work in sustainable rehab field
THANK YOU

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CASE STUDIES

WCB BLDG ENVELOPE RETROFIT

The Workers Compensation Board Building after retrofit. The stainless steel "expansion joints" are visible on the east façade and at the base of the columns.

Building Name: Workers Compensation Board Bldg
Location: 333 Broadway, Winnipeg, Manitoba
Project Team:
- 1x1 architecture inc.
- Smith Carter Architects
- Crosier Kilgour and Partners Ltd.
- SMS Engineering Ltd.
- Akman Construction Ltd.
- Alpha Masonry

Original Building: 1961
Rehabilitation: 2013
Original Use: Office Building
Intended New Use: Office Building

a passing design fancy, the restoration of the Workers Compensation Board constitutes a timeless symbol of a Modernist heritage building.

Outward displacement of the exterior granite cladding required by the introduction of a new high performance building envelope. The right side shows the location of the stainless steel "expansion joints".

SUSTAINABILITY CHALLENGES
- "Undoing" previous, insensitive alterations.
- Sourcing materials to match those originally installed.
- Re-installing the stone cladding with increased structural steel support to meet current National Building Code structural requirements.
- Presence of designated substances.
- Not damaging the existing panels during construction.

KEY SUSTAINABILITY STRATEGIES/TECHNIQUES
- Salvage and re-install existing granite cladding panels.
- Upgrade to a new high-performance building envelope.
- Install new high performance windows.
- Maintain and use a highly durable material palette.
- Ensure the finished project respects the original design.

INHERENT SUSTAINABLE ELEMENTS
- Re-use of the entire building for its intended use.
- Re-use of the existing cladding materials.
- Steel frame is a highly durable and flexible superstructure.
- Downtown office location.
- Maintain users in the building during construction.