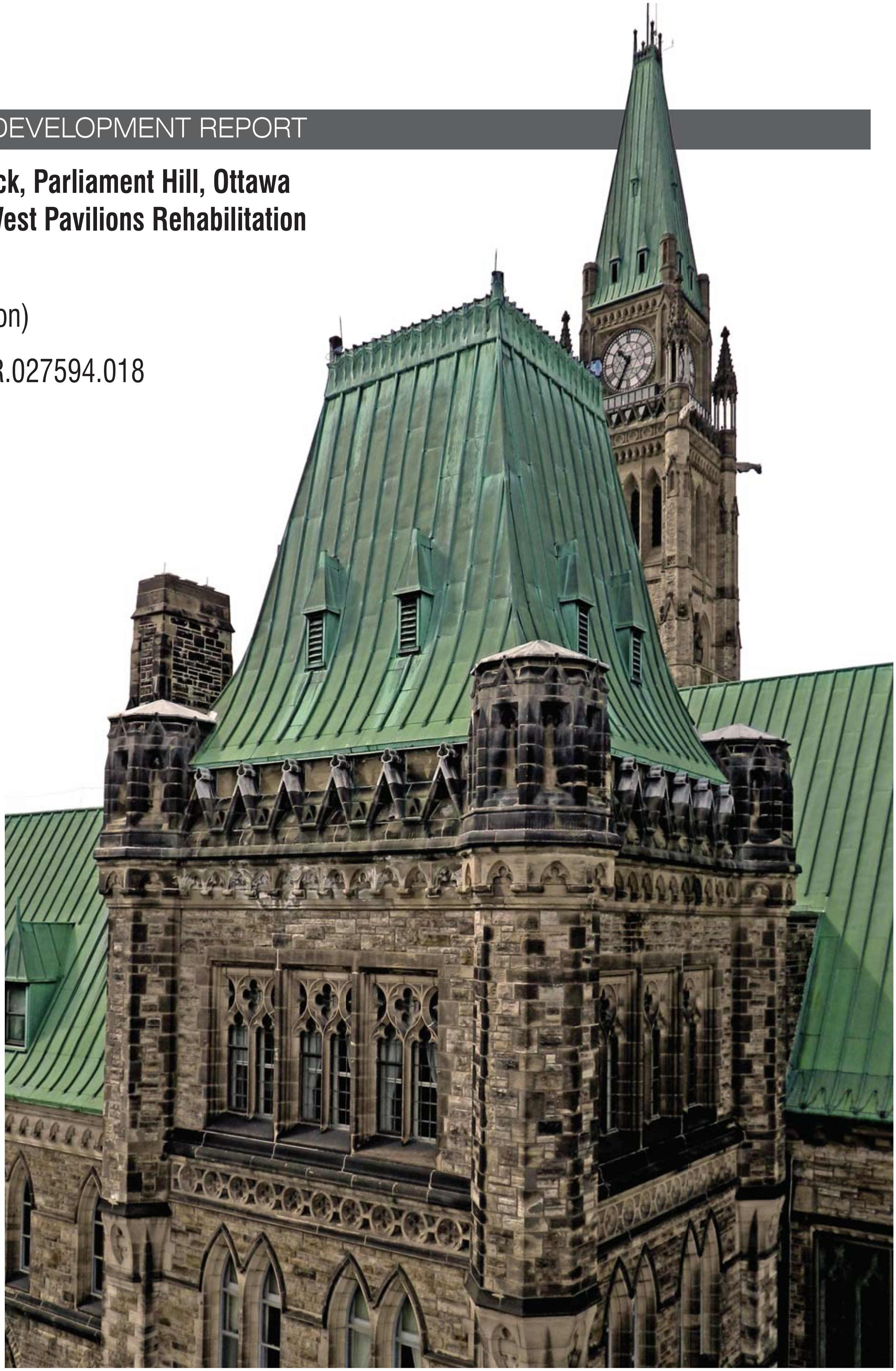
DESIGN DEVELOPMENT REPORT

Centre Block, Parliament Hill, Ottawa
East and West Pavilions Rehabilitation

July, 2013
(Final version)

Project # R.027594.018



FOURNIER GERSOVITZ MOSS DROLET & ASSOCIÉS ARCHITECTES

PART 1 – PROJECT OVERVIEW

1.1 EXECUTIVE SUMMARY

This Design Development (RS-4) report captures the 5 month period beginning at the end of the Schematic Design (RS-3) phase in February 2013, until May 9th, 2013 when the most recent progress meeting was held with PWGSC. The RS-4 phase is scheduled to end on July 2nd with PWGSC's approval to move into the Construction Documents (RS-5) phase. However the materials testing results will only be available early December 2013 as the tender documents are completed. At the time of writing this report FGMDA has not yet received written confirmation to proceed with Option 4 or approval for the associated $10.8M budget estimate. Instead the client gave verbal confirmation to move forward as if a written approval was granted.

The Schematic Design report contained three different options with budgets ranging from $9M to $11.7M and a set of recommended interventions estimated at $10.8M. The recommended interventions consist primarily of items from Option 3 and the chimney and scaffolding items from Option 2. The Design Development report includes further development of the recommended interventions, updates of the Risk Registry, the project schedule, the regulatory analysis, sustainable design strategies, and various testing programs. **Appendix XIV**: Specifications has also been added to the report and includes a table of contents for the specifications document as well as a list of working drawings.

Due to time constraints, the Class B construction estimate was not included in the first submission of the Design Development report but is included in the final submission scheduled for the 2nd of July, 2013. The total budget for the recommended option is 8.9 Million, excluding contingencies and tax.

The Centre Block is located within the National Historic Site of Parliament Hill and is itself a "Classified" building, according to the Federal Heritage Buildings Review Office (FHBRO). It is thus accorded the highest conservation status in the country. All work is to be done according to the *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010).

The Centre Block East and West Pavilion Rehabilitation (as a recapitalization project in advance of the Major Rehabilitation Project for Centre Block) has a limited scope of work relating primarily to the exterior envelope of the East and West Pavilions (see **Figure 1.1 – 1.3)** and should be followed up with a preventative maintenance program to ensure long term preservation. Included in the scope are: a complete **copper reroofing** of the mansard roofs; implementation of a **water-shedding strategy**; repairs of the flat **membrane roofs**; repairs to the **masonry**; repairs to the existing **windows. Seismic upgrading** is limited to the turrets and projections. Full seismic upgrading is deferred to the Major Rehabilitation Project. Foundation work is limited and interior interventions are minimal. The code review is ongoing pending clarification, requested by the code consultant.

All work, from the initial planning stages through construction, must be done in an occupied building with minimal disruption to the House of Commons and the Senate. Close coordination with the stakeholder representatives is ongoing to ensure occupant comfort and to minimize any conflict with other projects that are being planned for execution simultaneously with the Centre Block East and West Pavilion Rehabilitation project, most notably the Visitor Welcome Centre.

1.2 INTRODUCTION

The Design Development phase is 4.5 months long, beginning on January 17th, 2013 and ending on July 2nd, 2013. This report follows the 99% Schematic Design report (RS-3) which was initially submitted on February 8th, 2013 and again on March 14th subsequent to PWGSC comment integration. It represents 99% completion of the Design Development (RS-4) phase of the project and captures discussions that took place between Thursday January 17th, 2013 and Thursday May 9th, 2013. Any issues arising after the May 9th, 2013 meeting will be carried forward into the upcoming construction Documents (RS-5) phase of the project.

Several items have been carried forward from the Schematic Design phase as they are still evolving or remain incomplete from the previous phase.

These items include;

- The Detailed Field Investigations and Testing programme (DFIT);
- The meeting with the HRSDC Fire Commissioner.
- The Risk Registry;
- The cost estimate.

This report was written and edited by members of the FGMDA team, including Julia Gersovitz, Matteo Cendamo, Marianne Leroux, John Diodati, Alex Fedarenka, Nancy Labrecque, Greg Manley, Melissa Du-Plessis, Victoria Henderson, Lauran Unzueta, and Marielisa Delgado.

Information has also been provided by the consultant team members. This includes Derek Mes and Justin Vienneau from AAR; François Laframboise from Pageau-Morel; Brian McBurney from Hanscomb, François Thauvette from Novatech, Peter Goodeve from GoodeveManhire, Judy Jeske from Morrison Hershfield, James Crichton and Tim Seabert from Golder Associates, Keith Blades masonry conservator and Edmund Bowkett metals conservator. Specifications were coordinated with Jori Toniello of CircumSPECT.

1.3 CONTEXT

A general overview of the construction and maintenance of the Centre Block was discussed in the Pre-Design report and a summary of previous interventions was compiled for the Schematic Design report after reviewing documentation relating to interventions performed on the east and west pavilions over the last 40 years. This chronology of interventions serves as a starting point in the understanding of the actual building envelope condition and its performance over time (see **Figure 1.4 – 1.5**).

- 1970's: From Condition Assessment of the Center Block Masonry, 1999, p.28:
    - Repair work was also planned on masonry elements (turrets, chimneys, parapet walls) above the roof line in the late 1970's. Drawings prepared in 1976 indicate where work is required. Repairs included: repointing, parging of deteriorated stone, partial dismantling and rebuilding, and anchorage of stone work for the turrets. Those areas coincide precisely with the areas, identified in 1994, requiring masonry repairs on an urgent basis. Very little maintenance has been carried out between 1976 and the Emergency Masonry work and the South Façade Conservation Project. There was limited repointing and replacement of deteriorated stone at ground level.»
- 1984-1987: Roof repairs
    - Installation of heating cables at the lower lip of the roof. Remedial work included removing damaged copper sheeting from the edge of the roof to the dormer sills, repairing the concrete slab and placing weathered copper sheeting;
    - Replacement of flat roofs material.
- 1994-1996: Emergency Masonry Work
    - Complete dismantling and rebuilding and stabilization of all masonry elements above the roof line (turrets and chimneys). The brick back wall of the elements were changed for new concrete brick, vertical stainless steel reinforcing and stainless steel anchors were installed. Work at the pinnacle is to be confirmed.
    - Work below roof line of East and West towers is to be confirmed. Documentation has been requested by the Consultant team to complete the information.
- 2006: Removal of cresting on both East and West towers
- 2007-2008: Center Block Chimneys Stabilization
- 2007-2008: Remedial joint repairs

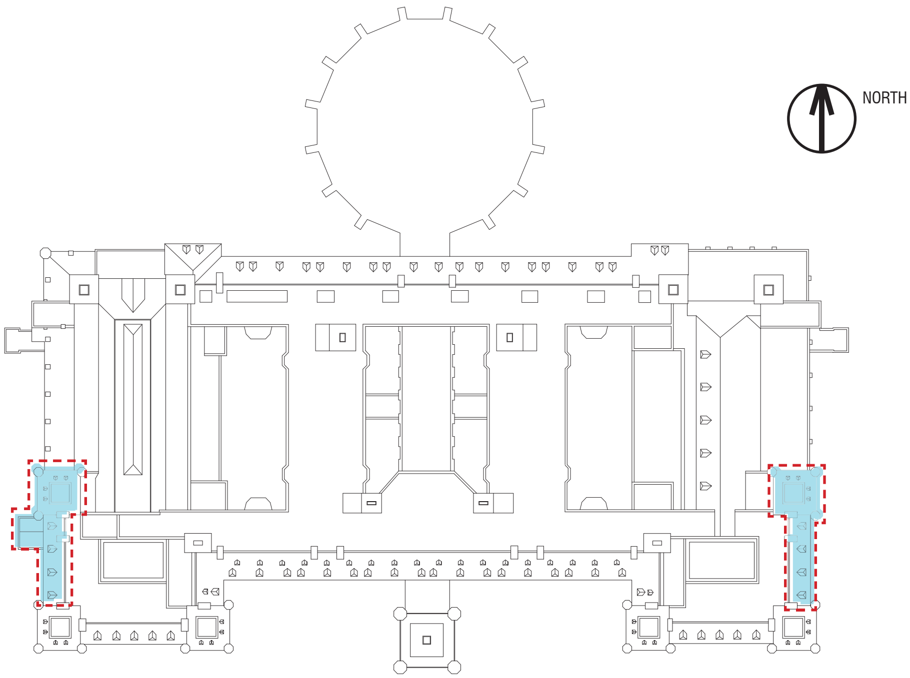


Figure 1-1 *Plan of Centre Block, showing East and West Pavilions area of work.*
Source: PWGSC base drawings.

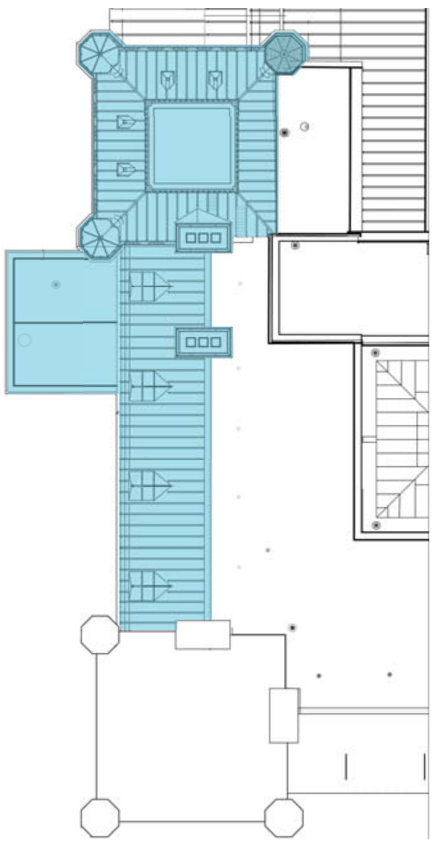


Figure 1-2 *West Pavilion area of work.*
Source: PWGSC base drawings.

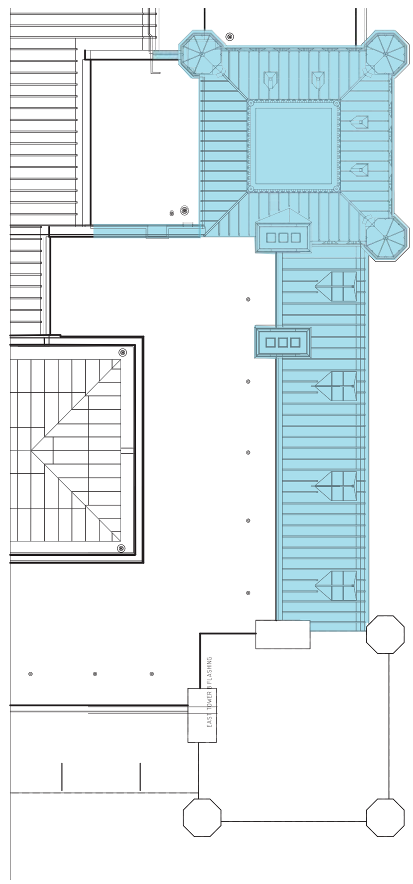


Figure 1-3 *East Pavilion area of work.*
Source: PWGSC base drawings.

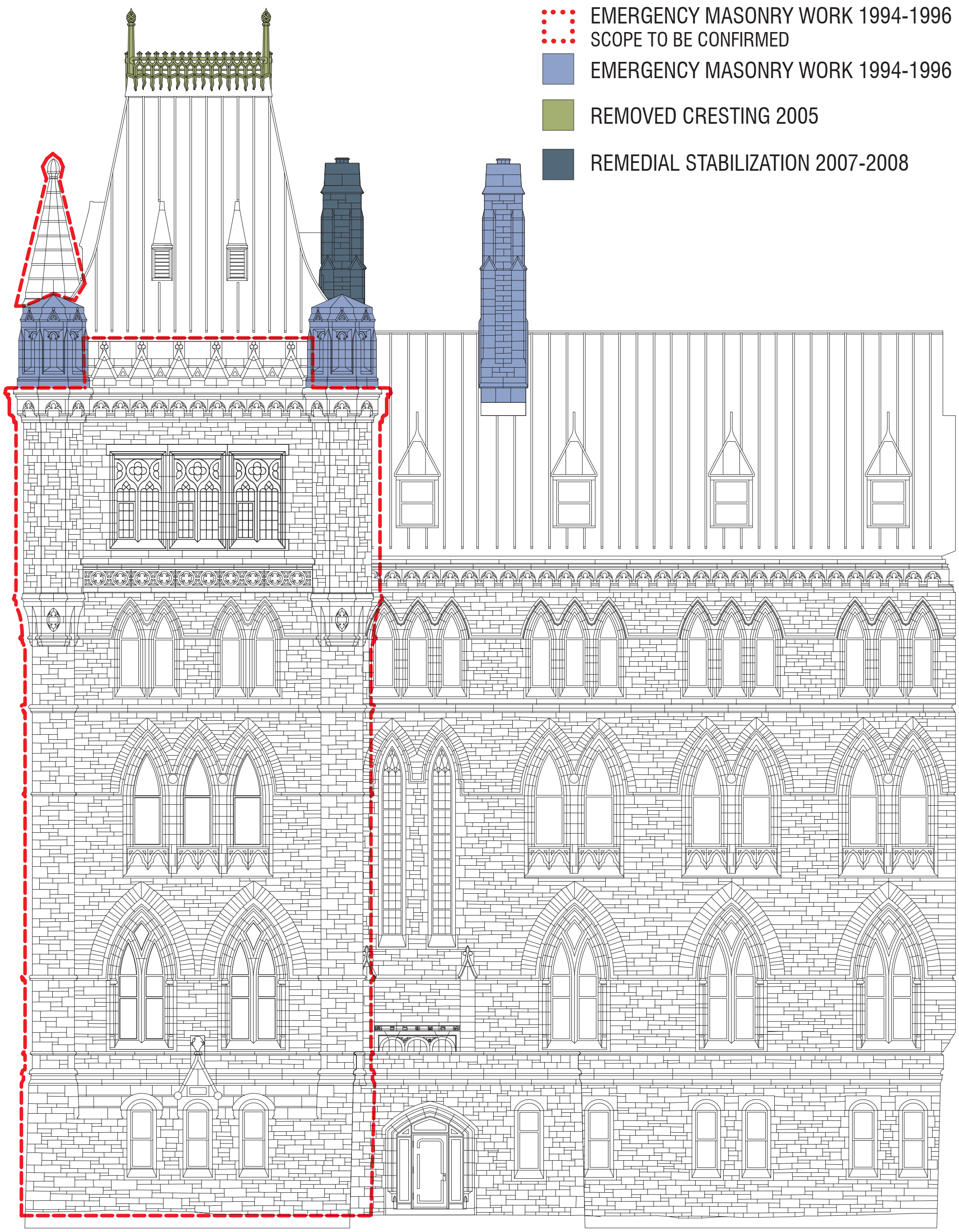


Figure 1-4 *Prior interventions on the West Pavilion*

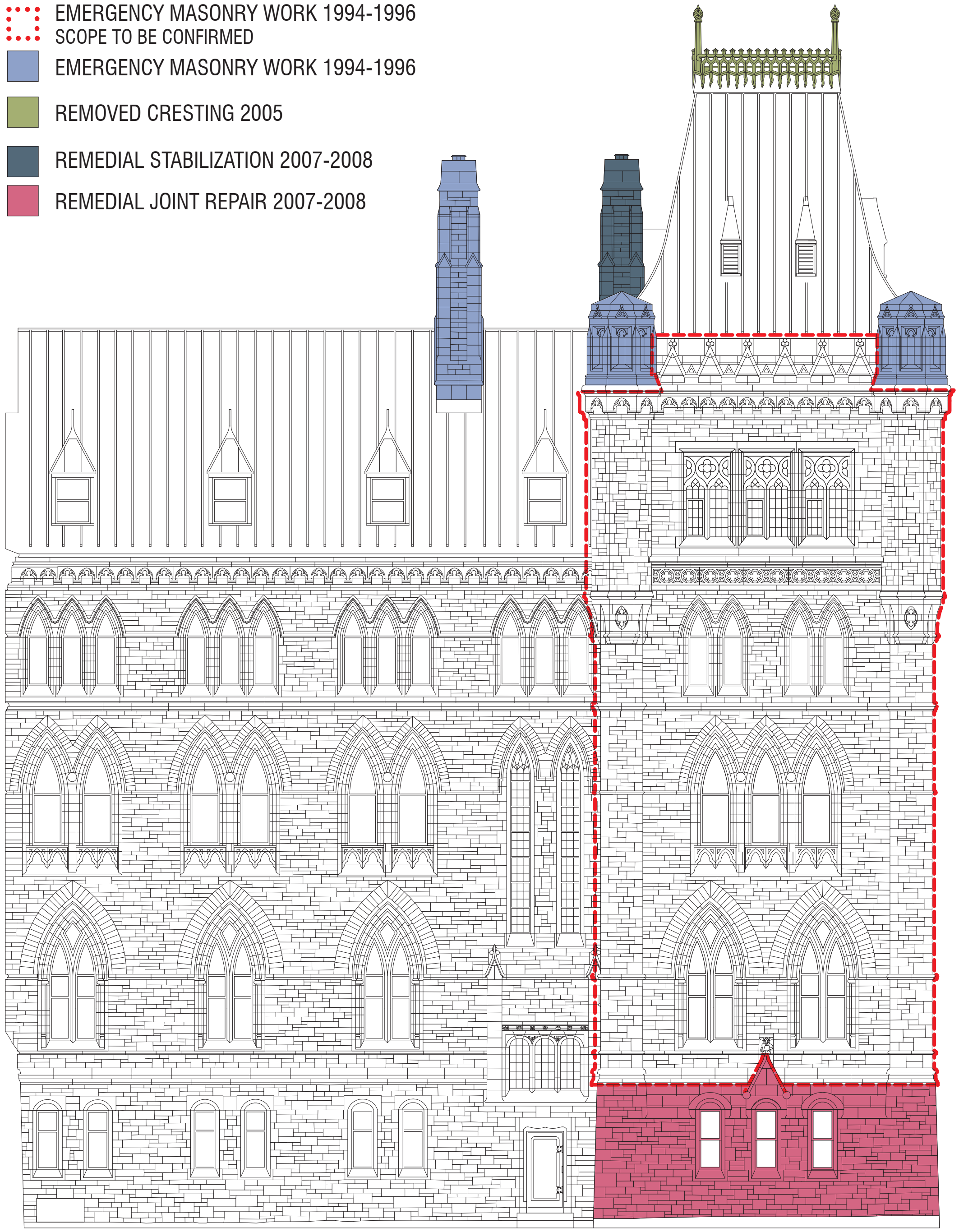


Figure 1-5 *Prior interventions on the East Pavilion*

PART 2 – PROJECT ADMINISTRATION

2.1 INFORMATION EXCHANGE AND TEAM MEETINGS

All documents that PWGSC made available have been uploaded to an FTP site hosted by FGMDA so it's accessible to the entire Consultant team. PWGSC has made available to the Consultant Team, 'Buzzsaw' accounts which will become the project repository for all communication and submittals with the client.

A detailed list of requested documents is included in Part 3 of this report. Several of the documents requested during the pre-design, schematic design, and design development phase have not been provided to the consultant team. Moving forward, it is assumed that these referenced reports will not be available for consultation. The lack of documentation for certain areas, such as the foundations, turret masonry work, and Cintec anchor placements means that the required information will have to come from new explorations or interpretations of the documents that the Consultant team has received and may be incomplete. A list of all documents that the Consultant team has received is included in **Appendix XIII:** Documents Received.

2.1.1 Coordination Meetings

Coordination meetings amongst the various consultants are being held on an as-needed, rather than on a regularly scheduled basis. These were chaired and directed by FGMDA representatives or the project Architect.

2.1.2 Meetings with PWGSC and Other Agencies

Fortnightly coordination meetings are an integral part of the project's Quality Management Plan and Control Strategy. These are held in PWGSC's Ottawa offices. Some of the attendees participated via conference call.

The meetings were attended by PWGSC's project managers, the HCD's design manager, the House-of-Commons and Senate coordination team representatives and the project architect, who represents the entire Consultant team. Other members of the Consultant team were invited to participate when their presence was required.

Meetings for the Design Development phase segued from the last meeting of the previous phase, which was held on January 17th, 2013 and will continue until May9th, 2013. The official end date of this phase is scheduled for July 2nd, 2013. 8 meetings were scheduled on the following dates:

#024 – Thurs Jan. 30th;
#025 – Thurs Feb. 14th;
#026 – Thurs Feb. 28th;
#027 – Thurs Mar. 14th Cancelled;
#027 – Thurs Mar. 28th;
#028 – Thurs Apr. 11th;
#029 – Thurs Apr. 25th;
#030 – Thurs May 9th;

In order to share information between PWGSC, its various agencies and the Consultant team, additional meeting were held on an as-need basis. These include the following:

RS-3

Thurs. Jun. 21st, 2012	Meeting between PWGSC, HCD, the South Façade Project Management team, the building's maintenance staff and the Consultant team was held in order to share information and relevant experiences encountered during the Centre Block Conservation of the South Façade project that was conducted in the mid-1990's.
Thurs. Jul. 19th, 2012	Meeting between PWGSC, HCD and FGMDA, was held to discuss the Quality Assurance Design Review comments issued for the Pre-Design Report.
Thurs. Sept. 27th, 2012	Meeting between PWGSC, HCD and FGMDA was held to review the 1995 Joannise report for the carvings and sculptural elements.
Fri. Nov. 9th, 2012	Meeting between PWGSC, HCD and FGMDA was held in order to discuss issues related to the Underground Services Drawing.
Wed. Nov. 21st, 2012	Meeting between PWGSC, RCMP and FGMDA was held in order to discuss security issues.
Thurs. Nov 22nd, 2012	Meeting between PWGSC, HCD and FGMDA was held to present preliminary findings resulting from the site investigations and exploratory openings.
Thurs. Nov. 29th, 2012	Meeting between PWGSC, HCD FGMDA and AAR was held in order to discuss the structural engineering modelling being used for this project's design.
Thurs. Dec. 6th, 2012	Meeting between PWGSC, HCD, the Dominion carver and FGMDA was held in order to resume discussions related to the carvings and sculptural elements that are included in the scope of work.
Wed. Jan 16th, 2013,	Meeting between PWGSC and their Geomatics consultant, FGMDA and Novatech, to review the Underground Services Drawing, coordinate the manner in which information can be retrieved and identify information that is required, but not contained in this document.

Thurs. Jan. 17th, 2013	Meeting between PWGCS, HCD, FGMDA, AAR, Pageau-Morel and Keith Blades, who participated via conference call. This was held to review the QAD Report comments that were dated Friday January 11th and made available to the Consultant team on Monday, January 14th, 2013.

RS-4

Mon. Feb 25th, 2013	Meeting between PWGSC, HCD, and FGMDA took place as a conference call in order to discuss the proposed material properties tests for the samples collected during the DFIT.
Thurs. May 2nd, 2013	Site visit for further investigation of the electrical and mechanical services throughout all areas of the project. Participants include Pageau-Morel, FGMDA. PWGSC provided an electrician.
Fri. May 3rd, 2013	Meeting between PWGSC, HCD, NRC, Keith Blades and FGMDA took place at the NRC in Ottawa in order to finalize the schedule and exact mortar recipes that will be tested in order to identify the best possible solution for the Rehabilitation Project.

2.1.3 Meetings with HRSDC Fire Commissioner

Morisson Hershfield, the project code consultant, prepared a proposed strategy for the application of the codes during the course of the work. This was sent to PWGSC for review and comment by HRSDC early in the RS-3 phase with the understanding that, if required, a meeting between the Commissioner and the Consultant team would be scheduled before the end of the RS-3 phase. However, internal restructuring with various Federal agencies resulted in some confusion as to whom the report should be sent to at HRSDC when the position of Fire Commissioner was officially eliminated. HRSDC's comments were returned to the Consultant group via PWGSC on April 18th, 2013. These comments were forwarded to Morisson Hershfield, which in turn requested clarification or supplemental information regarding certain issues. The code consultant is currently reviewing the comments received from HRSDC and will resubmit the regulatory report once this review is complete. Issues under revision include the requirements for a dry standpipe inside the scaffolding enclosure, and the incompatibilities between some of the recommendations made by HRSDC and the project objectives as described by PWGSC in the RFP. Specifically, the recommendation to board up all of the windows inside the scaffold enclosure with a 1-hour fire rating is contradictory to Section 2.1.4. which states:

> Work carried out will be done in such a manner as to ensure the continuous operation of the building. The Consultant will explore various strategies *and develop an acceptable strategy to ensure safety and to minimize the disruption to the Parliamentarians and their staff throughout the project. The strategy will identify and address impacts on the continued use of the building during the project, such as* ***natural light and ventilation*** *to the habitable areas of the interior...*

2.2 QUALITY MANAGEMENT PLAN

The Quality Management Plan is intended to ensure that the Consultant Team and services provided are consistently following best practices through a systematic set of strategies and activities to satisfy and exceed the Client's needs and objectives. The Quality Management Plan has the following objectives:

Be client focused;

- Clearly understand the needs and objectives of the client and other stakeholders with the goal of delivering the highest achievable level of professional service;
- Prompt response to client requests;
- Timely communications with Client and Consultants;
- Have a leadership structure establishing a unity of purpose thereby creating an environment that enables all to be fully involved with achieving the project objectives;
- Continually strive to improve design product by implementing a rigorous design process;
- Have a process approach to manage and balance *"activities-to-resources"* to achieve objectives;
- Implement a system approach to management to continually improve efficiencies to achieve quality objectives by identifying, understanding and managing all interrelated processes into a system;
- Satisfy professional development needs of staff through continued education and in-house training;
- Produce well detailed, clear and concise documentation;
- Capitalize on the efficiency of in-house technologies;
- Error prevention, not error catching;
- Effective administration of contracts on site;
- Effective and clear process for dealing with change management;
- Implement a clear Risk Management Plan;
- Lessons learned and sharing of information from recent and similar projects

2.2.1 Quality Control Planning

FGMDA's services management philosophy is based on:

- The elaboration of an appropriate Action Plan for the project;
- The structuring of an experienced, tailored-to-the-mandate Dedicated Project Team;
- The validation of the quality of the services rendered the schedules and the construction cost estimates.

2.2.2 Action Plan

The proposed Action Plan will reflects FGMDA's understanding of the mandate, the services required and the efficient undertaking of the required services. To attain the project's objectives, the Action Plan incorporates the following elements:

Leadership:

Essential to the success of the project are implementing a management structure that facilitates decision-making throughout the project and designating senior members of the team to participate with the Client from the start to the end of the process. This leadership has been undertaken by Julia Gersovitz who is guiding the team throughout the entire process.

Interdisciplinary Coordination:

Essential from the start of the design process is setting up a working methodology that encourages the close collaboration of all members of the Consultant team. This process is coordinated by the project architect and the individuals designated to coordinate specific components of the project. This process is characterized by an intensive interdisciplinary collaboration from the start of the project in order to establish the project's objectives and to identify the design synergies between the different components designed by different disciplines. Experience shows that open inter-disciplinary discussion and a synergistic approach will lead to a more complete understanding of all design issues and as a result will lead to more appropriate solutions.

Communication:

FGMDA believes in the importance of establishing an effective communication strategy through which the lines of communication and the communication tools are defined at the very beginning of the project. With today's communication technology, the risk of "information overload" exists. The production of large quantities of information with very little clear and pertinent direction is to be avoided. The design and construction process involves a large number of individuals and one that will be undertaken over many months. Specific communication tools will be introduced and implemented. The Project Architect is the key person for all of our project quality design and project construction communications. All decisions, information and communications are processed through the Project Architect. The Client contact is the PWGSC Project Manager.

Project Team Structure:
The consultant team is firmly committed towards creating a project dedicated team and assigning the most qualified individual to undertake the required tasks (see Section 2.2.3 : Project Team and Consultant Structure).

Information and Document Control:
There will be a large amount of information and formal documentation that will be communicated over the lifespan of the project. These may include programming, design and construction documentation submissions, recording the progress to date or at the completion of a specific task. Presentations will be made to the appropriate members of the client team and discussed so that the necessary feedback is received. Consultant recommendations will be issued to guide the decision making process. Standardized documentation templates will be used to ensure efficient tracking capabilities. Some of the standard information and documentation tools that will be utilized throughout the project are as follows:

Formal Submittals – Each phase of the project has formal submittals that are required services as part of the contract. All formal submittals will follow the formatting and procedures as directed by the client. Often, formal submittals will also require a presentation to various stakeholders that may take the form of a report and/or power point presentation which will be organized and coordinated through the Project Architect. All submissions are to be made to the PWGSC Project Manager.

Contract Documents – All contract documents (drawings and specifications) will follow the formatting requirements of PWGSC and the Contracting Directorate (RPCD), including official language requirements. All CAD drawings will follow standard PWGSC conventions for layering etc. as directed by the client.

Minutes of Meetings - All team and client meetings will have standardized minutes distributed accordingly. Minutes for meetings serve as an important communication tools to inform all members of the team of critical decisions taken.

Field Reporting – During construction the Site Resident Representative will perform frequent site reviews with observations documented in a standardized field report supplemented with photographs;

Responses to contractor Requests for Information – timely written responses to questions raised during tendering and through construction in a standardized format.

Shop Drawing Review Documentation – A formal procedure for reviewing and documenting submittals such as product data and shop drawings. All reviews will be performed in a timely fashion.

CCN & CO's – A standardized procedure and document templates will be implemented for circumstances where a contemplated change or change to the contract occurs.

Document Logs – A standardized log for document tracking will be implemented for the various phases of work. Examples include shop drawing, RFI, Contemplated Change Notices and Change Order Logs. These logs will be kept up to date for review and tracking purposes.

Technology – Information technology has changed the industry and how we work, making the design process and communications much more interactive – a valuable asset for our clients. We have a fully integrated IT support team built around the latest 3D modelling, production and visualization software. Our team is very well versed in applications such as Revit, AutCad, 3D Studio Max, Adobe Creative Suites to name a few. The team has access to a vast resource library of images and standardized details for referencing purposes.

Web Based Communications and Document Control - In order for all of this information to be available to the team at the proper time, it is our practice to establish an FTP project site on the FGMDA server. The site can then be the prime tool for distribution of information to all concerned and for the exchange of documentation. PWGSC has also made available Buzzsaw accounts for use as a standard project database for document control. Buzzsaw will become the project repository for all communications and submittals with the client.

WBS & Project Schedule:

A project-dedicated Work Breakdown Structure (WBS) and schedule have been prepared a consultant specializing in the preparation of Work Breakdown Structures, in which all the services to be provided and their respective deliverables are identified. The approvals to be requested and the inputs required from outside sources are also identified. The schedule has a start date of January 25th 2012 with a *"baselined"* end date of September 29th, 2016 and an additional 12 month guarantee period ending in October 2017. This WBS will be the road map for the delivery of services and will be updated formally monthly to reflect the present state of the project's development. A bi-weekly review of the status of the schedule will be reviewed during the project status meetings held every second week.

Cost Control:
The consultant team includes a professional costing consultant that has been engaged to monitor the costs to ensure they meet the objectives of the client and assure constructability. The cost consultant will monitor industry costs update the estimates during the design phase of the project and advise the team if it appears that the cost estimate will exceed the available construction funding. The cost consultant will report directly to the Project Architect who intern will advise the client and recommend the best course of action. The cost consultant will also be an active participant for any value engineering requirements during all phases of construction and assist the Project Architect if the need arises for contemplated changes to the contract.

Change Management:
It is always the goal of the Consultant Team to minimize risk, but there may be circumstances where a change to the contract will occur that impacts cost, schedule or both. Changes to the contact may occur due to changing objectives for the client, or due to unforeseen circumstances or site conditions. A process will be implemented for managing changes to the contract in direct consultation with the client and with a clear documentation process that includes standardized templates and tracking logs. The project Architect will administer in collaboration with the team all contemplated and actual changes.

Quality Assurance:
The team structure of FGMDA is tailored to respond to its role as prime consultant. The Project Architect, a senior professional under the responsibility of the Prime Architect, is in charge of the quality assurance. For this matter, he is assisted by a Team Leader in Materials Conservation for technical decision orientations, Coordinators for the production of all deliverables, and a Site Resident Representative for all issues on site during construction. Quality assurance in the production of informed consultant deliverables from the start of project and through the construction phase of the project includes, but is not limited to the following:

- Cursory visit of the building exterior;
- Cursory interiors survey and binoculars survey of the exterior;
- Interior survey and crane / lift survey of the exterior;
- Exploratory openings and materials testing;
- Review of deliverables by senior architects and engineers;
- Implement and follow a clearly defined document control process for each phase of work from inception to completion;
- Prequalification of contractors;
- Mock-ups and testing through the course of the construction;
- Monitoring of activities on site through frequent site visits by the resident site representative;

- Interpretation of the contract documents in a manner consistent with the intent of, and reasonably inferable from, the contract documents;
- Documentation and communication of construction activities in the form of field reports.

All deliverables submitted to the PWGSC Project Manager should be reviewed by the Prime Architect and Partner-in-Charge to ensure accuracy of the conservation approach, technical recommendations, etc.

Risk Management:
Implement a strategy to identify and minimize exposure or vulnerability to potential loss, an undesirable outcome, damage or injury as a direct or indirect effect of chosen actions, or inaction. A clearly defined risk registry and risk management plan has been included in section 2.4 Risk Registry of this report.

2.2.3 Project Team and Consultant Structure

Firm	Project Adminstration		Project Role	
	Name	Role	Name	Role
FGMDA Architects	Julia Gersovitz, OAQ, OAA, FRAIC, FAPT, CAHP	Partner in Charge & Prime Architect	Matteo Cendamo	Project Architect & Roofing
Project Architects			John Diodati	Team Leader & Masonry/ Materials Conservation
Conservation Architects			Nancy Labreque	Masonry Conservation
Sustainable Design			Alaiksei Fedarenka	Masonry Conservation
			Marianne Leroux	Project Coordination
			Greg Manley	Project Coordination
			Victoria Henderson	Project Coordination
AARL Consulting Engineers	Derek Mes, P. Eng	Partner-in-charge	Derek Mes	
Structural Engineers			Gholamreza Fathifazl	
Seismic Analysis and Design			Justin Vienneau	
Pageau Morel	Francois Laframboise	Partner-in-charge	François Laframboise	
Mech/Elect Engineers			Paul Germain	
			Bruno Tremblay	
Novatech	Ron Cerybk, P. Eng	Partner-in-charge	Ron Cerybk, P. Eng	Team Leader/Senior Project Manager
Civil Engineers			Francois Thauvette, P. Eng	Senior Design Engineer
			Steve Matthews	Design/Drafting
			Dan Vaughan	Senior Staff-Field
Goodeve Manhire Partnership	Peter Goodeve, P. Eng	Partner-in-charge	Peter Goodeve, P. Eng	
Structural Engineers- Scaffold Design				
Hanscomb	Arther Maw, PQS	Partner-in-Charge	Brian McBurney, PQS	Project Scheduling, Cost Estimation
Cost/Quantity Surveyor (PQS)			Grant Mercer , PQS	Project Scheduling, Cost Estimation
Time Planning/Scheduling Control				
Morrison Hershfield	Judy Jeske, P. Eng.	Partner-in-Charge	Judy Jeske, P.Eng	Senior Code Consultant
Code Consultant				
Golder Asssociates	James Crichton		James Crichton	
Environmental Consultants				
Specialized Consultants			Keith Blades	Masonry Conservator
			Edmund Bowkett	Windows / Metals Conservator
Patenaude Trempe	Richard Trempe OAQ	Partner in-Charge	Joseph Borsellino, Ing	Technical Resource
Building Envelope Specialist			Richard Trempe, OAQ	Building Envelope Specialist
			Patrick Masson	Sr.Technician, Director of Exploratory Investigations

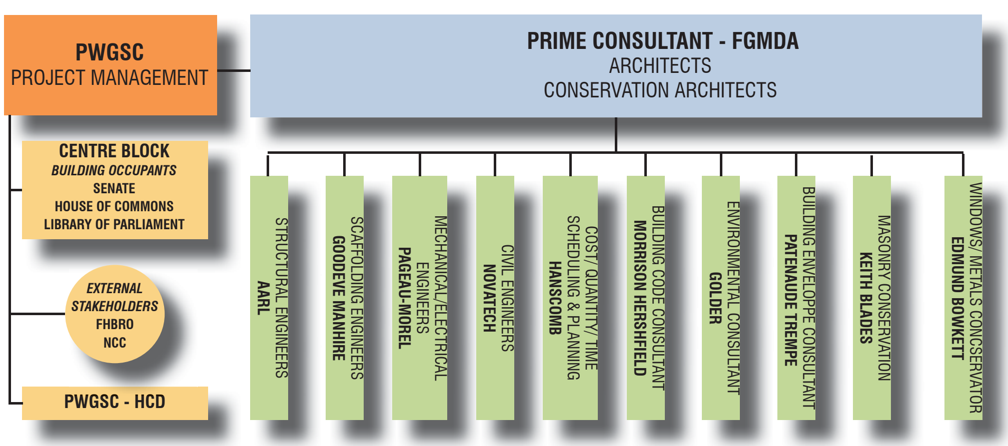


Figure 2.1: *Consultant Team Structure*

2.3 PROJECT BUDGET: SUBSTANTIVE (CLASS B) CONSTRUCTION ESTIMATE

The Class "B" estimate, appended to this report in Annex VII: Construction Budget Estimate, is intended to provide a realistic allocation of direct and indirect construction costs for the recommended option presented in section 8.1 of this report. The overall scope of work includes: conservation of the foundation (to be coordinated with adjacent projects), exterior masonry, roof, attic space, windows, structural integrity, limited seismic upgrade, adjustments to mechanical & electrical systems and scaffolding to provide working platform to perform the required work. Comments were received for the Class B and C budget within a couple of days and are currently being addressed.

Below is the Class B Construction Cost Estimate summary. The full budget can be found in **Appendix VII:** Construction Budget Estimate – Class B.

CENTRE BLOCK
EAST & WEST PAVILION REHABILITATION
OTTAWA, ONTARIO

Report Date : June 2013
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5. CONSTRUCTION COST ESTIMATE SUMMARY

COST SUMMARY:

-	New Construction	$4,642,700
-	Site Development	$400,000
-	Ancillary Work	$1,845,400
	Total- Including Site	**$6,888,100**
-	General Requirements & Fee	$1,239,900
-	Off Hours Premium	$812,800
	Total- Excluding Contingencies	**$8,940,800**
-	Design and Pricing Allowance	$625,900
-	Escalation Allowance	$191,300
-	Construction Allowance	$0
	Total- Including Contingencies	**$9,758,000**
-	Harmonized Sales Tax	$0
	Total Construction Estimate	**$9,758,000**

Figure 2.2: *Class B Estimate Overview*

2.4 RISK REGISTRY

2.4.1 Introduction

The purpose the Risk Registry document is to review “risks” as they generally pertain to the Centre Block East and West Pavilions Rehabilitation Project. The intent of the Risk Registry is to identify all potential risks to the project objectives, document strategies for planned options to mitigate those risks, and provide quantification of direct and indirect consequences associated with the risks. As this is considered a pilot project for the future overall Centre Block rehabilitation vision, the risk registry will be a valuable tool as groundwork for a future “Lessons Learned” document.

1. What is Risk?

The term “risk” refers to exposure or vulnerability to potential loss, an undesirable outcome, damage or injury as a direct or indirect effect of chosen actions, or inaction. Risk is often associated as an uncertainty on objectives caused by perceived potentials of uncertain future events that may or may not happen, or ambiguities caused by poor communications or lack of information. The impacts of risk could be an adversely negative or in fact have a positive effect on the overall project objectives.

Within each sequential phase of the design and construction of a project, a range of issues develops. Such issues generally relate, but are not limited, to client and design uncertainties, budget constraints, procurement of information, unknown conditions, incomplete or inadequate requirements and matters of policy by governing bodies at various levels and the general health of the economy. Some of these issues are minor and may have little impact upon the project. However, some issues are of a more significant in nature and may have a direct impact upon project budget cost and time of completion. In terms of planning for a construction project such as the Centre Block East and West Pavilions, the types of risks that may be encountered have a potential for direct, or indirect impacts on economic, scheduling, health & safety, information security, business and management objectives.

2. What is Risk Management?

The goal of risk management is to quantify the risks in such a way they are no longer uncertainties, and create mitigation strategies to limit exposure to a tolerance level acceptable to all stakeholders from the outset expectation. A Risk Management Plan firstly identifies strategies for dealing with risk that is congruent with the overall values and objectives of all stakeholders; secondly, creating a methodology for managing risk through identification, assessment and prioritization, and finally implementation and putting into action mitigation measures.

3. Strategies for Managing Risk

- Share, or transfer risk to another party ;
- Avoid the risk all together ;
- Reduce the probability of the risk ;
- Reduce the negative or undesirable effects of the risk ;
- Accept some or all of the potential or actual consequences of the risk.

4. Methodology

- Identify the case or issue ;
- Assess the vulnerability of the asset or stakeholders ;
- Determine the risk or likelihood of consequences whether positive or negative from the case to the objectives of all stakeholders ;
- Identify measures to mitigate or reduce the risk to an acceptable tolerance level ;
- Prioritize risk reduction measures – strategize mitigation of risk with qualitative and quantifiable objectives ;
- Implement mitigation measures.

5. Key Risk Factors at this Stage

Many risk factors are discussed in **Appendix XII:** Risk Registry. Risks at this stage relate to:

- Coordination with adjacent projects running simultaneously;
- A lack of qualified trades;
- The public tender contracting system;
- The quantification of hazardous materials in the tuck pointing mortar and in the basement where connections for mechanical and electrical systems will be made.

The sensitive nature of the location where the work will be taking place presents a high probability for the occurrence of work stoppages. With all of the other projects taking place on Parliament Hill there is also a risk of running into difficulties regarding the procurement of trades. This has a lower probability of occurring than work stoppages but the same impact risk is associated.

2.4.2 Centre Block East & West Pavilion Risk Registry

1. Description

The risk registry will be presented in both a table and narrative format (See **Appendix XII:** Risk Registry for current Risk Registry). The table is intended to be a high level summary of all risks identified by the Consultant Team which will be assigned a risk rating and allowance by Hanscomb, the project cost/quality surveyor. The risk registry table will be supplemented with a narrative, prepared by the Consultant Team that clearly identifies and describes the nature of the risk, the inherent potential consequences of that risk and strategies may be implemented to eliminate or reduce the exposure of the stakeholders to that risk. Once the uncertainty or risk has been identified and a mitigation strategy implemented, the risk becomes a "known" and will drop off the risk registry and can be added to a "Lessons Learned" document.

Hanscomb's Calculation of Risk Using a Percentages of Current Construction Costs

The risk allowance will be calculated using the set of following percentages. These percentages have been multiplied by the current cost estimate and schedule to obtain the risk allowance for each item (see **Table 2-1**).

Description	Probability	Cost Impact	Time Impact
Low	10.00%	2.50%	5.00%
Medium	20.00%	5.00%	10.00%
High	30.00%	7.50%	15.00%
Extremely High	99.99%	25.00%	50.00%

Table 2.1: *Calculation of Risk*

2.5 PROJECT SCHEDULE

The latest schedule, submitted on May 9th, 2013 and a summary of major milestones can be found in **Appendix VIII:** Proposed Project schedule. This in-progress document has been regularly updated and will continue to be updated as the project evolves. It is to be noted that the schedule is effective for the recommended option.

No major changes have been made to the baseline schedule during the RS-4 phase. Item that will carry forward into the next phase include the regulatory report, the risk registry, the budget, and the material testing results.

PART 3 – REVIEW OF REQUESTED DOCUMENTS

3.1 Summary of Requested Documents

The following table lists the documents, including reports and drawings, which were requested by the Consultant team. If items are highlighted in pink, they are considered to be containing information pertinent to this project and still outstanding. Any items in red have been designated as not available by the client.

A complete list of documents that have already been made available to the Consultant team can be found in **Appendix XVI:** Documents Received.

Document Request Tracking
Updated: Wednesday June 12th 2013.

	Requested documents	Person	Format	Date requested	Date submitted	Comments
19	**Docs requested during Investigations**			Apr10 - 20/12	NOT SUBMITTED	
20	**Prior masonry work on the turrets & chimneys:** According to Roger Labbé (Plouffe-Park's mason), these had undergone repair campaigns and seismic stabilizations in the late 1990's. Details of the interventions will help in evaluating whether these were successful or not.				NOT SUBMITTED	Some of this information may become available during discussions at the upcoming June 21st meeting, between the Consultant team and Plouffe-Park. Some of this information may be available on the photos referenced in item 24 below The photos from the South Façade's rehab show some of the stabilization work carried out in the chimneys, but not on the chimneys that are covered in this scope of work.
21	**Underground services drawing**	S. Nowsin			19-Jul-12	PWGSC transmitted to FGMDA, a CD-ROM containing the document in DWG format. Since viewing this document requires security clearance, PWGSC will send each of the other Consultants, their own copy. Some of the Consultants have picked up their copy of the document.
22	**Digitized version of Joannise Report**	P. White	pdf on DVD	6-Dec-12	14-Feb-13	As discussed at the meeting held Dec. 6th
23	**Tower C South West Pavilion Project # 707550**	S. Nowsin		23-Nov-12	NOT SUBMITTED	CINTEC anchors installed in towers (See email dated Nov 23, '12) File # 70755 / 609798 (see email dated Dec 18, 2012)
24	**Emergency work on East Pavilion roof parapet (Condition Assessment of Ctr Blk Masonry Report Mar 1999)**	S. Nowsin		23-Nov-12	NOT SUBMITTED	(See email dated Nov. 23, '12) East Pavilion Roof wall parapet (see email dated Nov. 23, 2012)
25	**Parapet wall emergency stabilization:**	S. Nowsin		18-Dec-12	NOT SUBMITTED	Report # 2977-129, Prepared by UMA Engineering, Sept. 20, 1994. (See email dated Dec 18, 2012.)
26	**Lessons Learned Appendix 2**	S Nowsin		16-Jan-13	NOT SUBMITTED	Ratio & Type of Masonry work completed compared to the overall masonry surface (see attached email dated Dec 14, forwarded to PWGSC on Jan 16, 2013)
27	**Chimney Details; specifically the vertical reinforcing embedment**			17-Feb-13	25-Apr-13	AAR requested chimney details. Bob Kirkshop has notified PM from South façade project
28	**2007 DSR report by InAIR Environmental Ltd.**	S. Nowsin	pdf	27-Feb-13	27-Feb-13	
29	**Centre Block Interior Recording. Project No. 412150**	S. Nowsin	digital / CAD	20-Mar-13	25-Apr-13	FGMDA originally received this document as part of a very large package. 23 of 38 pages are missing.
30	**DSR from Centre block exploratory openings Aug 2012**	S. Nowsin	digital	3-Apr-13	10-Apr-13	
31	**DSR from Centre Block basement and interiors**	S. Nowsin	Digital	23-May-13	27-May-13	PWGSC submitted this document and it was distributed to Golder for assessment.

Items are unavailable
Items have been received

PART 4 – REGULATORY ANALYSIS

4.1 REGULATORY ANALYSIS REPORT

The regulatory report produced by code consultant Morrison Hershfield was initially submitted in the Pre-Design report. HRSCD provided feedback in 10 categories listed below. After considering this feedback and participating in consultations with several groups, including the Ottawa Fire Department, a refined list of recommendations were made. They are described below.

Major points of concern were in relation to HRSDC's recommendation to add a 1 hour fire rating by boarding all of the Centre Block windows located within the scaffolding enclosure, as it is our understanding that this is in direct conflict with the construction work and the project performance requirements outlined in the RFP. Also, the installation of a dry standpipe to be installed inside the scaffolding enclosure is not recommended as construction workers would not be mandated to use it and firefighters would not incur the liability associated with entering a burning scaffolding in order to hook into a standpipe.

Particular attention should be paid to item #5 Fire separation as 4 possibilities have been proposed and each strategy has different implications. The option most highly recommended by the code consultant is a combination of item I and II, however these are not feasible since there is a requirement to provide ventilation openings for the delivery of fresh air to occupants. The recommendation is therefore a combination of items III and IV. This includes a sprinkler system activated with heat detectors within the scaffold enclosure and manual pull stations to initiate the Centre Block fire alarm system.

1. **Fire Protection:**
    a. A standpipe system within the scaffold area is **not** considered to be practicable or usable by either construction workers or the Fire Department. The Fire Department is expected to use an exterior fire attack or protect the Centre Block from within.
    b. Portable fire extinguishers throughout.
2. **Fire Alarm and Detection**
    a. A manual (i.e. bull horn) means to notify construction workers of a required evacuation due to a fire within the scaffold area or within the building (complete with trained personnel and identification of supervisory personal with responsibility to notify)
    b. Maintenance of the Centre Block fire alarm system at all times.
    c. Fire alarm audible device should be provided in the enclosure

3. **Fire watch**
    a. A recorded 1-hr fire watch shall be provided after hours when the fire detection system is disabled or not functioning.
4. **Fire Safety Plan**
    a. Construction fire safety plan
    b. Fire watch during and after all hot works.
5. **Fire Separation**

   At windows opening from Centre Block to the scaffold areas, we recommend one of the following:

    I. Protect window openings between the Centre Block and the scaffold areas with an assembly of wired glass in steel frame as a temporary closure. Please note that Lexan or other polycarbonate materials are combustible and although some can exhibit low flame spread properties, these materials will burn if exposed to sufficient heat and will propagate flame within the scaffold area and into the building under various fire scenarios.
    II. Cover window openings with an assembly of fire rated gypsum board both sides of steel studs.
    III. Protect the scaffold area with sprinklers (dry or deluge operated from heat detection within the scaffold area.
    IV. Install heat detectors and manual pull stations throughout the scaffold area to initiate the Centre Block fire alarm system in the event of a fire emergency within the scaffold area.

   It is recommended that a combination of options I and II be considered. Options III and IV are recommended in the event the event that window closures cannot be considered. However, it is noted that the closures recommended in options I and II must be closed except when work is underway on a specific window opening. If ventilation openings are required, options I and II will not work.
6. **Scaffolding**
    a. Noncombustible scaffold frame with solid wood or plywood planking (standard for industry).
    b. No accumulated storage of combustibles on the scaffold.
    c. Egress in conformance with occupational health and safety requirements for construction areas (i.e. not intended to conform to Building Codes as occupied spaces)
7. Emergency lighting shall be provided in the enclosure.
8. Fire Department access to the Centre Block, and to each scaffold as well as clearance to all hydrants, and fire department connections.
9. Protection of the public by covered passageways.

10. Consideration for a smoke exhaust fan from the top of the scaffold areas when scaffolding is completely enclosed (as in winter conditions). Fan can be manually started.

Although this new list of recommendations should be considered complete, the original Regulatory Report has been included in **Appendix X:** Regulatory Analysis as a reference.

PART 5 – HERITAGE CONSERVATION

5.1 HERITAGE CONSERVATION SUMMARY

The Heritage Conservation Strategy was established during the Pre-Design phase and refined during the Schematic Design phase. It remains the guiding principle for the design approach of all interventions for the Centre Block East and West Rehabilitation Project. First and foremost the strategy seeks to implement a minimal approach, in order to preserve the maximum amount of heritage fabric. Reconstruction or replacement of elements will be done only when absolutely necessary, due to irreversible failure or loss of integrity.

The Centre Block East and West Rehabilitation project will happen in advance of the Major Rehabilitation Project, and will be occurring while the Pavilions are fully occupied. In consequence, the scope has been limited to the exterior of the building and the potential impact on heritage character-defining elements restricted to the exterior of the building. These elements include the masonry, the gothic inspired carvings, the copper roofs, original windows and doors, the architectural metals, and the symmetry of the building. Contextually the symmetry is important as the interventions are developed, to ensure continuity not only between the interventions on the East and West Pavilions but also with previous works completed on the South Façade. The recommended option takes this into account and stresses a symmetry and balance of the overall composition and a consistency in appearance.

When preservation is not possible, materials will be replaced in kind (such as the copper cresting and finials) or with identical replacements (such as the copper roofing).

The addition of new elements (the ridged insulation in the Mansard roofs) will be done in a way that will mitigate negative impact on the exterior the character defining elements and be consistent with previous interventions (South Façade Project).

Two recommended interventions propose a visible change to the existing fabric: (1) the edge profile of the roof, to correct an inherent design defect, and (2) in the size of the dormer windows in the Mansard roofs, as a result of the addition of insulation.

The Conservation Strategy is described in full in **Appendix IX:** Conservation Strategy. The following paragraphs summarize some of the main features and intent.

Replacement Materials

- Investigations have included further review of documentation and exploratory openings of masonry, roofing and window elements. A testing program was developed for the mortars and the recipe most compatible with both the project goal of durability and stone will be selected.
- The replacement stone will be sourced from a quarry in the United States. It is the same quarry that has been supplying stone for projects on Parliament Hill for many years and is considered to be the only suitable source by the Masonry Conservator. More details regarding stone procurement are available in **Section 7.2.5.** Stone Procurement.

Cleaning

- Cleaning of the masonry and sculptural elements will most likely be accomplished through a combination of laser and micro abrasion. A collaborative effort between the Masonry Conservator, the Conservation Architect, and FHBRO will establish standards for the "degree of clean" through field trials. The goal is to clean to the point <u>before</u> the integrity of the stone surface could be compromised by the cleaning process.

Masonry

- The Conservation Strategy continues to favour a maximum retention of historic fabric. However, because of advanced deterioration, it is proposed that some areas of the masonry walls be dismantled and rebuilt in kind. These areas are found primarily at the base of the building, and at the corner turrets.
- Masonry interventions have favoured Dutchman repairs over stone replacement when possible, in order to preserve the maximum amount of heritage fabric.
- The recommended intervention is calling for 100% repointing. It is yet undetermined if the existing mortar will be removed by hand or with power tools. If power tools are to be permitted, , workers will likely have to demonstrate competency to the Masonry Conservator that they are capable of removing the mortar without damaging the surrounding stone prior to receiving authorization.
- When required, dismantling will be done in a way that conserves the maximum amount of original material. When removed, stones will be numbered to facilitate the reinstatement process.
- Although in the Pre-Design Report, reference was made to the potential impact of seismic upgrading of the chimneys and other projecting elements, the recommendation is to defer any seismic upgrades until the Major Rehabilitation Project because the chimneys perform to approximately 58% of the required 60% threshold for the current seismic code.
- The turrets are proposed to be dismantled and rebuilt, because of their overall deterioration, due to previous incompatible repairs. They will be rebuilt in kind, reusing original stone or replacement in kind. Seismic upgrading of the turrets will be incorporated into the rebuilding.

Roof

- The copper roofing material will be replaced, with a thicker gauge for longevity. The replacement in kind will follow the original detailing. Insulation is being proposed for the roof as a means of improving envelope performance, but not being considered for the walls and foundations.
- The copper cresting and finials will be replicated and reinstated. The copper shells will be reinforced with a metal endoskeleton instead of concrete in order to maximize the lifecycle of the new cresting installation.

Windows

- The window replacement/restoration has been deferred to the major project. The scope of work in the present project relates solely to spot repairs and temporary stabilization of the masonry jambs.

5.2 SUSTAINABLE DESIGN STRATEGIES

One of the project objectives outlined in the RFP focuses on sustainable design opportunities and implementation strategies. FGMDA believes that architectural conservation projects are themselves inherently sustainable and selected principles of sustainability can be implemented in the Centre Block East and West Pavilion Rehabilitation project.

The Treasury Board Policy on Management of Real Property refers to **life cycle** and **environmental responsibility** as follows:

> "6.1.9 The heritage character of federal buildings is respected and conserved throughout their [sic] **life cycle**…"
>
> "6.1.11 Real property is managed in an **environmentally responsible** manner consistent with the principles of sustainable development. The environmental condition of real property must be ascertained to determine whether it is or can be made environmentally compatible with its current and intended use. All available, relevant environmental information must be disclosed to anyone interested in occupying the real property."

The PWGSC Sustainable Development Strategy 2007-09 outlines several sustainability goals including but not limited to:

- Governance for sustainable development
- Sustainable development and use of natural resources
- Reduced greenhouse gas emissions
- Sustainable communities

5.2.1 Sustainable Design Objectives

Due to the historic significance of Centre Block it is imperative that sustainable design strategies be developed in conjunction with, the principles of heritage conservation that have already been identified in Section 5: Heritage Conservation. However, in instances where the principles of heritage conservation may not align with sustainable design strategies, it is important to remember that the first objective of the Centre Block: East and West Pavilion Rehabilitation project is to ensure the preservation of character defining elements of the building, as one of Canada's most important heritage buildings.

Precedents for the integration of sustainable design within the scope of architectural conservation typically achieve some sustainability objectives through categories such as diversion of construction waste; improvements on the Model National Energy Code; controlling embodied energies; reduction in carbon emission from the life-cycle environmental impact of construction and building operations; life-cycle analysis of specified materials; the removal of toxic materials in exchange for greener alternatives; and by responding to social sustainability issues such as enhancing public access and the conservation of important heritage structures.

5.2.2 Specific Opportunities

Several opportunities have been identified for the integration of sustainable design strategies.

1. **Conservation of materials and material specification**

   At its core, architectural conservation is a sustainable practice. In order to maintain the heritage character of the Centre Block, material replacement is minimized to locations where it is no longer feasible to conserve the existing or where a parasitic relationship exists. Such is the case where sandstone has previously been replaced with limestone. Limestone on top of sandstone causes a chemical reaction leading to a rapid deterioration to the supporting sandstone. By limiting the need for replacement materials, the need to manufacture and transport these materials is also limited.

2. **Diverting waste from landfills**

   Construction waste represents a significant challenge for projects trying to achieve credits for sustainability. Transporting and treating, if necessary, construction waste can be reduced and in rare cases eliminated all together by diverting through repurposing or recycling. In the case of the Centre Block, the copper roofing is no longer suitable for construction purposes but can be recycled at a metal recycling facility, and the stone that will be replaced can be crushed and reused for other applications.

3. **Toxic substance removal**
   Designated substance reports have identified the presence of several substances including, lead and asbestos within the limits of the Centre Block project. While the levels are quite low, precautions are being taken to safely and adequately remove these substances in order to improve the overall quality of the space for occupants in the long term and workers in the short term. When necessary, the materials will be replaced with less toxic and harmful alternatives.

4. **Thermal performance of building envelope**
   FGMDA has recommended installing 38mm - 50mm (1-1/2" to 2") insulation in the attic spaces to improve the thermal performance of the building envelope and increase the life cycle and longevity of the materials in the roof and attic spaces which are currently exposed to high levels of humidity due to condensation.

5. **Replacing 8 aluminium dormer windows**
   In the event that PWGSC decides to *permanently* replace the non-original, aluminium dormer windows as a result of adding insulation to the Mansard roofs, FGMDA would recommend the installation of high performance, energy efficient units. If the Major Rehabilitation Project includes the replacement of all windows within its scope, this option could be considered at that time.

PART 6 – DETAILED FIELD INVESTIGATIONS AND TESTING PROGRAM

Based on preliminary inspections, analysis and review during the RS-2 phase of existing documentation of the Pavilions and previously executed work on the South Façade, the Consultant Team prepared a Detailed Field Investigation and Testing program (DFIT) during the RS-3 and RS-4 phases. This program is necessary to gain a better understanding of the overall construction, existing conditions, deterioration and physical characteristics of the various elements making up the East and West Pavilions.

The investigations portion of the program was broken down to five major areas of study: roofing, attics, exterior masonry, interior masonry and windows. The information collected was used to develop the overall interventions that will be required to rehabilitate the Centre Block East and West Pavilions. Exterior masonry, windows and attic sections of the investigations were conducted from mid-August to mid-September 2012, when the House and Senate were on summer break. Roofs were investigated during the October 2012 break.

Invasive openings for interior masonry were scheduled to take place during the November 2012 break but were postponed until the December break due to scheduling conflicts with the Users. Instead, a non-invasive survey was conducted during the November break. This helped to establish the overall thickness of the exterior wall and to show how it varies from floor to floor. Later, the invasive testing on the West side was canceled at the request of the House of Commons. This was due to the presence of hazardous materials, as well as the overall negative impact and inconveniences the work would have posed. Upon further discussion, these openings were similarly cancelled on the Senate side of the building.

The testing portion of the program included non-destructive ground-penetrating radar readings that were conducted in the 6th floor West Pavilion attic, laboratory analysis of the existing materials that were removed during the building survey and exploratory openings, and a hygrothermal analysis of the wall sections.

All observations and a full description are available in Section 6 and Appendices I - VI of the Schematic Design Report. Observations for tests beginning during the RS-4 phase will be available during the RS-5 phase and will be presented to PWGSC as they are received. These results will be used to finalize the construction documents for tender. The following sections describe items that are ongoing and being carried forward into the next phase.

6.1 SAMPLE TESTING

Samples of stone, brick, and mortar were collected during the RS-2 phase and testing programs were developed to better understand the nature of the existing materials.

The testing program for the stone, brick and mortar has been finalized and the budget envelope has been approved by PWGSC. Mortar samples from stone and brick sections were sent to Highbridge Materials Consulting, INC. in early April and results will be available mid to late May. The overall testing budget was approved late April and NRC testing preparation will begin in mid-May. As long as Plouffe Park can supply a mason and the required stone to complete the tests all physical testing should be completed mid-November 2013. Preliminary results are expected to be available in phases. Basic physical properties should be available at the beginning of October 2013, freeze / thaw results should be available at the beginning of November, and bond test results should be available mid-November 2013. A final report can be expected early 2014. A meeting between masonry conservator Keith Blades, HCD member Maria Ines Subercaseaux, and NRC representative Ken Trischuk took place on May 3rd 2013 in order to identify which mortar recipes will be tested and establish the schedule.

As the final results of the testing program won't be available until the end of the Construction Documents phase or the beginning of the Tender Call phase it is expected that the initial specifications for the mortar will be revised once all the results are available.

In order to minimize cost and schedule delays, the tests completed at the NRC include procurement and preparation of stone materials by Plouffe Park.

The following tables list the information of the material testing program:

888-12 Centre Block - East & West Pavilions Rehabilitation

Issued for Coordination
Monday January 14th, 2013.

Proposed Mortar Testing by Highbridge

Mortars		ASTM C 1324		Preparation	Compressive Strenght	Vapour Transmission ASTM E 96 + at 90 days	Water Absorption ASTM C 67	Capillary Uptake
		Complete	Partial				Cold Water	
Existing	Brick backing		✓			✓	✓	✓
	Stone bedding	✓				✓	✓	✓

Table 6.1: *Mortar Testing by Highbridge*

888-12 Centre Block - East & West Pavilions Rehabilitation — Issued for Coordination

Proposed Stone & Brick Testing by NRC

Fri. Jan. 18, 2013.

	Material	Source	Petrography Evaluation (BSEN 12407) NRC	Resistance to Salt Crystallization BRE	Apparent density & porosity	Water abs @ atmospheric pressure (BSEN 13755)	Compressive strength	Initial Rate of Absorption	Vapour Transmission	Acid immersion	Expendable materials	Preparation *
Wallace	Existing	East or West Pav.	✓				✓				✓	✓
Wallace	Replacement 1	Wallace Quarry (Green)	✓				✓				✓	✓
Wallace	Replacement 2	Wallace Quarry (Buff)	✓				✓				✓	✓
Berea	Existing	East or West Pav.	✓			✓			✓		✓	✓
Berea	Replacement 1	Cleveland										
Berea	Replacement 2	Cleveland										
Berea	Replacement 3	Kipton										
Nepean	Existing	East or West Pav.	✓				✓				✓	✓
Nepean	Replacement 1	St-Canut Quarry	✓				✓				✓	✓
Nepean	Replacement 2	Quarry (tbd)	✓				✓				✓	✓
Brick	Existing	East or West Pav.					✓				✓	✓

Table 6.2: *Stone Testing by NRC*

888-12 Centre Block - East & West Pavilions Rehabilitation — Updated

Proposed Mortar Testing by NRC

Tues. June 11th, 2013

	Mortars		Prep	Compressive Strenght	Vapour Transmission (at 90 days)	Water Absorption 5h / 24h	Initial Rate of Absorption	Bond Strength	Frost Durability	Expendable Materials
Existing	**Brick backing**					✓				
Existing	**Stone bedding**					✓				
New	**As per original specs 1**	Berea			✓			✓	✓	✓
New	1:3+1/4 CL:S*	Nepean			✓			✓	✓	✓
New	**Control mix**	Berea			✓			✓	✓	✓
New	1:2-1/2: 8 C:L:S*	Nepean			✓			✓	✓	✓
New	**Natural Cement**	Berea			✓			✓	✓	✓
New	1: 2-1/2	Nepean			✓			✓	✓	✓
New	**Natural Cement**	Berea			✓			✓	✓	✓
New	1: 2-1/2 AEA	Nepean			✓			✓	✓	✓
New	**NHL-5**	Berea			✓			✓	✓	✓
New	1: 2-1/2 Secil S	Nepean			✓			✓	✓	✓
New	**NHL-5**	Berea			✓			✓	✓	✓
New	1: 2-1/2 Secil S AEA	Nepean			✓			✓	✓	✓
New	**NHL-5**	Berea			✓			✓	✓	✓
New	1: 2-1/2 St Astier S	Nepean			✓			✓	✓	✓
New	**NHL-5**	Berea			✓			✓	✓	✓
New	1: 2-1/2 St Astier S AEA	Nepean			✓			✓	✓	✓

All sand is Spratt masonry sand supplied by Plouffe Park
AEA = air entraining agent
*Federal white cement, Bondcrete type S lime with and air entraining agent blended in

Table 6.3: *Mortar Testing by NRC*

6.2 BUILDING ENVELOPE ANALYSIS

Patnaude Trempe, the Building Envelope specialist, was to conduct the theoretical hygrothermal analysis - computer simulations. Initially, these were to be conducted for the masonry envelope and the roofing assemblies. Of these, the masonry simulations were aborted due to the inability to collect the necessary climactic data at the interior of the building as well as specific information required about each of the components without disturbing the building's occupants. Without this data, the simulations would be inaccurate. The masonry work includes only repairs to damaged areas and no changes to the interior climatic conditions. Since the wall seems to have performed adequately, these simulations can be conducted as part of the Major Rehabilitation work, when the climatic conditions may be altered.

Instead, only static, one dimensional simulations using software such as HAM or CONDENSE were completed in order to evaluate the thermal performance of the roofing assemblies, and establish a theory with regards to the condensation of water within the assembly and its subsequent dispersion.

The tests were conducted by Patenaude Trempe in order to establish the location of dew points and their effect on the longevity of the components of the roofing assembly, and the potential benefits of adding rigid insulation to the roofing assembly.

Preliminary results indicate the existing dew point is found within the thickness of the existing 'Flex-or-Crete' deck and that it would be beneficial to add an air barrier and a layer of insulation at the exterior face of the deck. This will push the dew point outside of the existing structure, and into the new, insulation panels. This insulating material can be chosen to withstand moisture and condensation and will result in an increase of the theoretical life span of the existing roof assembly.

A more detailed analysis can be found in **Section 7.2.3:** Building Envelope Analysis

6.3 6TH FLOOR ATTIC OPENINGS

The openings were conducted between March 13th and March 15th, 2013 during the March break. Only one (located on the North wall) of the six bore holes revealed some delamination between the brick and/or the stone face. The 305mm x 305mm opening located in middle of the lower portion of the west wall was supposed to be the most likely place to find an embedded anchor but in the end contained none. There was some humidity but no delamination noted in the area. The opening was large enough to confirm our hypothesis of a 3 wythe back-up brick wall supporting the stone face, however we could not extrapolate these findings to other areas due to the limited size of the openings.

6.4 RECOMMENDATIONS FOR FURTHER EXPLORATIONS

At the time of submission of this report the Consultant team is recommending several future investigations to further their understanding of various elements. These include test pits or bore holes to expand the currently limited resources available on the current state of the foundations, materials testing for the samples of existing stone and mortar that were collected, any supplemental DSRs that might require completion, and additional site visits.

1. **Test Pits:** Although they are still being recommended by the engineering consultants, PWGSC confirmed that conducting exploratory openings or any excavation work around the foundations is highly undesirable and that if necessary, other means of collecting information should be considered. The Consultant team is taking that into consideration while evaluating the recommended level of intervention required at the foundation level and coordinating with adjacent projects running at the same time.
2. **Materials Testing:** The testing budget was approved by PWGSC and has already begun. NRC testing will begin in May and results a final report will be ready early in 2014.
3. **Designated Substance Reports:** As the recommended interventions continue to be refined it is possible that additional DSRs will be required, particularly regarding some of the mechanical and electrical work to be carried out when connections are made to the existing systems.
4. **Site Visit:** Additional site visits will be required in order to complete further visual inspections to facilitate the production of accurate tender documents. The use of a cherry picker has been requested for investigations relating to the review of sculptural elements, potential testing of mortar for lead and / or asbestos, and surveys to validate discrepancies found on base drawings supplied by PWGSC and those needed for tender documents. This visit is currently being planned for the month of July during the summer recess.

Each of these explorations represents a particular level of uncertainty and for that reason has been included in the Risk Registry.

PART 7 – DETAILED ANALYSIS AND DESIGN OPTIONS

7.1 SITE / CIVIL

7.1.1 Condition Assessment

Based on a review of the information provided by PWGSC to-date, some of the existing underground servicing information (i.e. location and elevation of weeping tiles and utilities, etc.) is incomplete. This information will be required to proceed to the detailed design stage of this project. The elevation of existing bedrock in the vicinity of the proposed works is unknown. Furthermore, the elevations of the East and West Pavilion footings need to be confirmed in relation to the elevation of the existing storm sewer system to determine if and where a positive outlet can be provided. In the absence of this information, approximate footing elevations were assumed and carried in the Risk Registry. If the actual elevations of the footings are found to be too deep relative to the elevation of the nearby storm sewer system, the proposed weeping tile may have to be raised above the footing elevation in order to provide a cost effective gravity outlet. Alternatively, if the weeping tile is too deep to connect to the near-by storm sewer system by gravity, a sump pit could be constructed internally, below the basement floor.

PWGSC has confirmed that weeping tile currently drains a small portion of the East Pavilion foundation wall. There is no weeping tile along the West Pavilion foundation wall; however there are storm sewers in the vicinity of the proposed works on both the east and west side of the building. Existing weeping tiles are also assumed to be located along the limits of the CBUS tunnels near the West Pavilion.

The Centre Block is currently serviced by a looped watermain network with service connections located on both the east and west sides of the building, in the vicinity of the proposed work. Siamese connections (fire department connections) are also located on the east and west sides of the building, in the vicinity of the proposed works. The siamese connections are located within 45m of nearby on-site fire hydrants.

The Centre Block is currently serviced by a sanitary sewer located on the west side of the building in the vicinity of the proposed work. There are no sanitary services or sewers on the east side of the building.

7.1.2 Options and Recommendations

The site / civil work related to this project is limited to the excavation, damp-proofing of the foundation walls, drainage improvements and backfill at the base of the areas of interventions along the East and West Pavilions. This work is to be coordinated with the re-pointing and repair of the masonry that extends approximately 400mm below grade.

Similar to the recent work completed along the south Façade of the Centre Block Senate Wing, which also included waterproofing and drainage of the southern portion of the East Pavilion foundation wall, the proposed subsurface drainage improvements will include the installation of a 150mm dia. perforated pipe c/w filter sock along the Pavilion footings. Replacement of the backfill with new free-draining materials in these areas is also an integral part of the 'Conservation of Foundation' component of this project. The intent is to provide a new weeping tile drainage system with gravity outlets to the existing on-site storm sewer system. The installation of a backflow preventer (backwater valve) is also recommended along the west side of the building. Although previously recommended, exploratory test pits to confirm the elevation of the footings, bedrock and the presence of nearby subsurface services were not completed. Consequently, the bedrock and footing elevations have been assumed in the vicinity of the proposed works. These elevations will be determined at the time of excavation. If the weeping tile is too deep to connect to the near-by storm sewer system by gravity and a sump pit is required, weeping tile flows would be drained to the internal sump pit and pumped to the nearby storm sewer system. Sump pumps, a backup system, electrical lines and an on-going maintenance program would be necessary to ensure the proper operation of this alternative system. If a sump pit and pumps are required on the west side of the building, a backflow preventer will no longer be necessary.

Weeping tile outlet options being considered at this time include:

- connecting to a nearby structure (i.e. catch basin or storm maintenance hole);
- connecting to a nearby storm sewer;
- connecting to the existing weeping tile system; or
- constructing a sump pit and pumping flows to the nearby storm sewer system.

The option of not installing weeping tile along the Pavilion footings was also considered, however this is not deemed a viable option as it does not meet the project goals and objectives. As indicated in a previous report, deep excavations (i.e. down to the footing elevations) were not considered to be cost effective at the time, due to the elevation of the existing storm sewer and the profusion of buried services, both known and unknown, which would have required extensive hand excavation.

All existing underground services in the vicinity of the East and West Pavilions are to be maintained and protected during all phases of construction. A minimum 6.0m wide fire route, fire hydrants and access to siamese connections (fire department connections) will also be required during all phases of construction.

Refer to Section 7.4.2 of the report for 'Options and Recommendations' relating to the domestic water and sanitary drainage requirements associated with the proposed work. Refer to **Appendix VII**: Proposed Site/Civil for drawings (C-1 and C-2) showing the location of existing services and utilities in the vicinity of the East and West Pavilions.

7.2 ARCHITECTURE / BUILDING ENVELOPE

7.2.1 Overview

Further review of information supplied by PWGSC has not resulted in any changes to the analysis or recommended option. As such, the analysis and recommendations from the RS-3 report have not changed and can be consulted in full in section 7.2 Architecture / Building Envelope of the Schematic Design report. Below is a summary of the recommended option and ongoing items related to architecture and the building envelope.

In summary, the option is as follows:

Roofs:

- Complete replacement of the copper and batten roofs of the mansards, dormers and towers with the addition of rigid insulation. Reports from the building envelope analysis suggest that 50mm insulation is preferable to 38mm insulation but has not yet been confirmed.
- Incorporating discrete design changes to eaves, drip edges and flashings to improve water shedding and direct it away from the masonry surfaces below.
- Complete replacement in kind of the copper flashings and flat membrane roofs at the towers and the West Entrance.
- Complete replacement in kind of the copper flashings at the chimney bases. Replication of cresting and finials at the tower parapets.
- South Façade documents suggest that the replicas were made with 16oz copper however, examination of the cresting removed in 2005 suggests that they were 20 or 24oz so this remains under discussion.
- Selective replacement and rehabilitation of the flat membrane roofs at their junction with the new copper replacement roofing.
- Selective replacement of the insulated tiles that are damaged during the rehabilitation of the flat roof membrane sections.
- Localized repairs to the roof slab (‘Flex-or-Crete’).

Masonry walls:

- Full re-pointing of masonry surfaces.
- Cleaning of masonry surfaces.
- Dismantling and re-building in specified areas, with 25% replacement of face stones and corner reinforcement in turrets at levels 3, 4 & 5. Additional sporadic replacement of face stone.
- Surface repairs as required.
- Temporary stabilization of masonry window jambs including consolidation, surface repairs and poulticing to remove salts.
- INTERVENTIONS TO BE CONFIRMED:
    - Consolidation, grout filling and stich anchors or only stich anchors in area of hollow sound.
    - Cleaning localized reinforcing or full reinforcement of beam uncovered by opening WT02.
- INTERVENTIONS UNDER DISCUSSION:
    - Flashing to protect the horizontal surfaces.

Windows:

- Stabilization of masonry window jambs.
- In-situ maintenance of aluminium windows.
- In-situ stabilization of steel and leaded glass windows.
- Temporary replacement of selected panes for ventilation.
- Replacement of 8 aluminium dormer windows.

Sculptural elements: Each sculptural element, including the carved elements, located within the scope of work for the Centre Block East and West Pavilions Rehabilitation Project are listed below in **Table 7.1** and **Table 7.2**. The right hand columns list the proposed interventions for each element. This table will be finalized after an exterior survey is completed in the month of July.

TREATMENT LEGEND for SCULPTURAL and CARVED ELEMENTS

1. TYPICAL BASE CONSERVATION

- Cut out and repoint joints;
- Removal of atmospheric soiling, sulphate crusts, organic growth, metallic stains, bitumen, tar, and paint;
- Removal of bird soiling and staining;
- Filling cracks;
- Pinning back surfaces and filling;
- Grouting thin plates of stone;
- Filling voids with repair mortar;
- Rubbing back friable stones;
- Removal of previous repairs;
- Treatment of exposed ferrous elements.

2. TYPICAL POULTICING APPLICATION (Aggressive cleaning)

- Removal of soluble salts using a poultice application.

**Poulticing is considered a reasonably aggressive treatment, typically required as a pre-treatment to chemical consolidation.

3. TYPICAL CHEMICAL CONSOLIDATION (Additional stabilization)

- Ethyl Silicate consolidation is to be used in very limited areas on each of the sculptures that would benefit from treatment. Localized rather than full stone treatment.

4. TYPICAL DUTCHMAN REPAIR (Sculptural Repairs)

- Replacement of small, missing detail. Typically only necessary to prevent accelerated damage to surviving detail.

5. TYPICAL STONE REPLACEMENT (Sculptural Replication)

- Complete replacement of sculptural elements but also includes large Dutchman repairs.

6. TYPICAL LEAD CAP FLASHING (Protection)

- Installation of lead flashing over certain elements to protect detail.

ID Number	Element Type	Description	Type of stone	Condition 1995	Notes:	Recommended Interventions: Base Intervention	Poultice Application	Chemical Consolidation	Dutchman Repair	Stone Replacement	Lead Cap Flashing
East elevation											
229	Capital	Two birds	Ohio	loose skins & flaking			✓			✓	
230	Capital	Bird, flowers, and leaves	Ohio	loose skins & flaking			✓			✓	
231	Capital	Maple leaves and Fleur de Lis	Ohio	loose skins & flaking			✓			✓	
232	Capital	Acanthus leaves and crosses	Ohio	loose skins & flaking			✓			✓	
233	Capital	Fish, water, and Scottish Thistle	Ohio	loose skins & flaking			✓			✓	
234	Capital	Squirrel, acorns, and leaves	Ohio	loose skins & flaking	Heavy loose on adjacent stones	✓	✓			✓	✓
235	Boss	Stylized bird (Eagle)	Ohio	Stone missing, loose skins		✓	✓			✓	
236	Boss	Acanthus leaves	Ohio	loose skins & flaking			✓			✓	
237	Boss	Face with tongue sticking out	Ohio	loose skins & flaking			✓			✓	
238	Boss	Face with mustache	Wallace	Stone missing, loose skins		✓	✓			✓	
239	Boss	Face with mustache and helmet	Wallace	Stone missing, loose skins & flaking		✓	✓			✓	✓
240		Vimy Ridge 1917-04-09	Wallace	Heavy loss & flaking							
241		Buffalo	Indiana Limestone			Replace					
242	Capital	Stylized acanthus leaves	Ohio	loose skins & flaking			✓			✓	
243	Capital	Stylized clover leaves	Ohio	loose skins & flaking			✓			✓	
244	Capital	Buffalo head	Ohio	loose skins & flaking			✓			✓	
245	Capital	Beaver and Maple leaves	Ohio	loose skins & flaking			✓			✓	
246	Boss	Eagle eating fruit	Ohio	loose skins & flaking			✓			✓	
247	Boss	Apples and leaves	Ohio	loose skins & flaking			✓			✓	
248	Boss	Face with tongue sticking out	Ohio	loose skins & flaking			✓			✓	
249	Boss	Owl	Ohio	loose skins & flaking			✓			✓	
WP10	Relief	Leaf?	Ohio	no information	To be reviewed By Keith						
WP11	Relief	Bird?	Ohio	no information	To be reviewed By Keith						
WP12	Relief	Leaf?	Ohio	no information	To be reviewed By Keith						
WP13	Relief	Fish?	Ohio	no information	To be reviewed By Keith						
WP14	Relief	Leaf?	Ohio	no information	To be reviewed By Keith						
WP15	Relief	Dragon?	Ohio	no information	To be reviewed By Keith						
WP16	Relief	Leaf?	Ohio	no information	To be reviewed By Keith						
WP17	Triangular relief		Ohio	no information	To be reviewed By Keith						
WP18	Triangular relief	Grotesque face?	Ohio	no information	To be reviewed By Keith						
WP19	Triangular relief	Grotesque face?	Ohio	no information	To be reviewed By Keith						
WP20	Triangular relief	Grotesque face?	Ohio	no information	To be reviewed By Keith						

Table 7.1: *Sculptural Elements East Pavilion*

Inverventions TBD

Important Damage Noted

ID Number	Element Type	Description	Type of stone	Condition 1995	Notes:	Recommended Interventions: Base Intervention	Poultice Application	Chemical Consolidation	Dutchman Repair	Stone Replacement	Lead Cap Flashing
West elevation											
407		Moose	Wallace	Heavy loss & flaking	efflorescence		✓		✓	✓	✓
408	Boss	Head	Wallace	loose skins & flaking			✓			✓	✓
409	Boss	Face with stylized leaf sprouting from bridge of nose	Wallace	Stone missing, loose skins		✓	✓			✓	
410	Capital	Oak leaves and acorns	Ohio	loose skins & flaking			✓			✓	
411	Capital	Leprechaun carrying leaf	Ohio	loose skins & flaking			✓			✓	
412	Capital	Indian head with Oak leaves (medicine man?)	Ohio	loose skins & flaking			✓			✓	
413	Capital	Farmer with sickle and sheat of wheat	Ohio	loose skins & flaking			✓			✓	
414	Boss	Snake	Wallace	Heavy loss & flaking			✓			✓	
415	Boss	Bird eating grapes	Wallace	light loss of surface			✓			✓	
416	Capital	Stylized acanthus leaves	Ohio	Heavy loss & flaking		✓	✓			✓	
417	Capital	Oak leaves and Fleur de Lis in Shield	Ohio	loose skins & flaking	Heavy loose on adjacent stones	✓	✓			✓	
418	Capital	Two wolves with Maple leaf shield	Ohio	loose skins & flaking			✓			✓	
419	Capital	Oak leaves	Ohio	loose skins & flaking	Heavy loose on adjacent stones	✓	✓			✓	
420	Capital	Acanthus leaves	Ohio	loose skins & flaking			✓			✓	
421	Capital	Two squirrels, Oak leaves, acorns	Ohio	loose skins & flaking			✓			✓	
422	Boss	Stylized bird	Ohio	Stone missing, loose skins		✓	✓			✓	
423	Boss	Corn	Ohio	loose skins & flaking			✓			✓	
424	Boss	Grotesque face	Ohio	Stone missing, loose skins		✓	✓			✓	
425	Triangular relief	Grotesque face	Ohio	Heavy loss & flaking	To be reviewed By Keith	✓	✓			✓	
426	Triangular relief	Grotesque face	Ohio	Heavy loss & flaking	To be reviewed By Keith	✓	✓			✓	✓
427	Triangular relief	Stylized Dragon	Ohio	Heavy loss & flaking	To be reviewed By Keith	✓	✓		✓	✓	✓
428	Triangular relief	Stylized bird?	Ohio	Severe loss & flaking	To be reviewed By Keith	Replace					
429	Relief	Winged body with human face	Ohio	Heavy loss & flaking	To be reviewed By Keith	✓	✓			✓	✓
430	Relief	Scottish thistles	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓
431	Rosette	Tudor Rose	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓
432	Relief	Grotesque animal face (pig?)	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓
433	Relief	Fleur de Lis	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓
434	Relief	Oak leaf	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓
435	Relief	Griffin	Ohio	Heavy loss & flaking	To be reviewed By Keith		✓			✓	✓

Table 7.2: *Sculptural Elements West Pavilion*

Inverventions TBD

Important Damage Noted

7.2.2 6th Floor Attic Openings

The openings were conducted between March 13th and March 15th, 2013 during the March break. Only one (located on the North wall) of the six bore holes revealed some delamination between the brick and/or the stone face. The 305mm x 305mm opening located in middle of the lower portion of the west wall was supposed to be the most likely place to find an embedded anchor, but in the end contained none. There was some humidity but no delamination noted in the area. The opening was large enough to confirm FGMDA's hypothesis of a 3 wythe back-up brick wall supporting the stone face, but could not extrapolate these findings to other areas due to the limited size of the openings. Observations of these openings can be found in **Appendix II**: Non Destructive Testing – Attic.

7.2.3 Building Envelope Analysis

A building envelope analysis was conducted to identify if condensation might be forming within the roof assembly, and if the addition of rigid insulation could improve the situation. Two roofing sections were analyzed in both their existing condition and again with the addition of ridged insulation. The first is a section through the 5th floor tower (assembly no 2) where there is a variable thickness of terracotta, and the second through the 6th floor tower (assembly no 1) where no terracotta is present. The model assumed a uniform thickness of materials throughout and estimated the location of dew points for existing and proposed roof compositions. Since the exploratory openings necessary to obtain all the relevant information were not possible, certain condition assumptions were made regarding materials. The Dew-Point method (2005 ASHRAE Handbook Fundamentals, ch 23) was used to evaluate the different scenarios and fixed variables were set for both exterior conditions (-25°C, 90% RH) and interior conditions (20°C, 30% RH).

Preliminary results indicate that condensation can form within the concrete slabs at both the 5th and 6th floors. The consultant team initially recommended a roof assembly composed of a vapour barrier, 38mm rigid insulation, 19mm plywood support, SBS membrane, and a 20oz copper sheet to be installed on top of the existing concrete. This assembly was used to repeat the same tests on the assemblies already tested. In this case, the existing SBS membrane simulates the existing 'rubberoid' membrane and acts as a vapour barrier.

Modified Assembly No 1: 6th Floor

The proposed modification increased the thermal resistance of the assembly from 0,78 m^2-C/W to 2,33 m^2-C/W but indicated a risk of condensation occurring within the ridged insulation. Depending on the temperature differential of inside and outside conditions there is a very small risk of condensation forming on the inside face of the plywood support panel. For this reason the building envelope consultant recommended that a non-putrescible panel be used in place of a standard sheet of plywood but this could be a costly modification to the roof assembly as the degree of difficulty for the installation would be higher. From an envelope performance criterion, the suggested air barrier is not required as the interior SBS membrane should be sufficient as a vapor barrier. However, the air barrier should be installed so it acts as a slip sheet between the existing deck and new insulation panels. A vapour barrier can also be installed between the deck and air barrier in the critical roof areas.

Finally the performance of the proposed assembly would be improved by removing the current fireproofing material as it would allow the concrete slab to remain warmer, forcing the dew point outside. The consultant team doesn't believe this is an acceptable solution because it cannot improve the envelope performance at the expense of code compliance.

Modified Assembly No 2: 5th Floor

The proposed modification increased the thermal resistance of the assembly from 1,27 m^2-C/W to 2,82 m^2-C/W but was insufficient for eliminating the risk of condensation within the existing concrete or the interior face of the existing SBS membrane. In order to move the dew point to the exterior side of the vapour barrier the existing concrete deck must be maintained at a higher temperature. This can be achieved by installing a thicker (50mm) rigid insulation panel.

Conclusion

General: There is a slight difference between the recommendations Morrison Hershfield provided for the South Façade project and the current recommendations. The consultant believes that this is due to the fact that Morrison Hershfield's modeling and analysis used actual conditions and material parameters values whereas the current report had to make assumptions regarding certain values and testing parameters. In order to make the testing conditions identical in an effort to corroborate the findings in both reports and the effect of the proposed modifications, exploratory openings of several square feet would have to be made in the attic, office spaces, and tower. It is understood that this is not possible due to the invasive nature of the process and the circumstances of occupancy.

As a result, the consultant team believes that it is prudent to recommend the installation of 50mm ridged insulation at all Mansard roof locations in order to ensure that the dew point would occur inside the insulation and not on any putrescible materials.

Tower: The tower represents a special circumstance since it is currently vented through the louvers, raising questions regarding the necessity of insulating an open air space. It is the Consultant team's belief that the 6th floor attic should be insulated with 50mm ridged insulation and the vented louvers should be maintained. This will achieve consistency in the roof profiles of the bay roofs and the south façade roofs, and it will eliminate the need to remove the copper roof we will be installing in order to insulate later on if the space becomes inhabited. Should the occupancy condition change at a later date, the suspended ceiling would have to be insulated, the louvers would have to be sealed, and mechanical ventilation would have to be instated to provide fresh air that the louvers were previously providing.

All findings and recommendations can be consulted in **Appendix XI:** Building Envelope Analysis. The proposed modifications to the roof assembly is being coordinated with the results of the modeling analyses and will be finalized shortly.

7.2.4 Windows

As a minimum intervention there will be in-situ maintenance of the aluminium windows, and in-situ stabilization of the steel and leaded glass windows. In order to provide ventilation to the rooms over the course of the project, select window panes will be temporarily replaced with new panes containing sealed collars for connections to the fresh air delivery system. The recommendation made by HRSDC to add a 1-four fire rating to all windows located within the scaffolding enclosure is currently under review by the code consultant.

Should the option to add insulation in the roof be retained, the increased thickness will potentially alter the profile of the roof and the 5th floor dormers windows at both the East and West Pavilions. This will affect the profile of eight existing aluminium windows and could necessitate their replacement with appropriately dimensioned new steel units. In this event, certain security requirements will have to be addressed. Specifically the six Users occupying the affected offices will have to be temporarily relocated. The two other windows occupy the tops of the stair wells at each of the buildings and may require separate security measures. Any repair work of the plaster surrounding the windows may need to be done under asbestos conditions.

A complete survey of windows can be found in **Appendix II**: Proposed Interventions: Windows. This information represents what was made available to FGMDA within the restrictions of surveying the interior of Centre Block and physical obstructions such as plexiglass additions.

7.2.5 Stone Procurement for Replacement Stone

The replacement stone for the Centre Block Project must come from the Cleveland quarries because it is the only stone that can meet the quality and quantity requirements for the project.

7.2.5.1: Sole Source Procurement

Berea Sandstone from quarries to the area west of Cleveland Ohio was supplied for the construction of the Parliament buildings in the 1860's. At that time some of the quarries were owned by a Canadian who supplied stone into Canada and specifically for the Parliament Buildings. The Berea Sandstone was used for the trim, decorative and carved elements on the buildings.

Today there are only two quarries currently operating and extracting stone in the area. Most of the original quarries are either worked out or have been developed in other ways so that extraction of stone is no longer possible. However, stone from the Berea deposit remains the only viable option for replacement and repairs to the Parliament Buildings

In 2006, stone from both quarries was sampled and tested for its characteristics, which included colour matching, suitability and durability.

Separate contracts would be required for the purchase and delivery of the stone from Cleveland to Ottawa, including *brokerage. The blocks would be delivered to and stored at the current facility (Macoun Centre, Pink road, Gatineau, QC), under adequate environmental conditions to allow proper weathering of the stones (which could take up to 6 months). The Masonry Contractors would then be required to procure the blocks from this facility when required for construction.*

Quarry Sources

Cleveland Quarries have supplied stone for repair work on the Parliament Buildings since the late 1970's. Recent restructuring and refinement in quarrying techniques has seen productivity increase and the volume of material extracted increase significantly since 2008. This includes the availability of the select clear buff material, which was previously only available in very small quantities. Thus they are able to meet the requirement to supply the quality and volume of material needed for the project. Typical block sizes range between 65 and 100 tons, yielding usable material between 65 and 70 %. Bed heights all exceed the minimum requirement of 900mm.

Kipton quarry was re-opened in 1996 and is a far smaller operation, principally supplying stone for landscaping and breakwaters rather than dimension stone for construction. Very small quantities of the "select clear buff" material have been quarried in the past. However, bed heights are shallow, typically 600mm, and only very limited quantities can be obtained per annum due to the difficult nature of the deposit.

7.2.5.2: Timeline

The consultants initiated the procurement planning process in June 2013 in order to have the stone on site before the winter of 2014 when the difficulty of transporting the stone is higher. It is noted that this timeline is generous as the masons will likely not be ready to install the replacement stones before summer of 2014, but we feel that there are no significant risks in proceeding with this timeline at this point. The schedule can be broke down as follows:

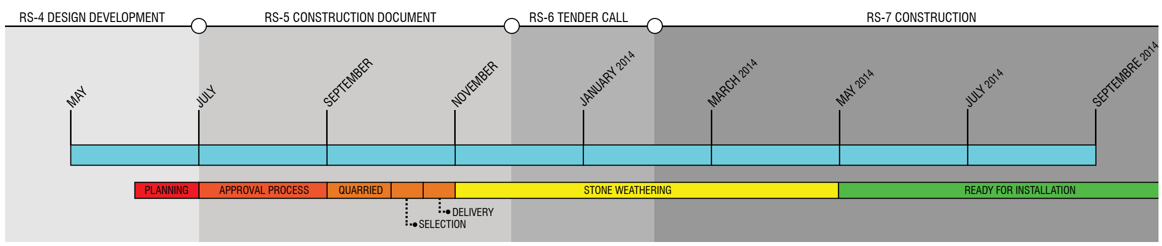


Figure 7.1: *Stone Procurement Schedule*

7.2.5.3: Quantities

The Masonry conservator has estimated that the project will require 2000 cubic feet of Berea and 15 tons of Nepean stone to complete the recommended stone replacements.

7.3 STRUCTURAL AND SEISMIC

7.3.1 Overview

Further review of additional information supplied by PWGSC yielded no new information. As such, the analysis and recommendations from the RS-3 report have not changed and can be consulted in full in section 7.3 Structural and Seismic of the Schematic Design report.

In summary, the options are as follows:

Chimneys: Status quo regarding any seismic upgrades for the chimneys since they currently satisfy 58.7% of the required 60% seismic loading requirements outlined in the 2010 NBCC.

Masonry walls: Further investigation of the steel beam uncovered by opening WT02 to determine the extent of corrosion and assess if a replacement is required.

Turrets: Dismantling and rebuilding of turrets and pinnacles.

Roof/masonry wall: Installation of reinforcement to help counteract thrust loads from the roof.

Roof: Localized repairs of the roof slab elements

Foundation walls: Localized concrete repairs, waterproofing, and installation of expansion joints.

7.4 MECHANICAL AND ELECTRICAL

1. Security

Meetings with PWGSC, RCMP and HOC/Senate Security need to be scheduled to review all security issues associated with the project including interference of all equipment on the roof, and to identify information that can or cannot be shown on the contract documents, in particular information on the site services drawings, for security reasons.

2. Mechanical

a) General

The detailed designs of the mechanical services will be developed up to the entry points, either at the scaffolding areas or the mud rooms. From that point, the contractor will be responsible for providing detailed designs of the mechanical services required to meet the tender documents' performance specifications. This should mitigate any potential risk and control costs. The methods of construction and type of scaffoldings are likely to be adapted by the contractor, which will likely require changes or adaptations to the design details and could result in claims from the contractors. In this case, responsibility falls on the contractor to meet the performance specifications at no extra cost.

b) Domestic water service

During construction, potable water will be required for the masons. Water service will connect to the existing service in the basement close to the East and West sides of construction areas, and will crosses exterior wall underground.

For curing of mortar, the water temperature has to be between a minimum of 10°C and a maximum of 25°C. Therefore domestic hot water will be required, an electric or gas fired water heater (at contractor's discretion) will have to be provided in the mud room or in another heated enclosure next to the scaffoldings.

c) Sanitary drainage

Sanitary drainage will be required for masonry work.

Drainage connection from the construction sites will have to be above ground level for gravity drainage on the west side and using a pumping station for the east side. Upon project completion, the contractor will then have to reinstate the building envelope where sanitary drainage crossed the wall.

d) Scaffolding enclosure heating – winter months

The scaffolding enclosures will require heating during the winter months using a glycol heating loop system, one system per pavilion c/w natural gas boilers and the associated circulating pumps installed within the mud room of each Pavilion, temporary flue gas vents, natural gas piping, controls, etc.
A detailed design by the contractors' Professional Engineer will be required in order to maintain a minimum scaffolding air temperature of 12^{C} in winter.

Energy source: Natural gas, connected to the underground high pressure natural gas service upstream of existing gas meter on the west facade. Natural gas piping will run up the West scaffoldings to the roof and over the roof to the East Pavilion.

e) Sprinkler Systems

In order to preserve window openings and avoid the construction of a 1 hour fire rated separation between the exiting building and the scaffolding, the scaffolding should be sprinklered. A dry pipe system will be designed to activate automatically if sprinklers are exposed to heat.

Sprinkler systems will be designed by contractor's Professional Engineer, and installed in the proposed mud room, interlocked with the Centre Block Fire Alarm system.

f) Standpipe System

A dry standpipe riser with siamese connection at ground level and fire connections has been proposed for the main stairwell of each scaffold, and has been included in the budget. In theory, the fire department will connect their fire truck to the closest hydrant and to the dry standpipe riser. However the code consultant has indicated that the Fire Department would not enter the scaffolding enclosure in the event of a fire to connect to a standpipe. As such, FGMDA believes that the $56,000 installation cost is not an efficient management of resources.

g) Portable Fire Extinguishers

Portable fire extinguishers are to be provided in the construction area as they offer good protection at a minimum cost. They should be unobstructed and easily accessible in the following key areas:

- Where hot work operations are carried out;
- Where combustibles are stored;
- Near or on any internal combustion engines;
- Where flammable and combustible liquids or gases are stored or handled;
- Where temporary fuel-fired equipment is used.

Portable fire extinguishers are to have a minimum rating of 2-A:10-B:C on moveable equipment and 4-A:40-B:C in all other locations.

h) Offices Ventilation + A/C

As part of the RFP, we were requested to provide fresh air for the occupants of 16 offices located on the fourth and fifth floors of Centre Block. Since there is no fresh air provided to the remaining offices either, we are proposing to extend the fresh air distribution to all the offices adjacent to the scaffoldings, as their occupants will not be able to open their windows during construction.
Also, PWGSC and HOC have requested that all the offices be provided with A/C equivalent to capacities provided by the existing window or “Pinguino” units. Three similar options exist for delivering fresh cooled air.
Fresh air will be provided by natural gas rooftop makeup air units (gas fired with electric cooling - one per Pavilion), and distributed to every office through an air distribution network of ducts attached vertically and horizontally on the outside of the scaffoldings but within the heated enclosure, and terminated with a 100mm diameter flexible duct attached to each office window. Fresh air would be provided to every office at a rate of 20 l/sec per room, at a constant temperature (+/- 22^{o}C) year round. The additional cooling capacity requirement air would be handled by “Pinguino” type A/C units.

Since the Pinguino” type A/C units exhaust the condenser’s heat through the windows into the scaffolding area, filters will have to be provided on the discharge side of the units, and replaced regularly to prevent dust migration to the offices. The office windows will have to be temporarily replaced with new panes having sealed collars for the fresh air duct and Pinguino exhaust connections.

Close coordination of distribution ductwork will be required in order to limit disruptions to workers. The rooftop makeup air units will be in operation not only when the offices are occupied, but also when construction work is in progress. The introduction of fresh air to the offices will maintain them under a slightly positive pressure and thus minimize the risk of dust carryover to the building.

i) Scaffoldings and Mud room ventilation

- Minimum ventilation rate for Acceptable Indoor Air Quality. The contractor is to provide and implement detailed designs of ventilation system to maintain minimum ventilation within scaffoldings areas meeting ASHRAE 62.1-2007, with a People Outdoor Air Rate (R_p) of 3.8 L/ s-person and an Area Outdoor Air Rate (R_a) of 0.3 L/ s-m^2
- Limit to Smoke Movement. The contractor is to provide and implement means to limit smoke movement meeting OBC 3.2.6.2 (3) with a vent to the outdoors or operable area near the bottom of the stair shaft, not less than 1,8 m^2 . No mechanical ventilation required.

3. Electrical

a) General

The detailed designs of the electrical services will be developed up to the entry points, either at the scaffolding areas or the mud rooms. From that point, the contractor will be responsible to provide detailed designs of the electrical services to meet the tender documents' performance specifications. Adaptations to the method of construction and type of scaffoldings in order to reduce risk and cost will likely require changes to design details. It is the contractor's responsibility to meet performance specification at no extra cost.

b) Power Requirements

Electrical power will be required for the following services:

- lighting within the scaffoldings and mud rooms for work performed overnight;
- power tools;
- hoists / material elevating devices;
- hot water heaters (gas or electric)
- roof top gas fired makeup air units;
- gas fired glycol boilers;
- glycol heating force flow units;
- glycol heating circulating pumps;
- general construction outlets / services;
- scaffolding's ventilation;
- mud room ventilation. .

The capacity requirements and source availability are to be evaluated.

Temporary power is available at 600V, 3 phases from electrical panels located in North side attics and in the basement. Remaining capacity available is unknown, but may suffice for the project requirements.. Each the east and West mud rooms will be provided with a 100 Amps 600V, 3Ø disconnect (capacity to be confirmed) – Refer to drawing E-1 From those points, the contractor will be responsible for designing and installing all the power distribution, feeders and accessories to feed all mechanical and electrical equipment within the scaffoldings and mud rooms.

The roof top make-up air units will be fed 600V, 3Ø from the machine rooms existing electrical panels. Re: drawing E-2.

c) Fire Alarm System

The building's fire alarm (FA) system is to be operational at all times. However, temporary shut-downs of the fire alarm system are permitted as per NFC Sentence 6.1.1.4.(1). We recommend providing notification for occupants working on the scaffoldings in the event of a fire in the building, and vice versa.

This involves extending signalling zones and installation of fire alarm signaling devices in the scaffold and mud room areas with provision of manual stations to allow workers to initiate the fire alarm as needed, and to connect to interlock the proposed dry pipe sprinkler systems to the Centre Block Fire Alarm System. To that effect, an addressable interface will be provided in each mud room, for the contractor to hook up each zone device (alarm devices, supervised devices, etc). The contractor will be responsible to detail design the FA system and accessories supporting the scaffoldings and mud room, as well as reprogramming the Centre Block FA system accordingly.

d) Lightning protection

Temporary lightning protection for the scaffoldings will be specified (performance specifications for the contractor to design and implement)

Part of the existing lightning protection of the roof will not be reusable upon completion of work and need to be replaced with new components for a guaranteed performance including down conductors, interception conductors, etc.

e) Cameras

Several security cameras located on the roof may need to be disconnected and removed from the masonry wall. They will likely have to be relocated temporarily during construction. Coordination is required with security/RCMP.

f) Exterior Lighting

Consideration should be given to reinstall a light fixture above the exterior door on the east side façade to improve the overall security.-

g) Heating cables

On the copper mansard, just to the North of the pinnacle on the North-East corner of the West Tower, heating cables may be in conflict with the proposed scaffoldings. Therefore they may have to be disconnected and removed from roof and replaced with new heating cables upon completion of work.

h) Cooper Roof Replacement

Copper roof replacement will require removal/replacement of the existing electrical conduits and equipment that is currently on the roof. Most of the conduits and cables involved are for lighting protection and heating cables.

7.5 SCAFFOLD DESIGN

Two options for scaffolding were presented in the Schematic Design report. The first (option 1) being a traditional scaffold structure and the second (option 3) being a structural steel design that required underground foundations. Since the first option didn't allow direct access to all areas of intervention and installing scaffolding footings was not a viable or cost effective option, the Consultant team proposed a hybrid of the two as a recommended intervention (Option 4). In essence, the recommended scaffolding design is a traditional one with structural steel components that will span larger sections and allow direct access to all areas within the scope of the project.

The Consultant team will be producing a performance specification for the scaffolding and have taken note of request made by the House of Commons in their feedback document. More information regarding the design of the scaffolding can be found in **Appendix VI:** Proposed Interventions – Scaffolding Design.

PART 8 – OPTIONS SUMMARY AND RECOMMENDATIONS

8.1 OPTIONS SUMMARY AND RECOMMENDATIONS

This section of the report has not been modified since the RS-3 submission since FGMDA is currently waiting for confirmation of the retained options from the Client. The following table presents the scope of work for the recommended option and should be read in conjunction with Appendices III to XIII for drawings, budget, schedule, conservation strategy, and risk analysis.

	Recommended Interventions
Conservation of Foundations	• Full re-pointing of masonry below grade (± 400 mm); • Repairing and patching the area of water infiltration in the basement level directly beneath the West Pavilion Entrance vestibule; • Patching and filling cracks in the concrete walls; • Repair damaged area and water infiltration at west pavilion entrance vestibule and at junction between service tunnel; • Damp-proofing the concrete walls; • Adding drainage tiles at the footings with installation of backflow preventers; • Replacing the backfill with new free draining material. **UNKNOWN INFORMATION AT THIS STAGE:** • Condition of concrete walls; • Elevation of the footings and bedrock; • Location and elevation of services; • Connectivity of structures and sewers.
Conservation of Exterior Masonry (with the exception of Attic Spaces, top of Turrets, Pinnacle and Chimneys)	• Full re-pointing of masonry surfaces; • Cleaning of masonry surfaces; • Full re-pointing of masonry surfaces; • Dismantling and re-building in specified areas, with 25% replacement of face stones and corner reinforcement in turrets at levels 3, 4 & 5; • Additional punctual replacement of face stone; • Surface repairs as required; • Temporary stabilization of masonry window jambs including consolidation, surface repairs and poulticing to remove salts. • Sculptural elements: Cleaning, consolidation, and removal for replacement where necessary. **INTERVENTIONS TO BE CONFIRMED:** • Consolidation, grout filling and stich anchors or only stich anchors in area of hollow sound; • Cleaning, localized reinforcing or full reinforcement of beam uncovered by opening WT02. **INTERVENTIONS UNDER DISCUSSION:** • Flashing to protect the horizontal surfaces;
Conservation of Roof	• Complete replacement of the copper and batten roofs of the mansards, dormers and towers with the addition of 38mm insulation; • Incorporating discrete design changes to eaves, drip edges and flashings to better shed the water away from the masonry surfaces below; • Complete replacement in kind of the copper flashings and flat membrane roofs at the towers and the West Entrance; • Complete replacement in kind of the copper flashings at the chimney bases; • Replication of cresting and finials at the tower parapets; • Selective replacement and rehabilitation of the flat membrane roofs at their junction with the new copper replacement roofing; • Localized repairs to the roof slab (flex-o-crete).
Conservation of Attic Spaces	• Local cleaning and painting of the corroded steel structure;
	• Installation of reinforcing anchors along the top of the walls to counteract lateral thrust from the roof; • Repairs to the damaged / missing fireproofing material (1-hour fire resistance). • Poulticing to remove salts, Dutchmen repairs where necessary on face stone and grout injection in brick back wall or dismantling and rebuilding of masonry exterior walls depending on existing condition.
Conservation of Windows	• In situ maintenance of the aluminum windows; • In situ stabilization and maintenance of the steel and leaded glass windows; • Replacement of offices windows panes with new temporary panes with sealed collars for ventilation; • Replacement of dormers aluminum windows for steel frame windows.
Conservation of Top of Turrets, and Pinnacle	• Dismantling and re-building of exterior stones; • Replacement of concrete brick back wall with sandstone; • Cleaning of the masonry surfaces; • Revised and additional structural 'stabilization.
Conservation of Chimneys	• Full re-pointing of masonry surfaces; • Surface repairs as required; • Status quo regarding seismic performance.
Mechanical	• Domestic water supplied through services available in the basement; • Sprinkler connections to services available in basement, • Dry sprinkler systems; • Sanitary drainage connected to sanitary drain in Centre Block; Basement; • Scaffolding enclosure heating: glycol heating loop with unit heaters and small natural gas boiler; • Dry standpipe riser with Siamese connection at ground level and fire connections installed in the main stairwell of each scaffold; • Portable fire extinguishers; • Desing and installation of boiler, piping distribution and heaters inside scaffoldings by contractor; • Make-up air units installed on rooftop and distributed as options 1 & 2; • Additional cooling by "Pinguino" type A/C units for individual temperature control; • Scaffolding and Mud room ventilation 'to assure minimum ventilation rate for acceptable indoor air quality and to limit smoke movement.
Electrical	• Electrical power supply to scaffoldings and mud rooms; • Extending signaling zones and installation of fire alarm signaling devices in scaffoldings and mud rooms; • Upgrade of the current lightning protection system and temporary grounding for scaffolding; • Removal and relocation of security cameras.
Scaffolding	• Traditional scaffold design with self supporting elements at specific locations where a traditional system cannot be properly implemented

Table 8.1: *Recommended Options Summary*

CENTRE BLOCK **EAST & WEST PAVILION REHABILITATION** **OTTAWA, ONTARIO**	**Report Date :** **Page No :**	**June 2013** **8**

5. CONSTRUCTION COST ESTIMATE SUMMARY

COST SUMMARY:

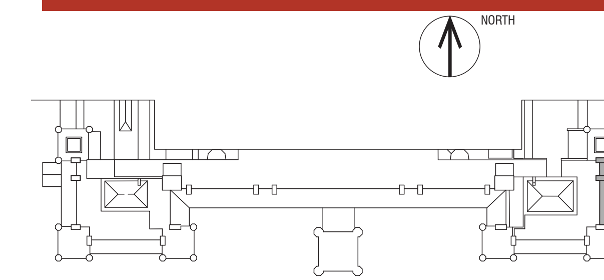
-	New Construction	$4,642,700
-	Site Development	$400,000
-	Ancillary Work	$1,845,400
	Total- Including Site	**$6,888,100**
-	General Requirements & Fee	$1,239,900
-	Off Hours Premium	$812,800
	Total- Excluding Contingencies	**$8,940,800**
-	Design and Pricing Allowance	$625,900
-	Escalation Allowance	$191,300
-	Construction Allowance	$0
	Total- Including Contingencies	**$9,758,000**
-	Harmonized Sales Tax	$0
	Total Construction Estimate	**$9,758,000**

Figure 8.1: *Class B Estimate Overview*

DESIGN DEVELOPMENT REPORT

RECOMMENDED
INTERVENTION

EAST BAY



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME COMPLETE REPLACEMENT OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 2 WYTHES OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- DISMANTLING & REBUILDING OF 20% OF INDICATED AREA. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- 10% OF TOTAL SURFACE OF EXTERIOR WALL MIGHT BE DISMANTLED AND REBUILT. WITHIN 10%, ASSUME REPLACEMENT OF 25% OF RUSTICATED NEPEAN SANDSTONE FACE STONES, 5% OF BEREA SANDSTONE (EXCLUDING WINDOWS) & 1 WYTHE OF BRICK BACKWALL.
- POULTICING TO REMOVE SALTS AND RUB BACK. DUTCHMEN REPAIRS WHERE NECESSARY. GROUT INJECTIONS IN ATTIC BRICK BACKWALL OF TOWERS.
- R STONE REPLACEMENT
- CR CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

• CRACK CONSOLIDATION	8 UNITS
• DUTCHMAN	2-5 UNITS
• HEAVY EROSION	10m²
• PREVIOUS REPAIR	1.5m²

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

- 100% RE-POINTING OF MASONRY BELOW GRADE (400mm), MIN 38mm DEEP.
- PATCHING AND FILLING CRACKS IN THE CONCRETE WALLS. REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT
- DAMP-PROOFING OF CONCRETE FOUNDATION WALLS.
- INSTALLING DRAINAGE TILES AT FOOTINGS. REFER TO SECTION 7.1.2. OF SCHEMATIC DESIGN REPORT.
- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

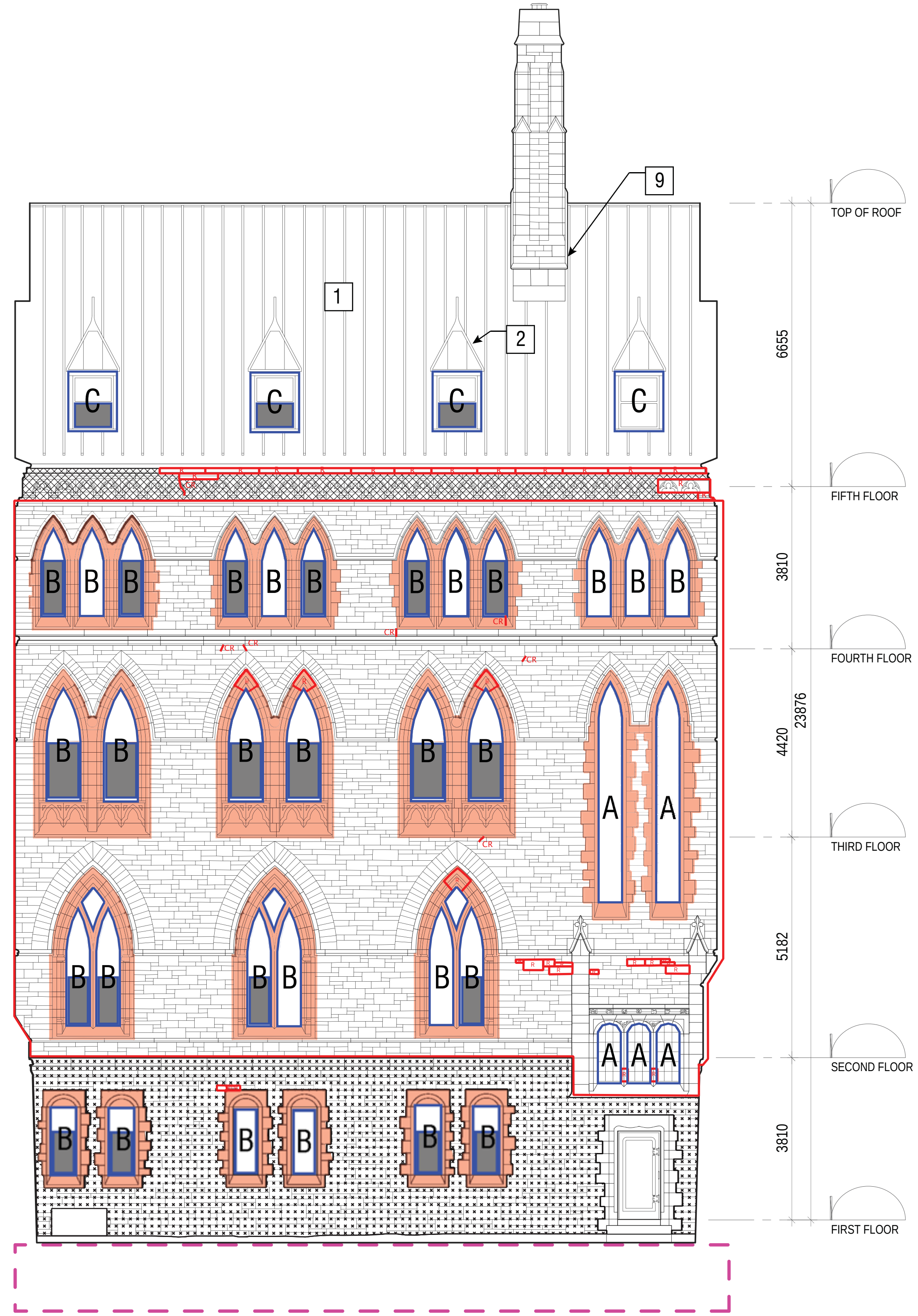
- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
- LEVEL OF FOOTING TO BE DETERMINED.
- REFER TO BASEMENT KEY PLAN FOR LIMIT OF SCOPE OF WORK.

CONSERVATION OF ROOF

1. REPLACEMENT OF COPPER ROOFING WITH 20 OZ. COPPER SHEATHING. PARGING REPAIRS AT EXISTING FLEX-O-CRETE LIGHTWEIGHT CONCRETE ROOF TO LEVEL SURFACE. SELECTIVE REPLACEMENT AND REHABILITATION OF FLAT ROOFING AT THE JUNCTION WITH COPPER ROOFING.
2. REPLACEMENT OF COPPER ROOFING AT DORMERS WITH 20 OZ. COPPER SHEATHING.
3. REPLACEMENT OF COPPER ROOFING AT DORMERS AND LOUVERS.
4. REPLACEMENT OF TOURRET LEAD CAP
5. REPLACEMENT OF TOWER GABLET LEAD CAP
6. REPLICATION OF FINIAL WITH 16 OZ. COPPER.
7. REPLICATION OF CRESTING WITH 16 OZ. COPPER.
8. REPLACEMENT OF COPPER FLASHING AND FLAT ROOFING AT TOWERS AND WEST ENTRANCE.
9. REPLACEMENT OF COPPER FLASHING AT CHIMNEY BASES.

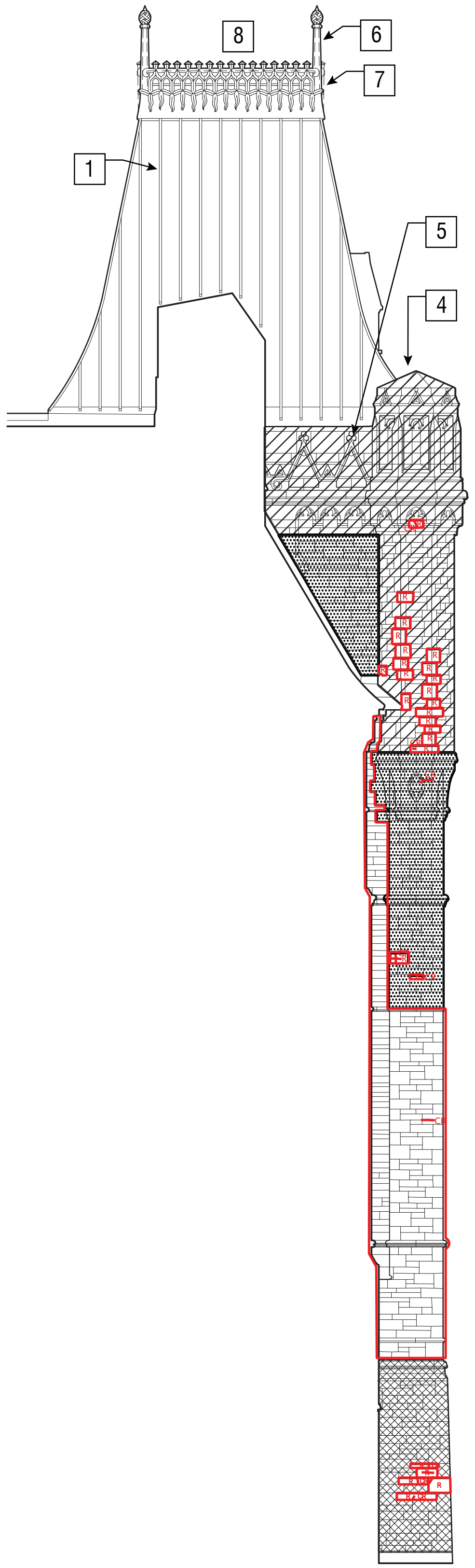
CONSERVATION OF WINDOWS

- A STEEL AND LEADED GLASS WINDOWS: IN SITU STABILIZATION AND MAINTENANCE.
- B ALUMINIUM WINDOWS: IN SITU MAINTENANCE.
- C REPLACEMENT OF ALUMINIUM WINDOWS WITH NEW STEEL WINDOW UNITS AS PER SOUTH FACADE REPLICA OF THE ORIGINAL.
- REPLACEMENT OF WINDOW PANES WITH TEMPORARY PANES CONTAINING SEALED COLLARS FOR VENTILATION. REINSTALLATION OF ORIGINAL PANES AT END OF PROJECT.



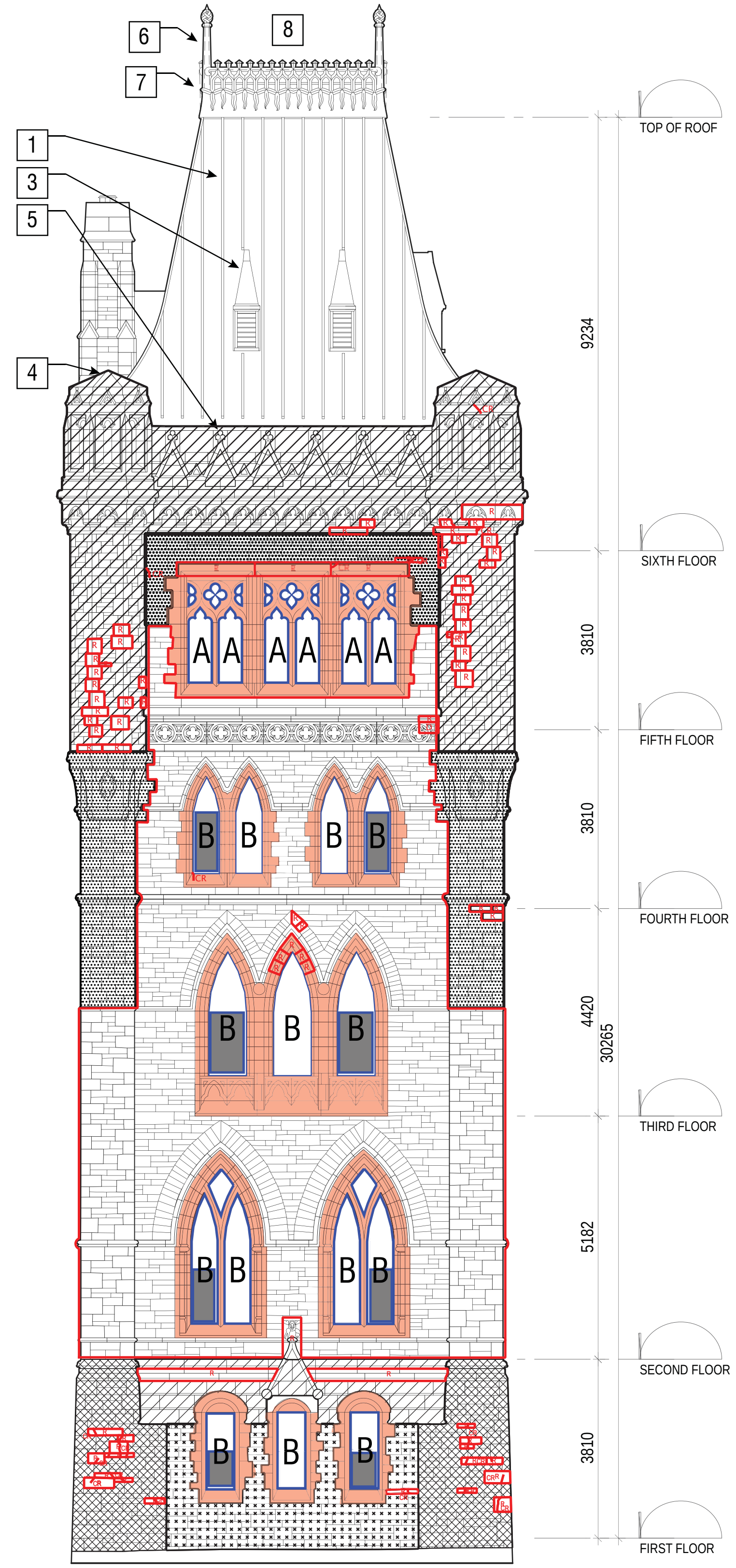
EAST BAY - EAST ELEVATION

NOT TO SCALE



EAST TOWER - SOUTH ELEVATION

NOT TO SCALE



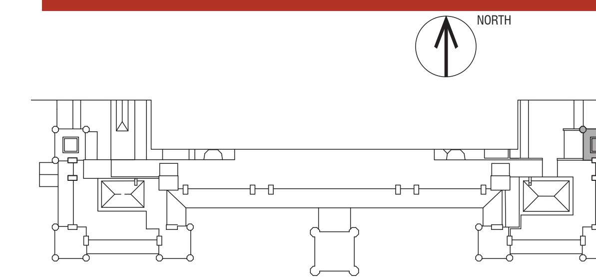
EAST TOWER - EAST ELEVATION

NOT TO SCALE

DESIGN DEVELOPMENT REPORT

RECOMMENDED
INTERVENTION

EAST TOWER



LEGEND

CONSERVATION OF EXTERIOR MASONRY

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- R — STONE REPLACEMENT
- CR — CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

- CRACK CONSOLIDATION 8 UNITS
- DUTCHMAN 2-5 UNITS
- HEAVY EROSION $10m^2$
- PREVIOUS REPAIR $1.5m^2$

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

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- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

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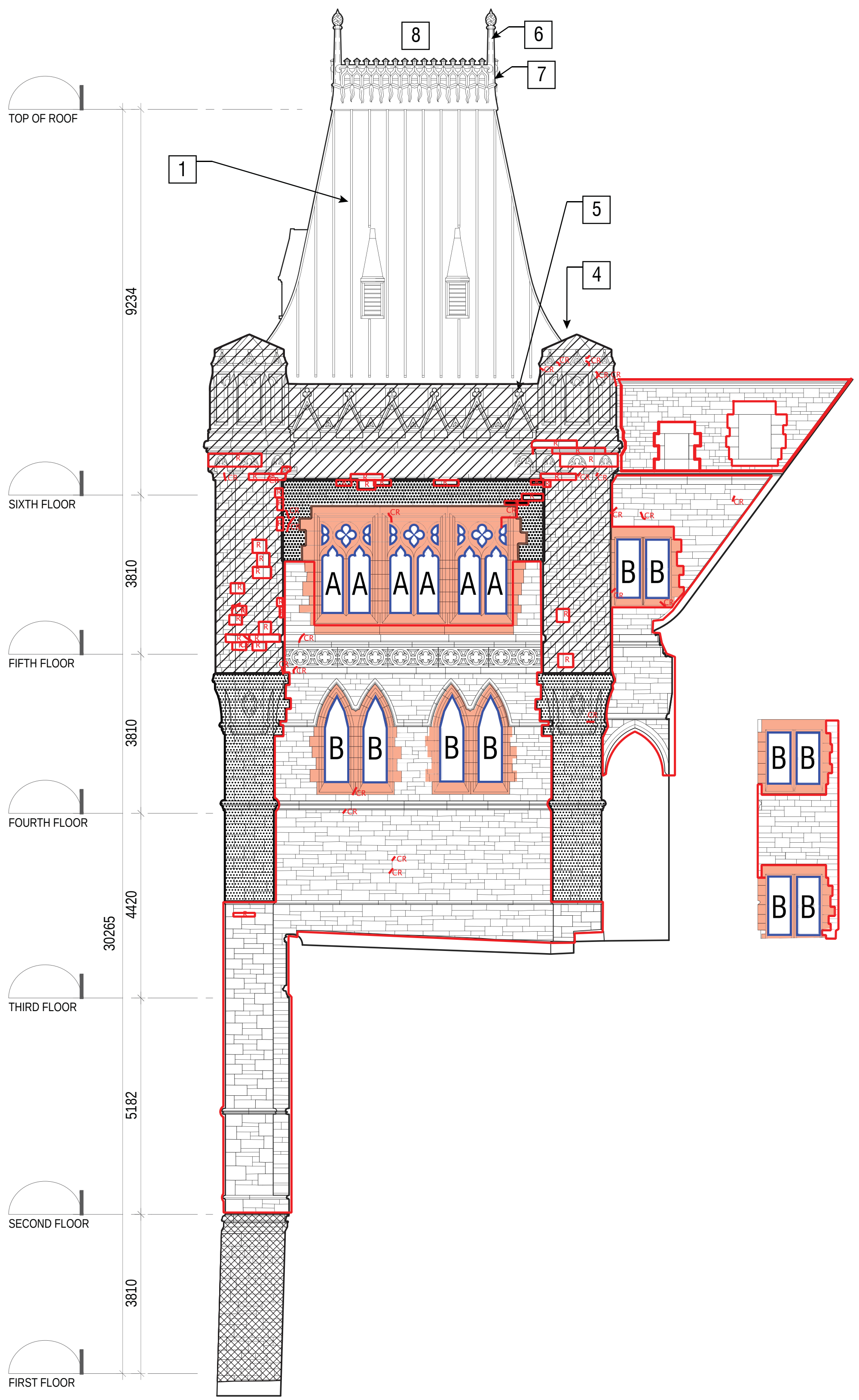
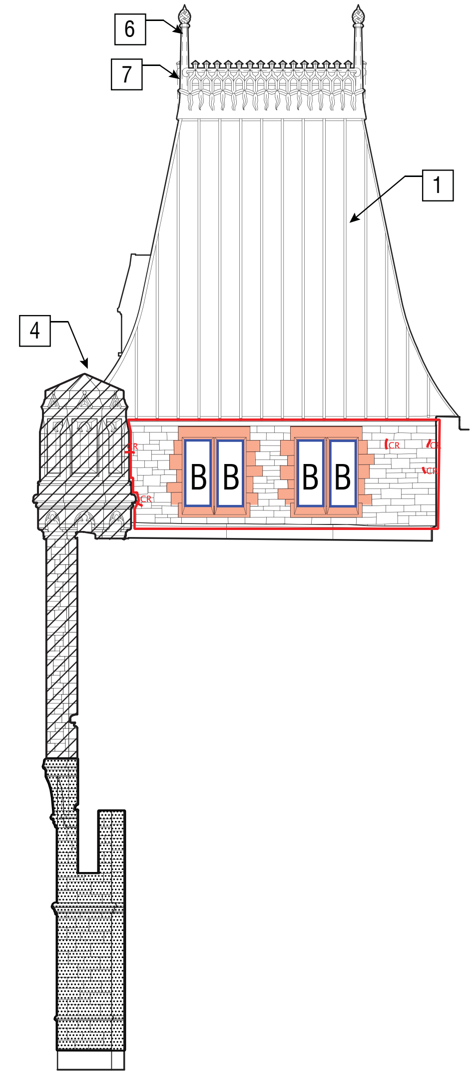


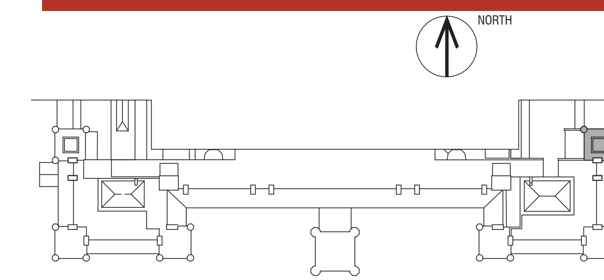
EAST TOWER - NORTH ELEVATION
NOT TO SCALE



EAST TOWER - WEST ELEVATION
NOT TO SCALE

RECOMMENDED
INTERVENTION

EAST TOWER



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CR CRACKS IN STONE

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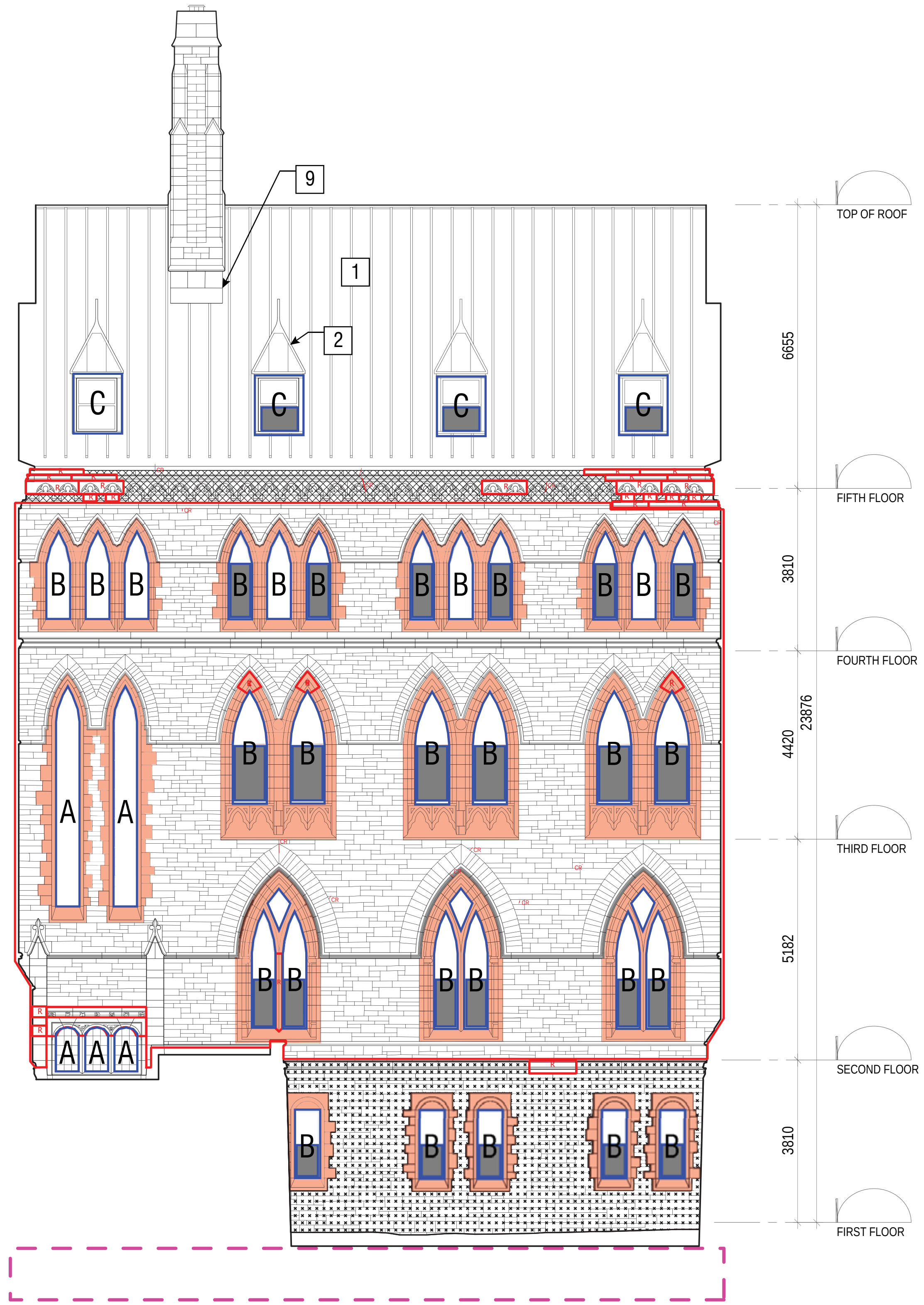
REPLACEMENT OF WINDOW PANES WITH TEMPORARY PANES CONTAINING SEALED COLLARS FOR VENTILATION. REINSTALLATION OF ORIGINAL PANES AT END OF PROJECT.

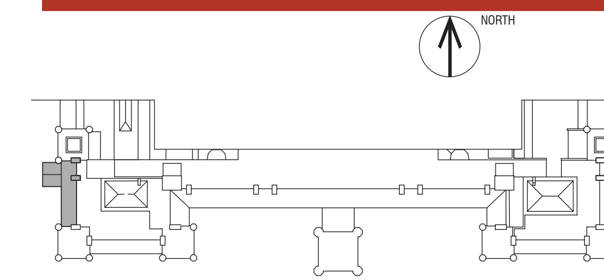


WEST BAY - WEST ELEVATION
NOT TO SCALE

DESIGN DEVELOPMENT REPORT

RECOMMENDED
INTERVENTION

WEST BAY



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME COMPLETE REPLACEMENT OF BRICK BACKWALL & 25% OF FACE STONES.
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R STONE REPLACEMENT

CR CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

- CRACK CONSOLIDATION 8 UNITS
- DUTCHMAN 2-5 UNITS
- HEAVY EROSION $10m^2$
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MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

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- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
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CONSERVATION OF ROOF

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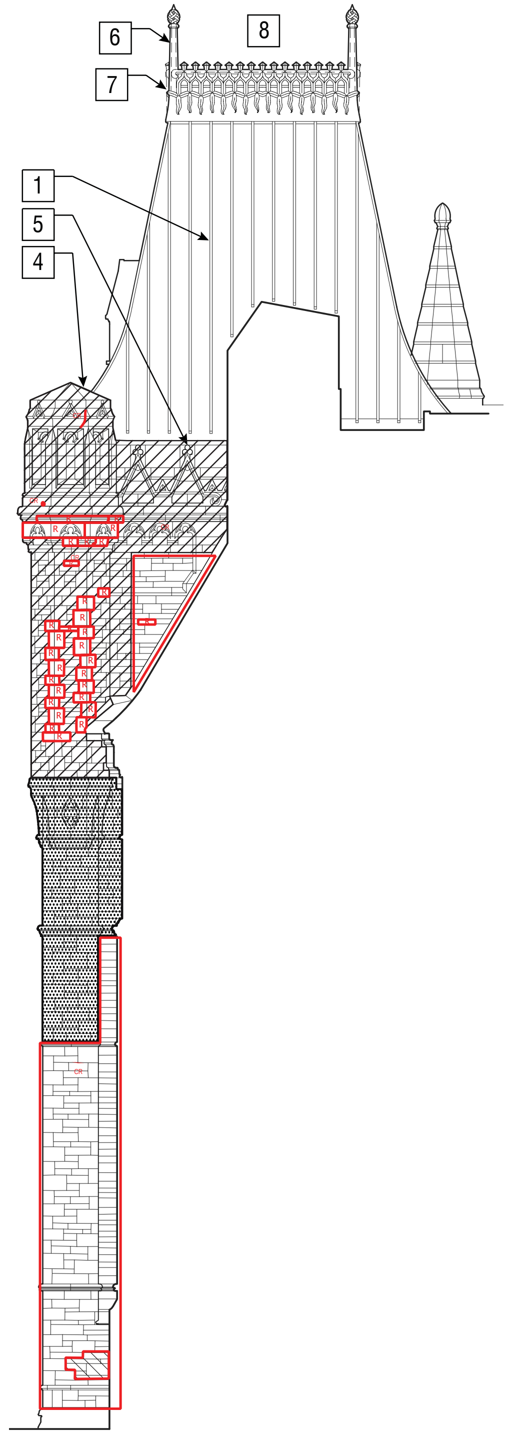
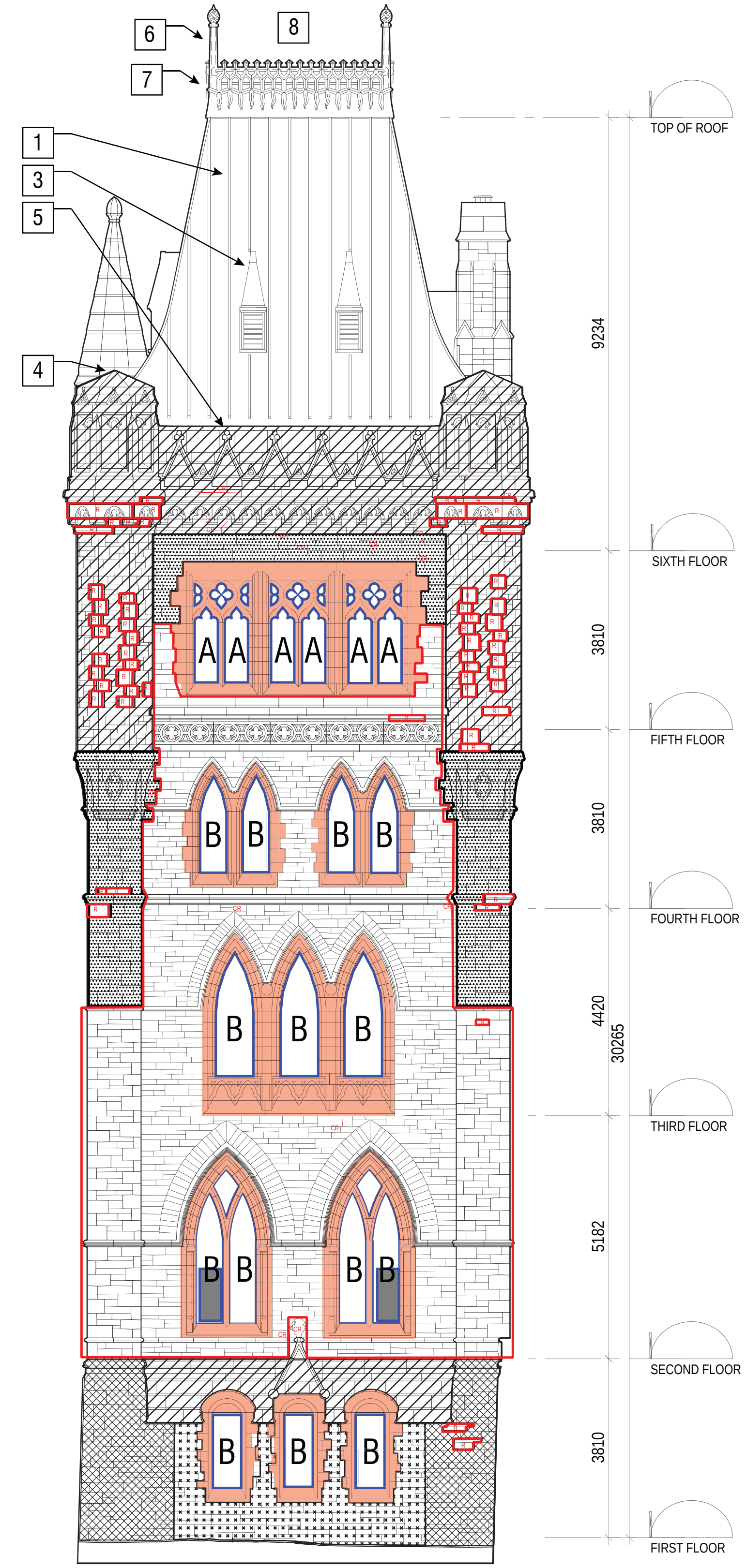


WEST TOWER - SOUTH ELEVATION

NOT TO SCALE

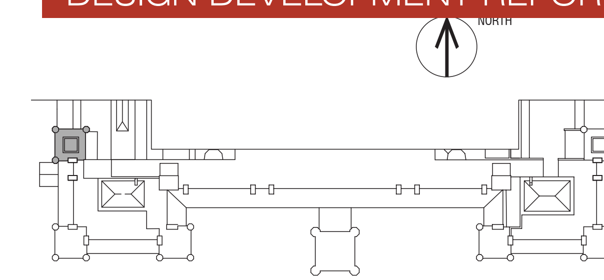


WEST TOWER - WEST ELEVATION

NOT TO SCALE

RECOMMENDED
INTERVENTION

WEST TOWER



LEGEND

CONSERVATION OF EXTERIOR MASONRY

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MASONRY WINDOW JAMBS:

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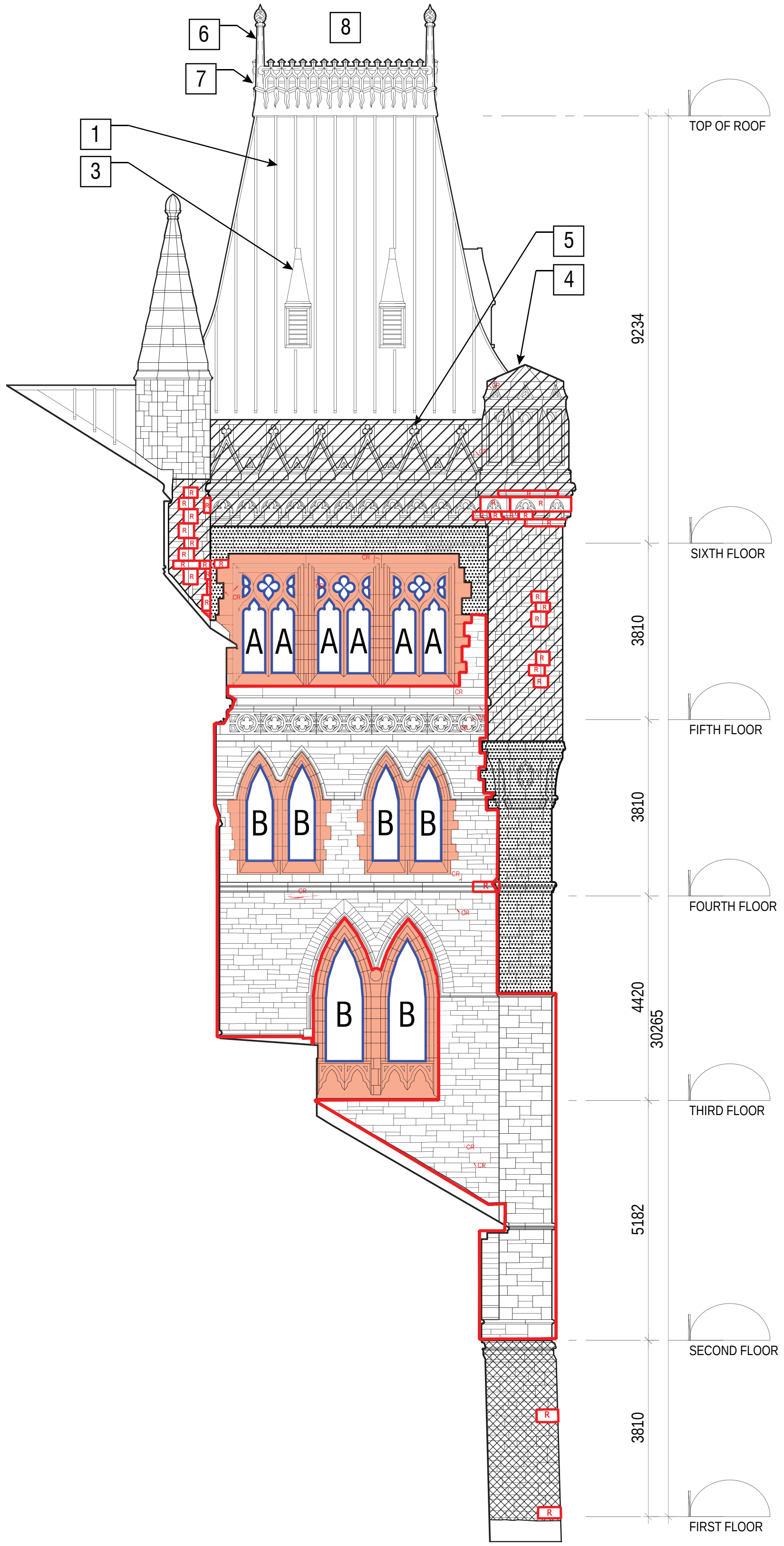
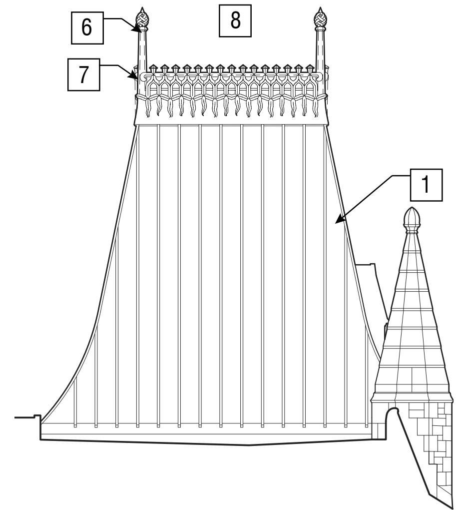
FOURNIER GERSOVITZ MOSS DROLET & ASSOCIÉS ARCHITECTES



WEST TOWER - NORTH ELEVATION

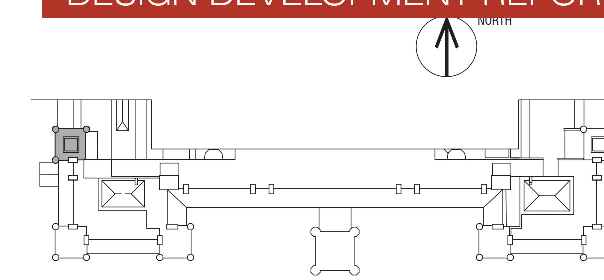
NOT TO SCALE



WEST TOWER - EAST ELEVATION

NOT TO SCALE

DESIGN DEVELOPMENT REPORT



RECOMMENDED

INTERVENTION

WEST TOWER

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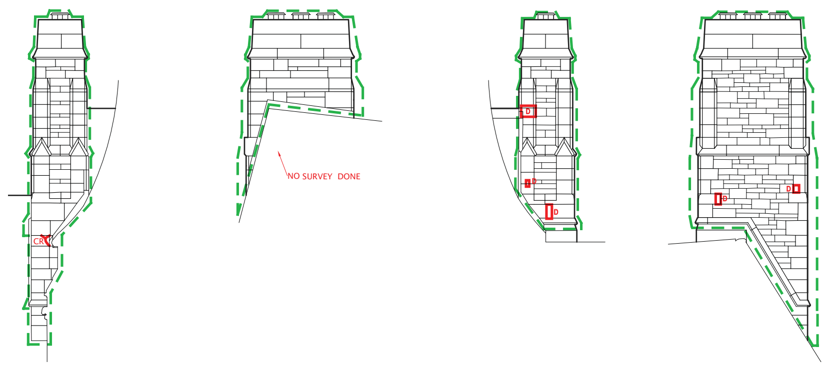
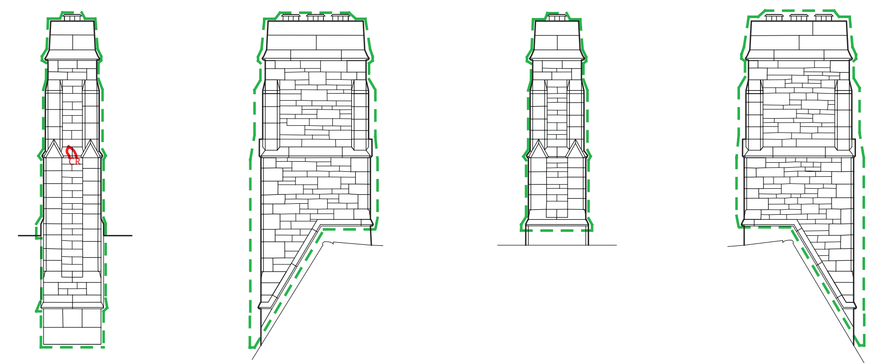


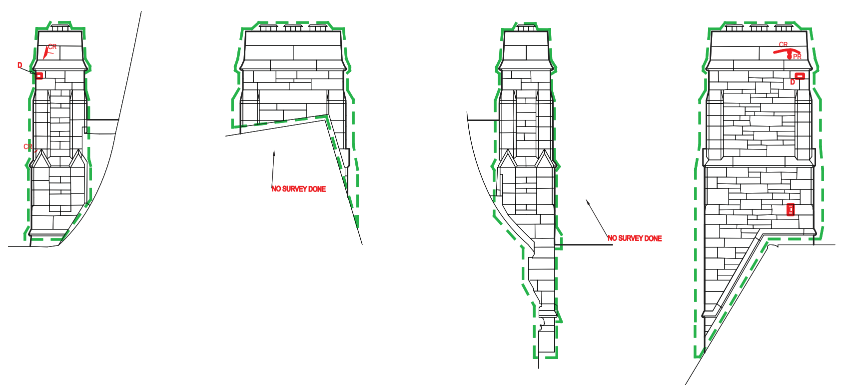
EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

EAST CHIMNEY #8
NOT TO SCALE



EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

EAST CHIMNEY #9
NOT TO SCALE



EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST CHIMNEY #9
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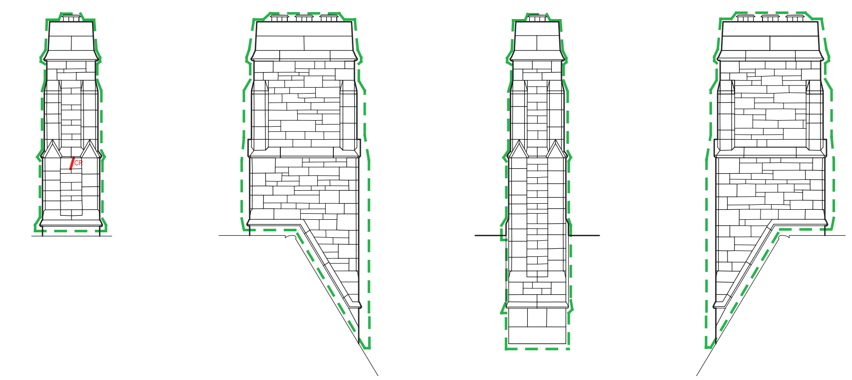

EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST CHIMNEY #8
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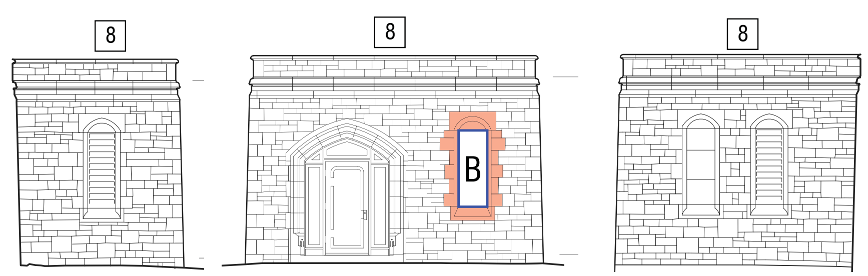
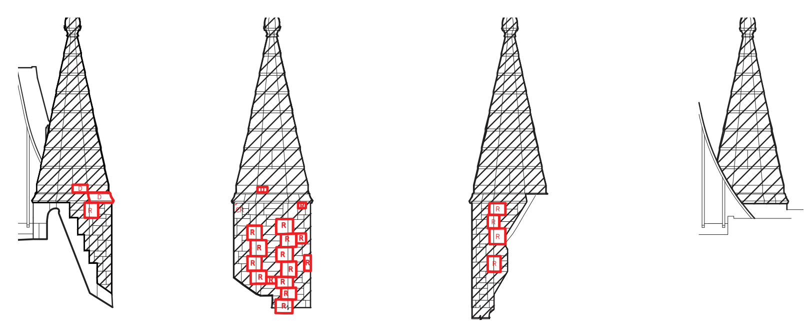


NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST ENTRANCE
NOT TO SCALE

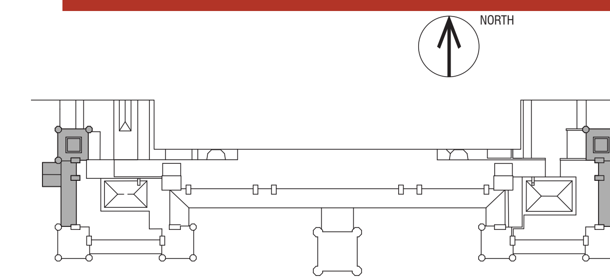


EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST TOWER - PINNACLE
NOT TO SCALE

RECOMMENDED
INTERVENTION

EAST & WEST PAVILIONS



LEGEND

CONSERVATION OF EXTERIOR MASONRY

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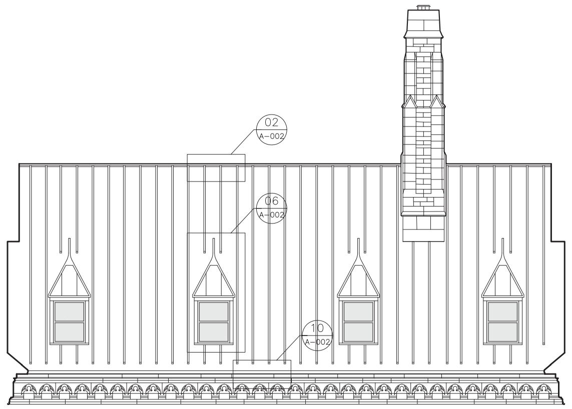
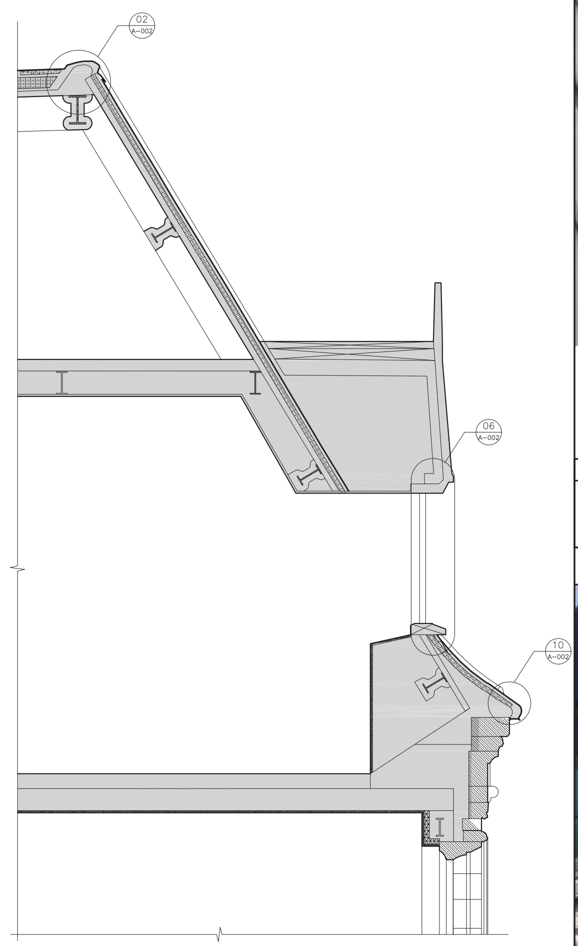
PAVILION ROOF INTERVENTIONS



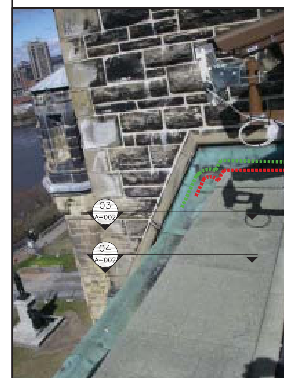
01 PAVILION ELEVATION 1:75



05 BAY SECTION 1:20

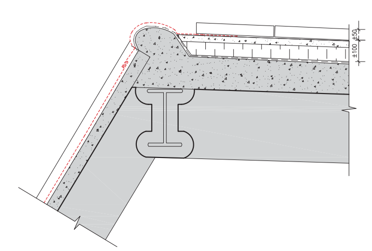
A) EXISTING

3-ROOF PARAPET



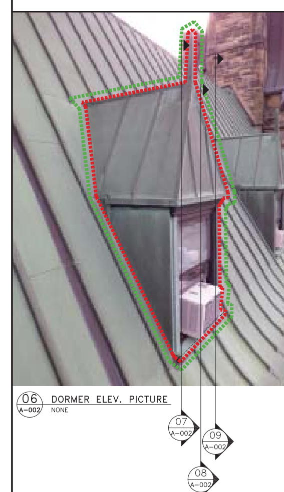
02 TOWER ELEVATION PICTURE NONE

GENERAL EXISTING COMPOSITION
-20oz. Copper sheathing
-SBS Membrane
-Existing Lightweight Concrete
-Existing Fire Protection

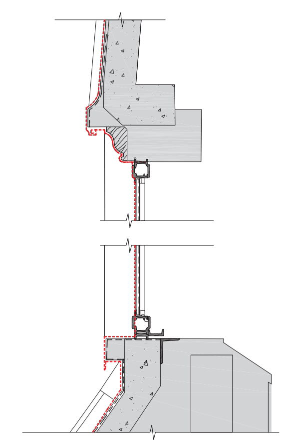


03 EXISTING ROOF PARAPET SECTION 1:5

4-DORMERS



06 DORMER ELEV. PICTURE NONE



07 SECTION EXISTING DORMER 1:5

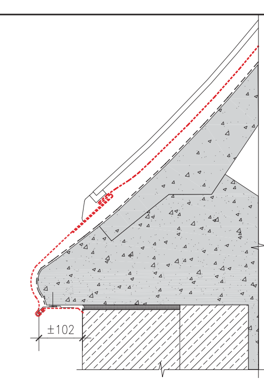
LEYENDE

EXISTING ROOF LINE

NEW ROOF LINE

5-EAVES

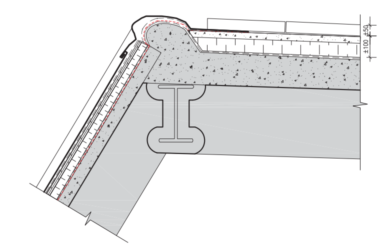
10 EAVE ELEVATION PICTURE NONE



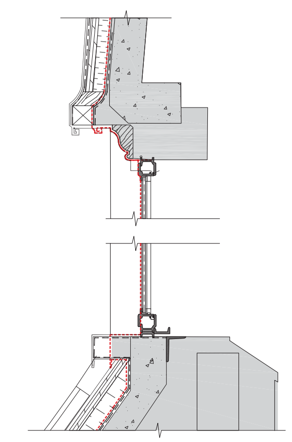
11 ROOF EAVES EXISTING SECTION 1:5

B) PROPOSAL

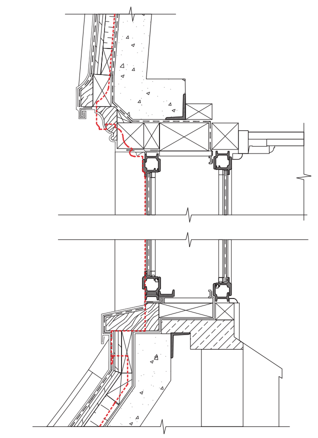
GENERAL ROOF PROPOSAL COMPOSITION
- New copper 20oz. sheathing
-SBS elastomer bitumen membrane
-19 mm plywood
- 38 mm rigid insulation
- SBS Membrane
-Existing lightweight concrete
-Existing Fire Protection



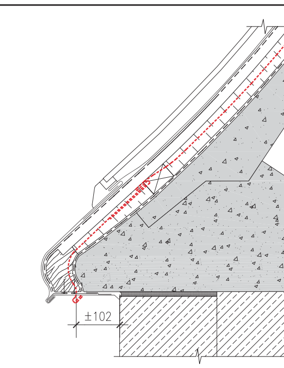
04 PROPOSAL ROOF PARAPET SECTION 1:5



08 PROPOSAL SECTION DORMER (using same window) 1:5

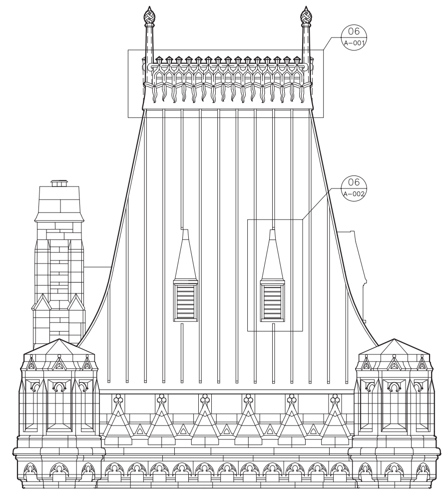


09 PROPOSAL SECTION DORMER (new smaller window) 1:5

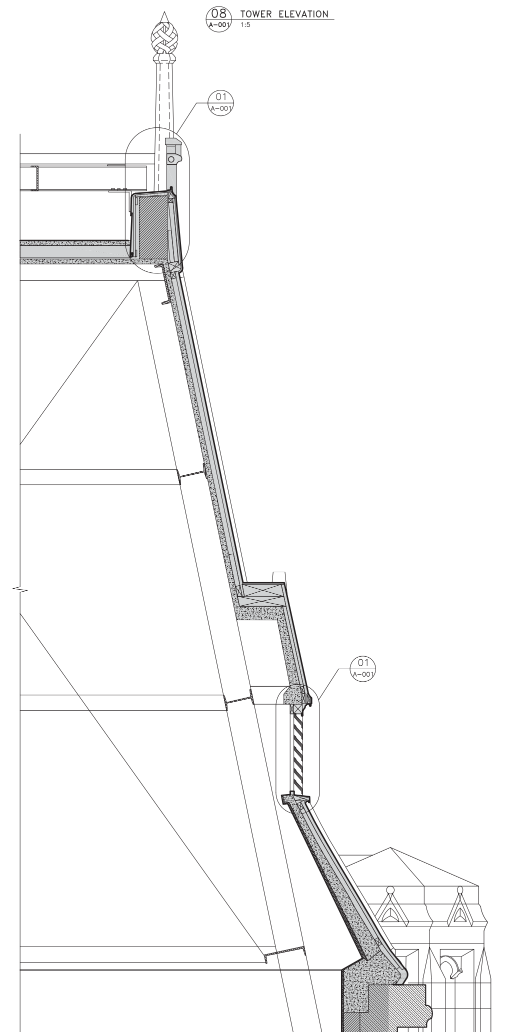


12 ROOF EAVES PROPOSAL SECTION 1:5

TOWER ROOF INTERVENTIONS



08 A-001 TOWER ELEVATION
1:5



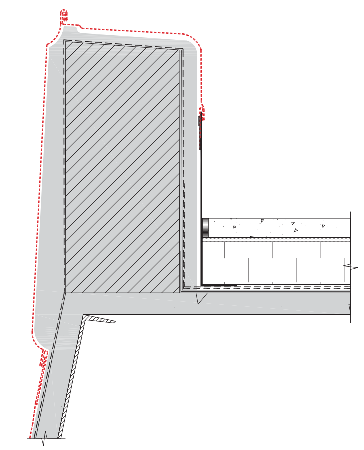
07 A-001 TOWER SECTION
1:5

A) EXISTING

1- PARAPET / CRESTING

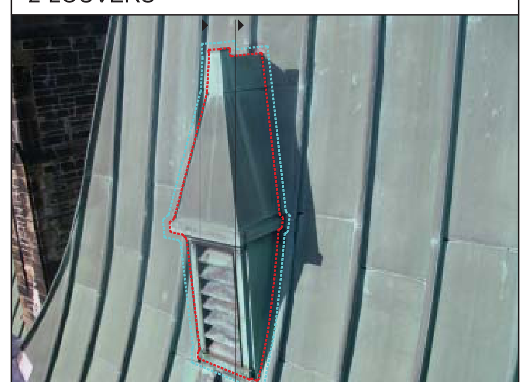
06 A-001 PARAPET/CRESTING ELEVATION PICTURE
NONE

GENERAL EXISTING COMPOSITION
-20oz. Copper sheathing
-SBS Membrane
-Existing Lightweight Concrete
-Existing Fire Protection

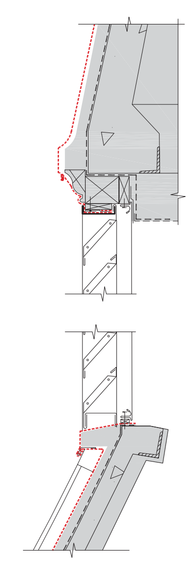


04 A-001 PARAPET CRESTING EXISTING SECTION
1:5

2-LOUVERS



05 A-001 LOWER ELEVATION PICTURE
1:5



03 A-001 LOUVER EXISTING SECTION
1:5

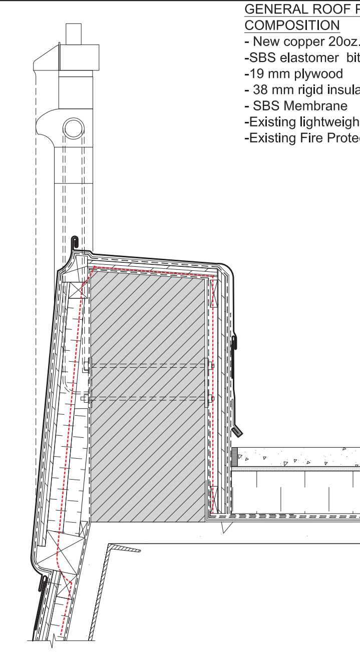
LEYENDE

EXISTING ROOF LINE

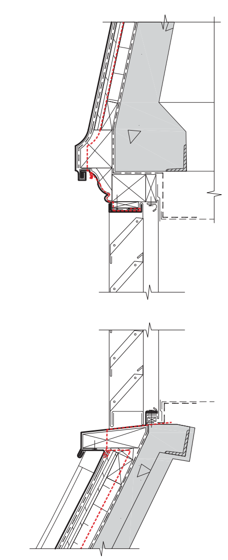
NEW ROOF LINE

B) PROPOSAL

GENERAL ROOF PROPOSAL COMPOSITION
- New copper 20oz. sheathing
-SBS elastomer bitumen membrane
-19 mm plywood
- 38 mm rigid insulation
- SBS Membrane
-Existing lightweight concrete
-Existing Fire Protection



02 A-001 PARAPET CRESTING PROPOSAL SECTION
1:5



01 A-001 LOUVER PROPOSAL SECTION
1:5

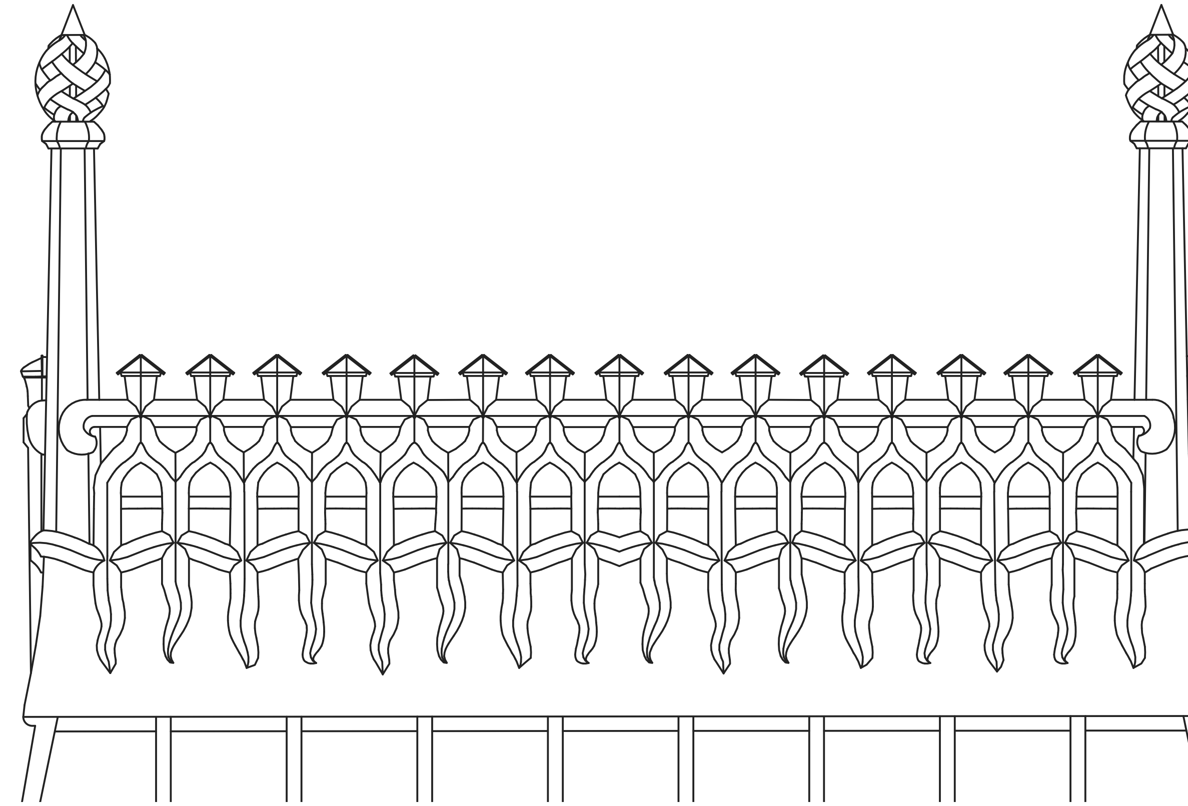
CENTRE BLOCK East and West Pavilions Rehabilitation
July 2013

Typical Roof Study of Tower

FOURNIER GERSOVITZ MOSS DROLET & ASSOCIÉS ARCHITECTES

The original cresting and finials were removed and stored outdoors when they became so damaged they presented a falling hazard. Originally constructed out of copper and filled with concrete, the replicas will most likely be made of copper with a metal endoskeleton acting as a reinforcing agent.

The replicas will be based on surveys of the old cresting that has been conserved by PWGSC, and the drawings that were provided by PWGSC.



8.2 CONTRACTING STRATEGY

The Schematic Design report presented 5 options for contracting strategies. 1) General Contractor Lump Sum (low bid), 2) Construction Management, 3) Two Envelope System, 4) Prequalification of specialized trades, and 5) Unit Rate. Initial discussions between PWGSC and the Consultant team have identified two possibilities as viable options for the Centre Block East and West Pavilion Rehabilitation project. The consultant team initially recommended a prequalification option and eventually suggested a hybrid with a two envelope system. In essence, it would be a two envelope system allowing for both a technical and cost review but with a modification to the technical review allowing for the Consultant to request specific information from the bidders. For example, it was discussed that the technical review could contain signed letters confirming the participation of each of the key contractors. Typically the contractor would only have to provide a list of potential teammates but this proposed modification would aid in assuring that only qualified contractors perform specialized work and that the team that gets accepted by the Client is in fact the team that ends up completing the work.

The Consultant team is currently compiling a list of items to propose to RPCD in order to refine a contracting strategy that will ideally be based on the lowest cost while ensuring that the entire contracting team, including trade managers, possess the skills and expertise necessary to execute their mandate and ensure that the final product reflects the building's extraordinary heritage value and prestigious location.

APPENDIX I
DFIT
WEST TOWER ATTIC

APPENDIX I: WEST TOWER ATTIC

Investigations and visual inspection of the attic spaces were conducted in September, 2012 via direct access and again in March 2013. Observations from the September 2012 visit can be found in the Schematic design report and observations from the March 2013 visit are illustrated below. These investigations took place in order to gain a clearer understanding of the condition and composition of the masonry walls inside the attic spaces. The ground penetrating radar test that was completed by GBG in the RS-3 phase questioned the presence of masonry anchors as well as potential areas of delamination. In order to get a better understanding of the GPR results, 6 bore holes and one 305mm x 305mm opening were made. The bore holes were used to explore issues related to delamination and voiding and the 305mm x 305mm opening was made where a masonry anchor was suspected. Ultimately, only one bore hole showed signs of voiding and there was no evidence of a masonry anchor in the wall. More details of these findings can be seen below.

Figure 2-I: Bore hole through brick.

Bore holes

- Only two of the six bore holes demonstrated any voiding and one of those two had significant voiding.
- With the help of a boroscope it was possible to identify the number of wyhtes of brick inside some of the bore holes.

Figure 2-II: Bore hole into the back of face stone.

Figure 2-III: Bore hole showing minor voiding around mortar.

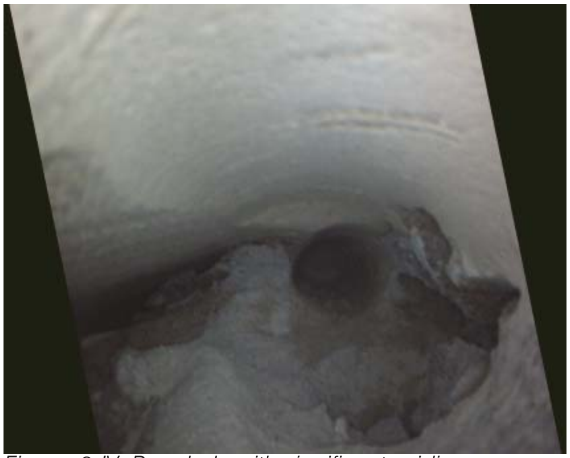


Figure 2-IV: Bore hole with significant voiding.


Figure 2-V: Voiding on right side.

Bore holes

- The Eastern most bore hole on the North facing wall had the most significant levels of voiding.


Figure 2-VI: Voiding on right side.

Figure 2-VII: Alternate course brick wythes visible.

35mm x 305mm opening

- There was no sign of masonry anchors inside the opening.
- It was possible to identify the number of wyhtes of brick inside some of the bore holes.
- Backing mortar is harder than the brick itself.

Figure 2-VIII: Excavated until the back of the face stone.

Figure 2-IX: Evidence of humidity towards the face stone.

Figure 2-X: Evidence of humidity towards the face stone.

Figure 2-XI: Evidence of humidity towards the face stone.

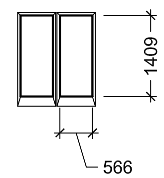
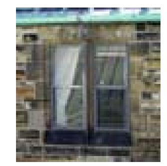
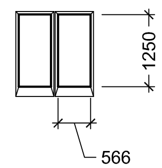
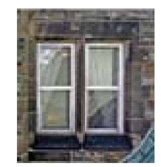
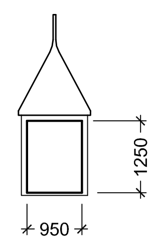
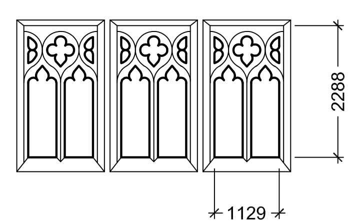
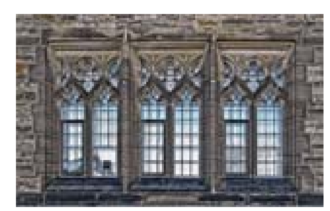
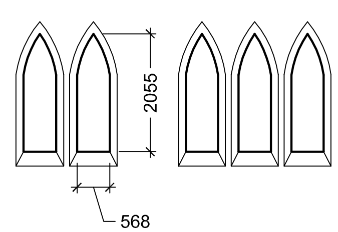
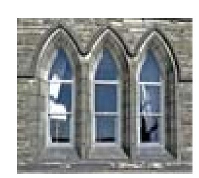
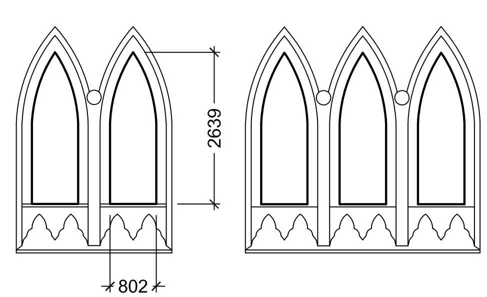
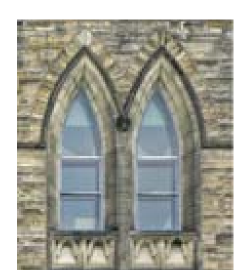
35mm x 305mm opening

- Some evidence of humidity was found inside the large opening which corresponds to the high levels of efflorescence noted on the exterior.

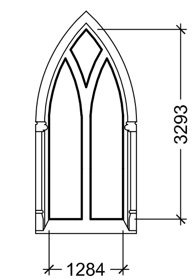
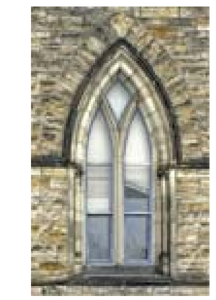
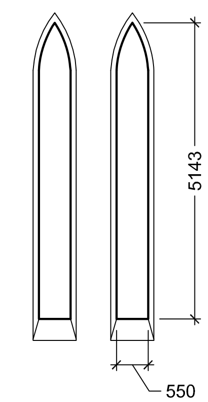
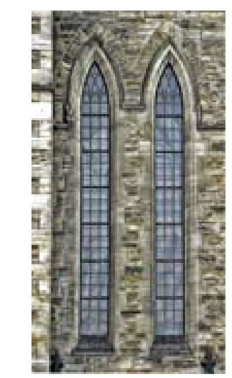
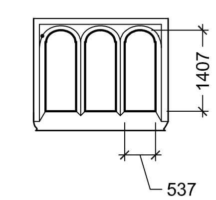
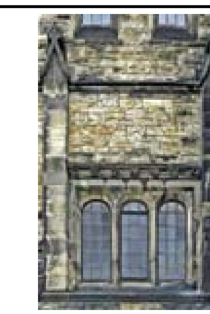
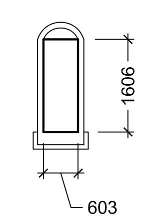
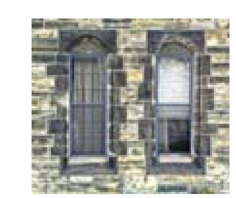
Figure 2-XII: Thickness of backwall at this location.

APPENDIX II
PROPOSED INTERVENTIONS
WINDOWS

WINDOW TYPE DATA

TYPE MARK*	LOCATION / DESCRIPTION	DRAFTING APPEARANCE & GENERAL DIMENSIONS** (SCALE = 1:200)	SAMPLE PHOTOGRAPH
FF	EAST PAVILION ONLY, 6TH FLOOR / UNIT OCCURS IN PAIRS SEPARATED BY MASONRY JAMB; SINGLE-HUNG ALUMINIUM FRAMES		
J	EAST PAVILION ONLY, UPPER FLOORS / UNIT OCCURS IN PAIRS SEPARATED BY MASONRY JAMB; SINGLE-HUNG ALUMINIUM FRAMES		
O	EAST & WEST PAVILIONS, 5TH FLOOR / UNIT OCCURS AT ROOF DORMER WITH SINGLE-HUNG ALUMINIUM FRAME		
P	EAST & WEST PAVILIONS, 5TH FLOOR / UNIT OCCURS IN SERIES OF THREE; LEADED GLASS IN ORIGINAL STEEL FRAME BELOW; LEADED GLASS IN STONE TRACERY ABOVE.		
M	EAST & WEST PAVILIONS, 4TH FLOOR / UNIT OCCURS IN SERIES OF TWO OR THREE; SINGLE-HUNG ALUMINUM FRAME WITH ARCH-TOP		
F	EAST & WEST PAVILIONS, 3RD FLOOR / UNIT OCCURS IN SERIES OF TWO OR THREE SEPARATED BY MASONRY JAMB; SINGLE-HUNG ALMINIUM FRAME WITH ARCH-TOP		

WINDOW TYPE DATA

TYPE MARK	LOCATION / DESCRIPTION	DRAFTING APPEARANCE & GENERAL DIMENSIONS* (SCALE = 1:100)	SAMPLE PHOTOGRAPH
D	EAST & WEST PAVILIONS, 2ND FLOOR / UNIT COMPRISES THREE ALUMINUM FRAMES SEPARATED BY MASONRY MULLION; TWO SINGLE-HUNG PANES PER UNIT		
G	EAST & WEST PAVILIONS, STAIR / UNIT OCCURS IN SERIES OF TWO AT STAIR TOWER; LEADED GLASS IN ORIGINAL STEEL FRAME		
B	EAST & WEST PAVILIONS, STAIR / UNIT OCCURS IN SERIES OF THREE AT STAIR TOWER; LEADED GLASS IN ORIGINAL STEEL FRAME WITH ARCH TOP; CENTER UNIT IS OPERABLE		
A	EAST & WEST PAVILIONS, 1ST FLOOR / UNIT OCCURS INDIVIDUALLY OR PAIRED; SINGLE-HUNG OR FIXED ALUMINIUM FRAME (ORIGINAL STEEL FRAME OCCURS AT ONE LOCATION, EAST PAVILION: 187SC-1)		

**TYPE MARKS ARE TAKEN FROM HISTORIC DRAWINGS.*
***DIMENSIONS ARE FOR GENERAL REFERENCE ONLY. EACH WINDOW IS CUSTOM FIT TO MASONRY OPENING AND THUS DIMENSIONS VARY BY UNIT.*

LOCATION	WINDOW ID										FRAME					GLAZING				HARDWARE				WALL/ ANCHOR					GENERAL	
Building	No.	Type		Width (mm)		Height (mm)		A.F.F (mm)	Mechanism	Operable / Fixed	Aluminum	Steel	Original	Corrosion	Notes	Single	Leaded	Cracked	Notes	Steel	Aluminum	Original	Operational	Stone	Head	Sill	Left jamb	Right jamb	Notes	INTERVENTION
West Tower	101A-1	A	24	610	63	1607	38	953	Single hung		✓			✓	Adhesive at the top of the frame. Screws in frame.	✓			A/C exhaust installed in storm window panel	✓				Severe damage, open joints, staining, crumbling stone, efflorescence, biological colonization.	Severe damage, efflorescence, water infiltration, biological colonization, dirty.	Marble sill extension with severe damage, efflorescence, water infiltration, crumbling	Efflorescence, paint, dirt	Severe damage, efflorescence, water infiltration, biological colonization, dirty, open joint.	**Other:** Vinyl storm window screw in masonry. Interior wall finish is in bad shape and paint is blistering.	B
West Tower	101A-2	A	24	610	63	1607	38	953	Single hung		✓			✓		✓				✓				Severe damage, erosion, dirt, efflorescence, water infiltration, staining	Severe damage, efflorescence, moisture, signs of water infiltration.	Severe damage, erosion, dirt, efflorescence, water infiltration.	Crumbling, erosion, efflorescence, dirt.	Severe damage, open joint, efflorescence, dirt	**Other:** Vinyl storm window screw in masonry. Wall paint is blistering around the window.	B
West Tower	101A-3	A	24	610	63	1607	38	953	Single hung		✓					✓				✓				Severe damage, efflorescence, significant erosion, moisture, water infiltration.	Signs of water infiltration, erosion, dirt	Signs of water infiltration, erosion, dirt, crumbling.	Signs of water infiltration, erosion, dirt, efflorescence	Significant water infiltration, erosion, efflorescence, crumbling, dirt.	Aluminum storm window screw in masonry.	B
West Pavilion	101S-1	A	24	610	62	1575	38	959	Single hung		✓				Loos sash, air infiltration	✓				✓				Severe damage, spalling, staining, efflorescence, chipped stone, moisture		Marble sill extension, chipped stone and severe damage.	Crumbling. Previous stone replacement possible.		Wood storm window screw in masonry.	B
West Pavilion	103S-1	A	24	610	62	1575	38	953	Single hung		✓				Loos sash, air infiltration	✓				✓				Severe damage, evidence of water infiltration, efflorescence, moisture.		Marble sill extension, chipped stone and some scratches, severe damage.	Previous replacement stone possible?	Evidence of water infiltration, efflorescence		B
West Pavilion	103S-2	A	24	610	62	1575	38	953	Single hung	O	✓					✓				✓					previous stone replacement possible		Efflorescence		Wood storm window screw in masonry.	B
West Pavilion	105S-1	A	24	610	63	1588	37	940	Single hung	O	✓					✓				✓				Severe damage, staining, crumbling efflorescence.	Severe efflorescence, water infiltration, moisture, and stone crumbling.	Efflorescence and signs of water infiltration.	Staining and signs of water infiltration.	Severe efflorescence, water infiltration, and moisture.	Wood storm window frame remaining but screen removed.	B
West Pavilion	105S-2	A	24	610	63	1588	37	940	Single hung		✓				Loos sash, air infiltration	✓				✓				Severe damage, staining, stone crumbling, efflorescence, spalling, nail and screw in masonry.	Painted, previous stone replacement possible.	Stone chipped and dirty, sign of water infiltration	severe signs of water infiltration and efflorescence	erosion, sign of water infiltration, severe efflorescence at the top.	**Other:** Wood radiator cover on a marble platform. Wood storm window frame remaining but screen removed.	B
East Tower	174F-1	A	22.5	572	61	1537	37	946	Single hung		✓					✓				✓				Not accessible because of wooden box.					**Wood:** 2 layers of wood arched at head with wood shutters at bottom. Water infiltration visible around plaster at the top. The masonry in poor condition at exterior	B
East Tower	174F-2	A	22.5	572	61	1537	37	946	Single hung		✓					✓				✓				Not accessible because of wooden box.					**Wood:** 2 layers of wood arched at head with wood shutters at bottom. Water infiltration visible around plaster at the top. The masonry in poor condition at exterior	B
East Tower	174F-3	A	22.5	572	61	1537	37	946	Single hung		✓					✓				✓				Not accessible because of wooden box.					**Wood:** 2 layers of wood arched at head with wood shutters at bottom. Water infiltration visible around plaster at the top. The masonry in poor condition at exterior	B
East Pavilion	185S-1	A	24	610	64	1613	38	965	Single hung		✓					✓				✓				Severe damage, open joints, staining, stone crumbling, efflorescence, biological colonization, dirty.		Marble sill extension	Previous stone replacement possible.	Previous stone replacement possible.	**Wood:** Wood storm window frame with screen removed.	B
East Pavilion	185S-2	A	24	610	64	1613	38	965	Single hung		✓					✓				✓				Severe damage, staining, stone crumbling, efflorescence, dirty.		Marble sill extension	Previous stone replacement possible.	Previous stone replacement possible.	**Wood:** Wood storm window, frame remain, screen removed.	B
East Pavilion	187SB-1	A	24	610	64	1613	38	965	Single hung		✓					✓			Lower sash glazing has an obscure glazing.	✓				Very severe damage, open join, staining, a lot of crumbling stone and efflorescence, spalling, and dirty. Previous stone replacement possible.	Corner damaged.		Efflorescence	Crumbling	Wood storm window screw in masonry, wood trim remains, screen removed. Steel security screw in masonry.	B
East Pavilion	187SC-1	A	24	610	63	1600	37	927	Single hung		✓				Original steel frame remains, screen removed.	✓				✓				Severe damage, dirt, open joint, stone chipped, sign of water infiltration, efflorescence.	Inappropriate patch.	Marble sill extension		Inappropriate patch.	**Wood** storm window trim remain, screen remove.	B
East Pavilion	189S-1	A	30.5	775	63	1594	36	914	Single hung		✓				Aluminum tape on sash	✓				✓				Severe damage, very dirt, a lot of efflorescence, stone chipped, inappropriate patches.		Marble sill extension with biological colonization.			**Wood.** Wood trim around the frame perimeter. **Wall/Anchor:** Stone.	B
East Pavilion	189S-2	A	30.5	775	63	1594	36	914	Single hung		✓					✓				✓				Severe damage, water infiltration, efflorescence, spalling, stone chipped, screw in masonry, dirt,	Severe stone damage	Marble sill extension		Severe stone damage	**Wood:** Wood trim around the frame perimeter.	B
West Pavilion	201S-1	D	48	1219	127	3226		0	Single hung	O	✓				Sash difficult to open									very dirty, some efflorescence, scratching, screws in the masonry.		Marble sill under wood appears to be broken, fragmentation and spalling.	Stone chipped		**Other:** signs of wood trim.	B
West Pavilion	203S-1	D	48	1219	127	3226		0	Single hung	O	✓								Plexiglass storm window at the bottom					very dirty, water infiltration, efflorescence and peeling paint at the top.		Wood sill with marble cover dented on top			**Other:** wiring running from the top of the window is covered with wood trim.	B
West Pavilion	205S-1	D	48	1219	127	3226		0	Single hung	O	✓				Air infiltration, sash not opening properly									Moisture, water infiltration, staining.		Wood covered marble sill and radiator.			**Other:** Wiring running from top of window covered with wood trim.	B
West Tower	211NA-1	D	48	1219	132	3340	25	635	Single hung	F	✓				Misaligned sash with gap, poor condition and air infiltration.						✓		Not working	signs of water infiltration, dirt, bad caulking, some hardware for the curtain screw in masonry, some patches.		marble sill (Tindal stone) with bronze grill insert for radiator.				B
West Tower	211NA-2	D	48	1219	131	3327	25	635	Single hung		✓				Poor caulking						✓		Not working	Severe moisture level and water infiltration, chipped stone, stained, plaster cracking around, dirty.	Significant moisture	Water damage				B
East Tower	274F-1	D	48	1219	138	3505	25	635	Single hung		✓				Loose sash, moderate air infiltration.			✓						Masonry damage, dirt, soiled, efflorescence at the top, stone chipped.		Wood sill extension			Storm window screw in masonry.	B
East Tower	274F-2	D	48	1219	138	3505	25	635	Single hung		✓				Misaligned sash air infiltration.									masonry damage, dirt, stone chipped, some efflorescence.		Wood sill extension			Aluminum storm window screw in masonry.	B
East Pavilion	287S-1	D	48	1219	138	3505	25	635	Single hung		✓				Loose sash air infiltration.						✓		✓	masonry damage, stone chipped, some efflorescence, hole,		marble sill extension.			Storm window screw in masonry: bottom part = wood screen, upper part= plexiglass	B
East Pavilion	289S-1	D	48	1219	138	3505	25	635	Single hung		✓				Loose sash air infiltration.						✓		✓	Masonry damages, chipped stone, dirty, little water infiltration, stone painted, some efflorescence		Marble sill extension cracked.			storm window screw in masonry: bottom part = wood screen, upper part= plexiglass	B
East Pavilion	289S-2	D	48	1219	138	3505	25	635	Single hung		✓				Very loose sash and significant air infiltration.									Masonry damage, some efflorescence, stone chipped, dirt, stone painted,		Marble sill extension cracked.			storm window screw in masonry: bottom part = wood screen, upper part= plexiglass	B
West Pavilion	301S-1	F	31	787	102	2578		0	Single hung		✓					✓			Ballistic glass, sever condensation	✓				Water infiltration		Damaged				B
West Pavilion	301S-2	F	31	787	102	2578		0	Single hung	F	✓					✓			Ballistic glass	✓						Stone sill in poor condition, wood sill extension damaged.			screw in window	B
West Tower	301SB-1	F	30	762		0	17	419	Single hung		✓					✓				✓				severe damage, very dirty.		Marble sill extension severe damage, crack, dirt.			**Other:** Steel: steel grill installed between the window and storm window, screw in the masonry.	B

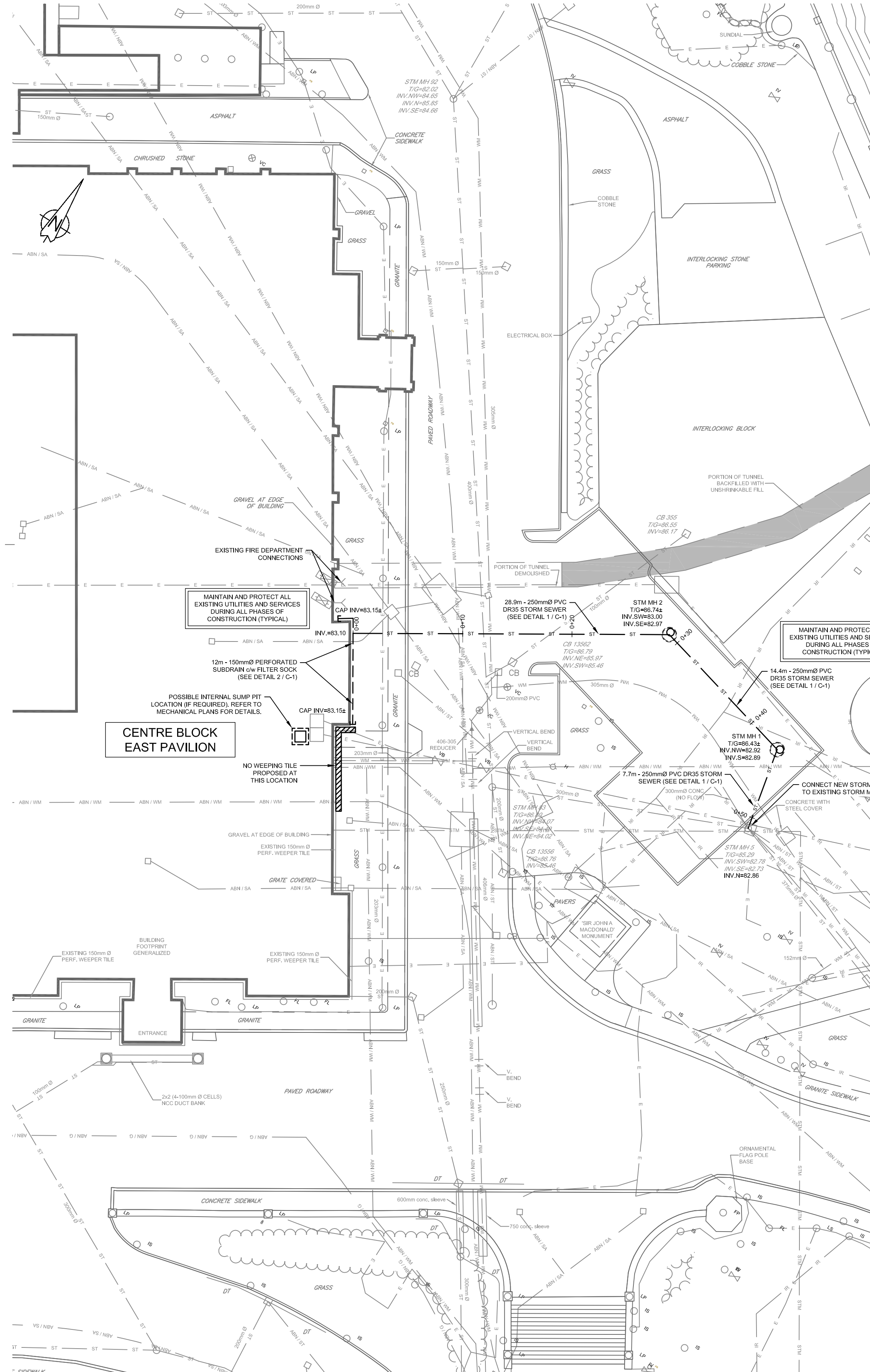
LOCATION	WINDOW ID										FRAME				
Building	No.	Type		Width (mm)		Height (mm)		A.F.F (mm)	Mechanism	Operable / Fixed	Aluminum	Steel	Original	Corrosion	Notes
West Tower	301SB-2	F	30	762		0	17	419	Single hung		✓				
West Tower	301SC-1	F	30	762		0	17	419	Single hung		✓				
West Tower	301SC-2	F	30	762		0	17	419	Single hung		✓				Misaligned sash with large gaps.
West Tower	301SC-3	F	30	762		0	17	419	Single hung		✓				
West Pavilion	303S-1	F	31	787	101	2553		0	Single hung	F	✓				Not accessible
West Pavilion	303S-2	F	31	787	101	2553		0	Single hung	F	✓				Not accessible
West Pavilion	305S-1	F	31	787	101	2553		0	Single hung	F	✓				Not accessible
West Pavilion	305S-2	F	31	787	101	2553		0	Single hung		✓				
East Tower	374F-1	F	31.5	800	100	2540	32	800	Single hung		✓				Air infiltration, aluminum tape.
East Tower	374F-2	F	31	787	100	2540	32	800	Single hung		✓				Screw in frame, black tape at bottom.
East Tower	374F-3	F	31	787	100	2540	32	800	Single hung		✓				Air infiltration.
East Pavilion	385S-1	F	37.5	953	100	2527	31	787	Single hung		✓				Loose sash, air infiltration.
East Pavilion	385S-2	F	37.5	953	100	2527	31	787	Single hung		✓				Air infiltration
East Pavilion	387S-1	F	30.5	775	101	2565	32	800	Single hung		✓				Loose sash, air infiltration.
East Pavilion	387S-2	F	31	787	101	2565	32	800	Single hung		✓				Loose sash, air infiltration.
East Pavilion	389S-1	F	31	787	99	2502	30	762	Single hung		✓				Air infiltration, bottom rail detached.
East Pavilion	389S-2	F	31	787	99	2502	30	762	Single hung		✓				Loose sash, air infiltration.
West Pavilion	401S-1	M		0	80	2032	25	635	Single hung	O	✓				Loose sash
West Tower	402S-1	M		0	91	2311		0	Single hung	O	✓				
West Tower	402S-2	M		0	91	2311		0	Single hung	O	✓				
West Tower	402S-3	M		0	91	2311		0	Single hung		✓				
West Tower	402S-4	M		0	91	2311		0	Single hung		✓				Poor condition
West Pavilion	403S-1	M		0	80	2032	25	635	Single hung		✓				Air infiltration, loose sash
West Pavilion	405S-1	M		0	80	2032	25	635	Single hung		✓				
East Tower	472F-1	O		0	40	1016		0							Replacement window, loose sash, air infiltration.
East Tower	474F-1	M		0	79	2007		0	Single hung		✓				Replacement window, loose sash, air infiltration.
East Tower	474F-2	M		0	79	2007		0	Single hung		✓				
East Tower	474F-3	M		0	79	2007		0	Single hung		✓				Replacement window
East Tower	474F-4	M		0	79	2007		0	Single hung		✓				Loose sash, air infiltration
East Pavilion	485S-1	M		0	81	2057	27	673	Single hung		✓				replacement window, heavy air infiltration, misaligned sash, caulking around frame.
East Pavilion	487S-1	M		0	81	2057		0	Single hung		✓				Replacement window
East Pavilion	489S-1	M		0	81	2057		0	Single hung		✓				Replacement window
West Pavilion	501S-1	O	34	864	47	1194	49	1245	Single hung	O	✓				Two layers of aluminum, air infiltration, condensation, loose sash.
West Tower	502S-1	P		0		0		0	Casement			✓	✓		

No.	GLAZING				HARDWARE			
	Single	Leaded	Cracked	Notes	Steel	Aluminum	Original	Operational
301SB-2	✓				✓			
301SC-1	✓				✓			
301SC-2	✓				✓			
301SC-3	✓				✓			
303S-1	✓			Ballistic glass	✓			
303S-2	✓			Ballistic glass	✓			
305S-1	✓			Ballistic glass	✓			
305S-2	✓				✓			
374F-1	✓				✓			✓
374F-2	✓			Plexiglass storm window		✓		
374F-3	✓					✓		✓
385S-1	✓					✓		
385S-2	✓					✓		
387S-1	✓					✓		
387S-2	✓					✓		
389S-1	✓		✓			✓		
389S-2	✓					✓		
401S-1	✓					✓		✓
402S-1	✓					✓		
402S-2	✓					✓		✓
402S-3	✓					✓		
402S-4	✓					✓		
403S-1	✓					✓		✓
405S-1	✓					✓		
472F-1						✓		
474F-1	✓					✓		✓
474F-2	✓				✓			
474F-3	✓				✓			NO
474F-4	✓					✓		✓
485S-1	✓					✓		✓
487S-1	✓					✓		✓
489S-1	✓					✓		✓
501S-1	✓				✓			
502S-1		✓			✓		✓	✓

No.	WALL/ ANCHOR					GENERAL	
	Stone	Head	Sill	Left jamb	Right jamb	Notes	INTERVENTION
301SB-2	very dirty, some damage.		Original marble sill extension, cabinet with heater mounted on marble and new stone platform.		severe scratching	**Other:** Steel grill installed between window and storm window, screw in masonry.	B
301SC-1						**Other:** Steel grill installed between window and storm window, screw in masonry.	B
301SC-2	very dirty, some damage		Original marble sill extension, cabinet with heater mounted on marble and new stone platform.			**Other:** Steel grill installed between window and storm window, screw in masonry.	B
301SC-3	very dirty, severe damage, fragmentation, crack, signs of water infiltration.		Original marble sill extension, cabinet with heater mounted on marble and new stone platform.			**Other:** Steel grill installed between window and storm window, screw in masonry. Vinyl storm window.	B
303S-1							B
303S-2							B
305S-1							B
305S-2							B
374F-1	Stone damage, efflorescence, screw in masonry, water infiltration.						B
374F-2	Stone damage, efflorescence, water infiltration, chipped, screw in stone.		Wood sill extension				B
374F-3	Stone damage, efflorescence, heavily soil, chipped, sign of water infiltration.		Marble sill extension crack.			**Other:** Radiator with marble platform.	B
385S-1	Stone damage, open joint, dirt, efflorescence, many screws, chipped.		Marble sill extension.				B
385S-2	Stone damage, very dirt, significant efflorescence, water infiltration, stone chipped.		Marble sill extension with radiator in front.			**Other:** plexiglass storm window screw in masonry.	B
387S-1	Stone damage, efflorescence, dirt, water infiltration, previous repairs.		Marble sill extension with radiator in front.			**Other:** plexiglass storm window screw in masonry.	B
387S-2	Stone damage, efflorescence, water infiltration, dirt.		Marble sill extension.			**Other:** plexiglass storm window screw in masonry.	B
389S-1	stone damage, screw, very dirty, efflorescence, screw in sill.		marble sill extension			Wood frame remain screw in wall and	B
389S-2	Stone damage, a lot of efflorescence, chipped, very dirty.		Marble sill extension cracked.			Aluminum storm window screw in marble sill extension, masonry and wall	B
401S-1	Stone damage, very dirty, painted in areas, efflorescence, screw, chipped stone.		Marble sill extension.				B
402S-1	very dirty, signs of water infiltration, many holes from screws, open joints.		chipped.			Plexiglass storm screw in masonry. **Other:** Trim removed, not painted behind.	B
402S-2	signs of water infiltration, some chipped stone, small patches.		marble sill covered with wood.			**Other:** Trace of trim removed, not painted behind. Plexiglass storm window screw in masonry.	B
402S-3	signs of water infiltration, some chipped stone, open joint.				Heavy water infiltration	**Other:** Plexiglass storm window screw in masonry.	B
402S-4	signs of water infiltration, some chipped stone, open joints, small patches.		Wood sill			.**Other:** plexiglass storm window screw in masonry.	B
403S-1	Masonry is very dirty, numerous hole from screws, paint splatter. Probably some water infiltration and efflorescence		Marble sill and marble plate under radiator stained.		Some damage.		B
405S-1	Masonry is very dirty, numerous hole from screws, chipped stone, open joint. Probably some water infiltration and efflorescence.		marble sill covered with wood				B
472F-1	Stone damage, painted splatter, efflorescence, water infiltration, staining,		marble sill extension.			Wood storm window screw in masonry.	B
474F-1	Stone damage, painted splatter, efflorescence, water infiltration, staining,		marble sill extension.			Wood storm window screw in masonry.	B
474F-2	Stone damage, painted splatter, efflorescence, water infiltration, staining,					Wood storm window screw in masonry.	B
474F-3	Stone damage, signs of water infiltration, efflorescence, dirt.		Considerable sill damage.			Wood storm window screw in masonry.	B
474F-4	Some deterioration, efflorescence, chipped, dirt.		Marble sill extension and wood cover on radiator.			Wood storm window screw in masonry. Frames remains but screen removed.	B
485S-1	Damage stone, inappropriate color grout, some smeared,		Marble sill cracked and chipped.			screw for Plexiglas storm window? **Other:** avian protection on outside sill.	B
487S-1	Stone damage, dirt, efflorescence, width joint, sign of water infiltration,					screw for Plexiglas storm window?	B
489S-1	Stone damage, dirt, efflorescence, width joint, sign of water infiltration,					screw for Plexiglas storm window?	B
501S-1			2nd marble sill is slopped			Wood trim around the window. **Wall/Anchor:** According to historic drawings there is wood blocking. **Other:** There is marble stone under the radiator.	C
502S-1	sign of water infiltration, open joint.		Marble sill is damaged.	damaged stone, water infiltration.		**Other:** Two layers of aluminum storm window screws in the stone.	A

LOCATION	WINDOW ID										FRAME					GLAZING				HARDWARE				WALL/ ANCHOR					GENERAL	
Building	No.	Type		Width (mm)		Height (mm)		A.F.F (mm)	Mechanism	Operable / Fixed	Aluminum	Steel	Original	Corrosion	Notes	Single	Leaded	Cracked	Notes	Steel	Aluminum	Original	Operational	Stone	Head	Sill	Left jamb	Right jamb	Notes	INTERVENTION
West Tower	502S-2	P		0		0		0	Casement			✓	✓	✓			✓			✓		✓		sign of water infiltration, open joint, cracked mullion					**Other:** Two layers of aluminum storm window screws in the stone.	A
West Tower	502S-3	P		0		0		0	Casement			✓	✓	✓			✓			✓		✓	✓	sign of water infiltration, broken stone.		Marble sill chipped.			**Other:** Two layers of aluminum storm window screws in the stone.	A
West Tower	502S-4	P		0		0		0	Casement			✓	✓				✓		Upper pane cracked. Lower left pane replaced for A/C unit.	✓		✓	NO	sign of water infiltration, open joint, dirty.	Chipped stone	Water infiltration	Wall plaster paint is scaling.		**Other:** Two layers of aluminum storm window screws in the stone.	A
West Tower	502S-5	P		0		0		0	Casement			✓	✓	✓			✓			✓		✓	✓	signs of water infiltration, many open joints, dirty, chipped stones.	Stone chipped				**Other:** Two layers of aluminum storm window screws in the stone.	A
West Tower	502S-6	P		0		0		0	Casement			✓	✓	✓	Bottom right rail is broken and severely damaged.		✓	✓	lower pane replaced for A/C unit.	✓		✓	NO	Stone: signs of water infiltration. Many open joints, dirty.					**Other:** Plaster finish surrounding is cracked.	A
West Pavilion	503S-1	O	33	838	47	1194	49	1245	Single hung	O	✓				Two layers of aluminum, air infiltration, condensation, loose sash.	✓				✓						2nd marble sill is slopped			**Wall/Anchor:** Wood: according to historic drawings is made of wood blocking. **Other:** signs of water infiltration in the plaster wall below the window sill.	C
West Pavilion	505S-1	O	33	838	47	1194	49	1245	Single hung	O	✓				Two layers of aluminum, air infiltration, condensation, loose sash.	✓				✓						3rd marble sill is slopped			**Wall/Anchor:** Wood: According to historic drawings is wood blocking. **Other:** Radiator is covered by a wood box. Wood trim around the frame. Signs of heavy water infiltration on the plaster wall below the window sill.	C
East Tower	572F-1	O		0	60	1518	51	1283	Single hung	O	✓				Replacement window doesn't fit properly into masonry opening.	✓				✓				Severe damage, efflorescence, spalling, cracked		marble sill extension			**Other:** wood radiator cover with marble sill.	B
East Tower	574S-1	P		0	46	1168		0	Casement	O		✓	✓	✓			✓			✓		✓		Some damage, open joint, dirt, sign of water infiltration, efflorescence, bad caulking, spalling.					**Other:** Storm window screw in masonry	A
East Tower	574S-2	P		0	46	1168		0	Casement	O		✓	✓	✓			✓			✓		✓	✓	Stone damage, open joint, indication of water infiltration, spotting and cracking.					**Other:** Storm window screw in masonry	A
East Tower	574S-3	P		0	46	1168		0	Casement	O		✓	✓	✓			✓	✓		✓		✓		some damage, open joint, indication of water infiltration, spotting.					**Other:** Storm window screw in masonry	A
East Tower	574S-4	P		0	46	1162		0	Casement			✓	✓	✓			✓			✓		✓		Stone damage, dirt, spalling, indication of water infiltration, spotting. Outside jamb has a broken stone.					**Other:** Storm window screw in masonry	A
East Tower	574S-5	P		0	46	1156		0	Casement			✓	✓	✓			✓		Bottom left pane replaced for A/C unit.	✓		✓	✓	Stone damage, dirt, spalling, peeling, open joint, indication of water infiltration, spotting.					**Other:** Storm window screw in masonry	A
East Tower	574S-6	P		0		0		0	Casement			✓	✓	✓			✓	✓		✓		✓	✓	Stone damage, efflorescence, dirt, open joint, indication of water infiltration, spotting.					**Other:** Storm window screw in masonry	A
East Pavilion	585S-1	O	23	584	52	1308		0	Single hung	O	✓					✓				✓						Marble sill extension			Wood: according to historic drawings it's wood blocking. **Other:** Storm window.	C
East Pavilion	587S-1	O		0	51	1295		0	Single hung	O	✓					✓				✓						Marble sill extension			Wood: according to historic drawings it's made of wood. **Other:** Aluminum: storm window.	C
East Pavilion	589S-1	O	33.5	851	51	1295		0	Single hung	O	✓					✓				✓						Marble sill extension			Wood: according to historic drawings it's wood blocking. **Other:** Storm window with misaligned sash.	C
East Tower	677S-1			0		0		0																						B
East Tower	677S-2			0		0		0																						B
East Tower	COR3-1		48	1219	54	1359	76	1918																						B
West Pavilion	ST1-1	B		0	41	1048		0	Single hung			✓	✓	✓	painted finish	✓				✓		✓	✓	deterioration, moisture, efflorescence, staining, chips.		moisture and staining	severe damage, moisture, efflorescence.	severe damage, moisture, efflorescence.		A
West Pavilion	ST1-2	G	21.5	546	204	5182	39	978	Single hung	F		✓	✓	✓		✓									Severe moisture and efflorescence					A
West Pavilion	ST1-3	G	21.5	546	204	5182	39	978	Single hung	F		✓	✓	✓		✓									Severe moisture and efflorescence	open joint between sill and right jamb.	one chip	One patch		A
West Pavilion	ST1-4	M		0		0		0	Single hung	O	✓					✓					✓			A lot of efflorescence, moisture, signs of water infiltration, staining, some open joint						B
West Pavilion	ST1-5	O		0		0		0	Single hung	O	✓					✓				✓										C
East Pavilion	ST4-1	B		0	54	1359		0	Single hung	O		✓	✓		Painted black finish, air infiltration and extreme bowing	✓				✓				Severe damage, spalling, efflorescence, sign of water infiltration, open joint, biological colonization	water infiltration at corner.		sever water infiltration, crumbling	Previous stone replacement possible.		A
East Pavilion	ST4-2	G	21.5	546	204	5182		0	Single hung			✓	✓	✓		✓								some masonry damage, sign of water infiltration, efflorescence, spalling.	sign of water infiltration and efflorescence.					A
East Pavilion	ST4-3	G	21	533	204	5182		0	Single hung			✓	✓			✓		✓						some masonry damage, signs of water infiltration, efflorescence, spalling.	Signs of water infiltration, efflorescence, patches.					A
East Pavilion	ST4-4	M		0		0		0	Single hung	O	✓					✓				✓										B
East Pavilion	ST4-5	O	39	991	59	1499	120	3048	Single hung	O	✓					✓				✓						Marble sill extension			Wood: According to historic drawings, it's wood blocking. Plaster finish.	C
West Pavilion	STS-2	A	24.75	629	67	1689		0	Single hung	NO		✓	✓	✓		✓			and blasted finish	✓				Some paint and scratches						B

APPENDIX III
PROPOSED INTERVENTIONS
SITE/CIVIL



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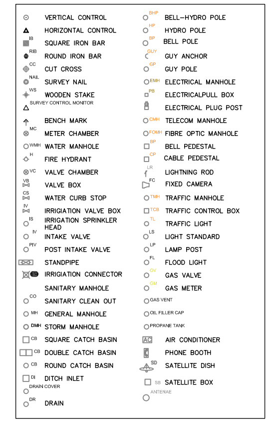
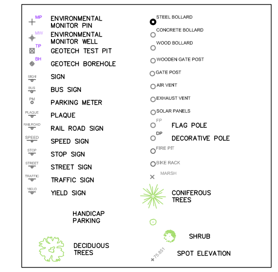
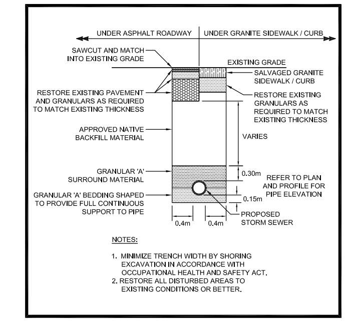
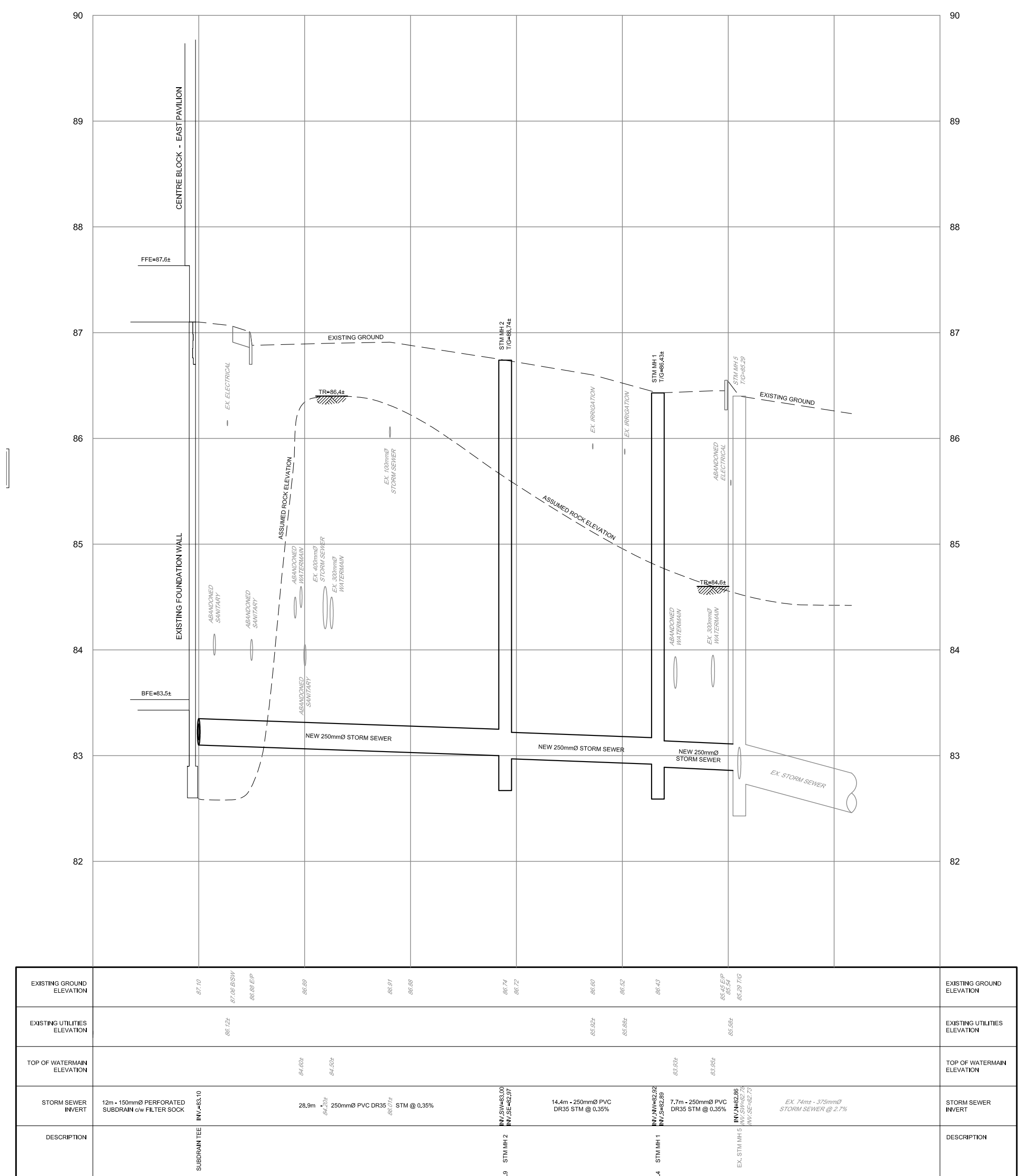


LEGEND	
B	U/G BELL TELEPHONE SERVICE
A-B	A/G BELL TELEPHONE SERVICE
C	U/G COMMUNICATION SERVICE
A-C	A/G COMMUNICATION SERVICE
F/O	U/G FIBER OPTICS
E	U/G ELECTRICAL SERVICE
HV	U/G HIGH VOLTAGE ELECTRICAL
A-LV	A/G ELECTRICAL SERVICE
A-HV	A/G HIGH VOLTAGE ELECTRICAL
A-S	A/G SECURITY LINE
SEC	SECURITY SERVICE LINE
CWR	CHILLED WATER RETURN
CWS	CHILLED WATER SUPPLY
STM / C	CONDENSATE
STM	STEAM CONDUIT
ABN / STM	STEAM CONDUIT ABANDONED
WM	WATERMAIN CONDUIT
IR	IRRIGATION LINE
ABN / WM	WATERMAIN ABANDONED
ST	STORM SEWER
ABN / ST	STORM ABANDONED
SA	SANITARY SEWER
	COMBINED SEWER
	SANITARY FORCED MAIN
ABN / SA	SANITARY ABANDONED
G	GAS LINE
ABN / G	GAS LINE ABANDONED
	TREE LINE/ EDGE OF BUSH
	TOP OF SLOPE
	BOTTOM OF SLOPE

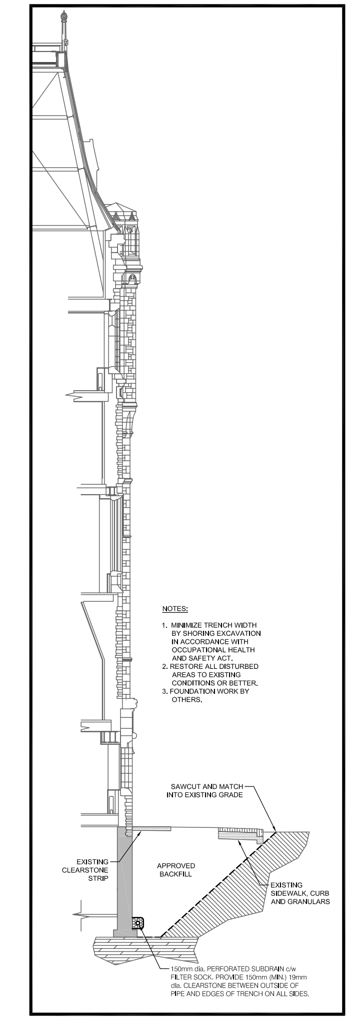




1 C-1 TYP. SECTION: STORM SEWER TRENCH
CENTRE BLOCK - EAST & WEST PAVILIONS
SCALE / ÉCHELLE: 1:50



SCALE: 1:200 (HORIZONTAL)
1:20 (VERTICAL)



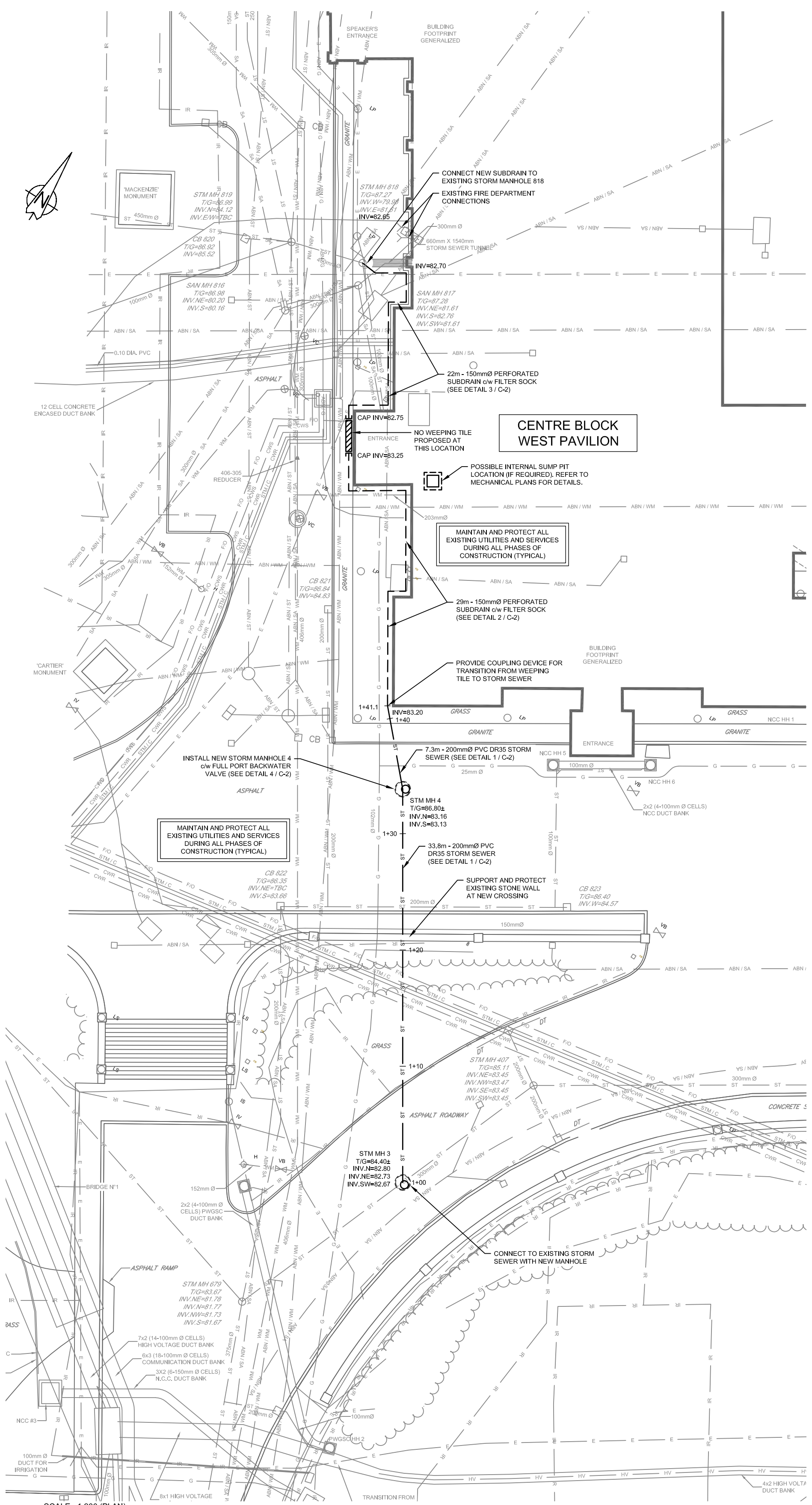
2 C-1 FOUNDATION DRAINAGE SECTION
CENTRE BLOCK - EAST PAVILION 'C'
SCALE / ÉCHELLE: 1:100

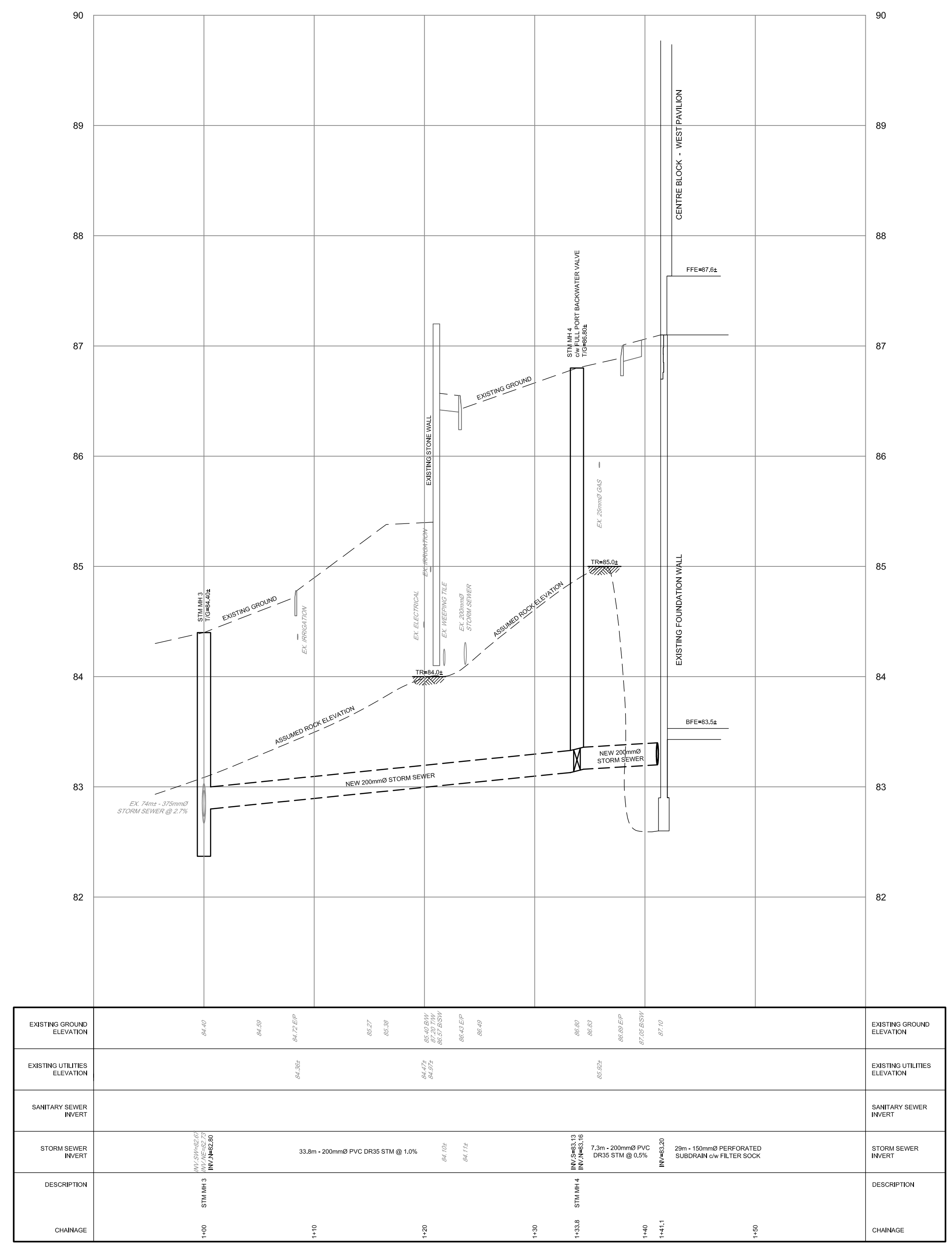
GENERAL NOTES:

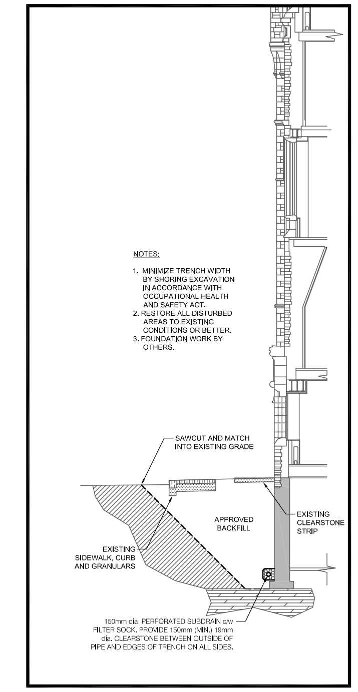
1) COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2) DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3) OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE COMMENCING CONSTRUCTION.
4) RESTORE ALL DISTURBED AREAS TO EXISTING CONDITIONS OR BETTER.
5) ALL ELEVATIONS ARE GEODETIC.
6) REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.

NOTES GÉNÉRALES :

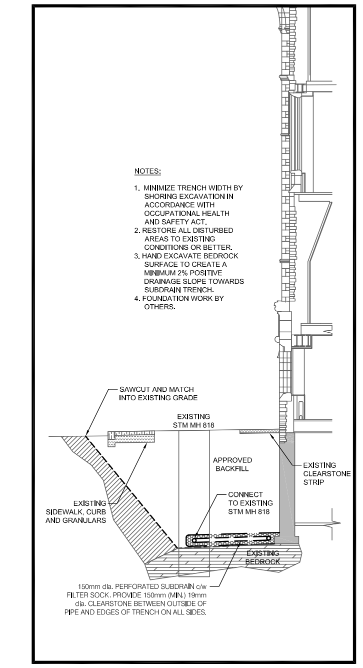
1) COORDONNER ET PLANIFIER TOUS LES TRAVAUX AVEC LES AUTRES COMMERCES ET ENTREPRENEURS.
2) DÉTERMINER PRÉCISÉMENT L'EMPLACEMENT, LA TAILLE, LE MATÉRIEL ET L'ÉLÉVATION DE TOUTES LES INSTALLATIONS EXISTANTES AVANT D'ENTREPRENDRE LES TRAVAUX DE CONSTRUCTION. PROTÉGER LES INSTALLATIONS EXISTANTES ET EN ASSUMER LA RESPONSABILITÉ INDÉPENDAMMENT DU FAIT QU'ELLES SOIENT REPRÉSENTÉES OU NON SUR CE PLAN.
3) OBTENIR TOUS LES PERMIS ET LES APPROBATIONS NÉCESSAIRES AVANT D'ENTREPRENDRE LES TRAVAUX DE CONSTRUCTION.
4) RESTAURER L'ENSEMBLE DES ZONES AFFECTÉES EN RÉTABLISSANT L'ÉTAT ORIGINAL DES LIEUX OU EN L'AMÉLIORANT.
5) TOUTES LES ÉLÉVATIONS SONT GÉODÉSIQUES.
6) SE REPORTER AUX PLANS DE L'ARCHITECTE ET DE L'ARCHITECTE-PAYSAGISTE POUR LES ZONES ET LES DIMENSIONS DES ÉDIFICES ET DES REVÊTEMENTS EN DUR.



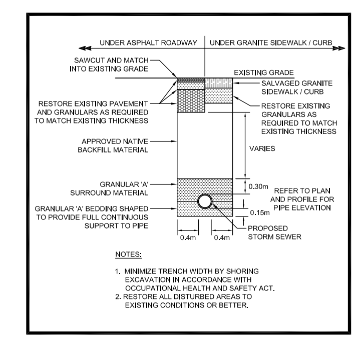




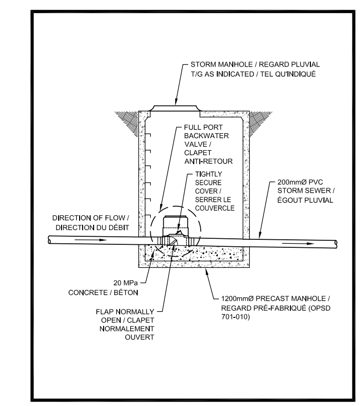
2 C-2 FOUNDATION DRAINAGE SECTION
CENTRE BLOCK - WEST PAVILION 'B'
SCALE / ÉCHELLE: 1:100



3 C-2 FOUNDATION DRAINAGE SECTION
CENTRE BLOCK - WEST PAVILION 'C'
SCALE / ÉCHELLE: 1:100



1 C-2 TYP. SECTION: STORM SEWER TRENCH
CENTRE BLOCK - EAST & WEST PAVILIONS
SCALE / ÉCHELLE: 1:50



4 C-2 STORM MH c/w BACKWATER VALVE
CENTRE BLOCK - WEST PAVILION
SCALE / ÉCHELLE: 1:50

GENERAL NOTES:

1) COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.

2) DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.

3) OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE COMMENCING CONSTRUCTION.

4) RESTORE ALL DISTURBED AREAS TO EXISTING CONDITIONS OR BETTER.

5) ALL ELEVATIONS ARE GEODETIC.

6) REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.

NOTES GÉNÉRALES :

1) COORDONNER ET PLANIFIER TOUS LES TRAVAUX AVEC LES AUTRES COMMERCES ET ENTREPRENEURS.

2) DÉTERMINER PRÉCISÉMENT L'EMPLACEMENT, LA TAILLE, LE MATÉRIEL ET L'ÉLÉVATION DE TOUTES LES INSTALLATIONS EXISTANTES AVANT D'ENTREPRENDRE LES TRAVAUX DE CONSTRUCTION. PROTÉGER LES INSTALLATIONS EXISTANTES ET EN ASSUMER LA RESPONSABILITÉ INDÉPENDAMMENT DU FAIT QU'ELLES SOIENT REPRÉSENTÉES OU NON SUR CE PLAN.

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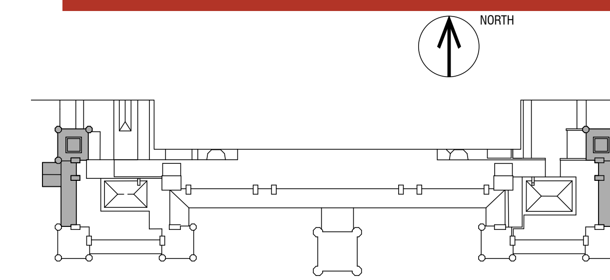
6) SE REPORTER AUX PLANS DE L'ARCHITECTE ET DE L'ARCHITECTE-PAYSAGISTE POUR LES ZONES ET LES DIMENSIONS DES ÉDIFICES ET DES REVÊTEMENTS EN DUR.

APPENDIX IV
PROPOSED INTERVENTIONS
ARCHITECTURE

EAST & WEST PAVILIONS

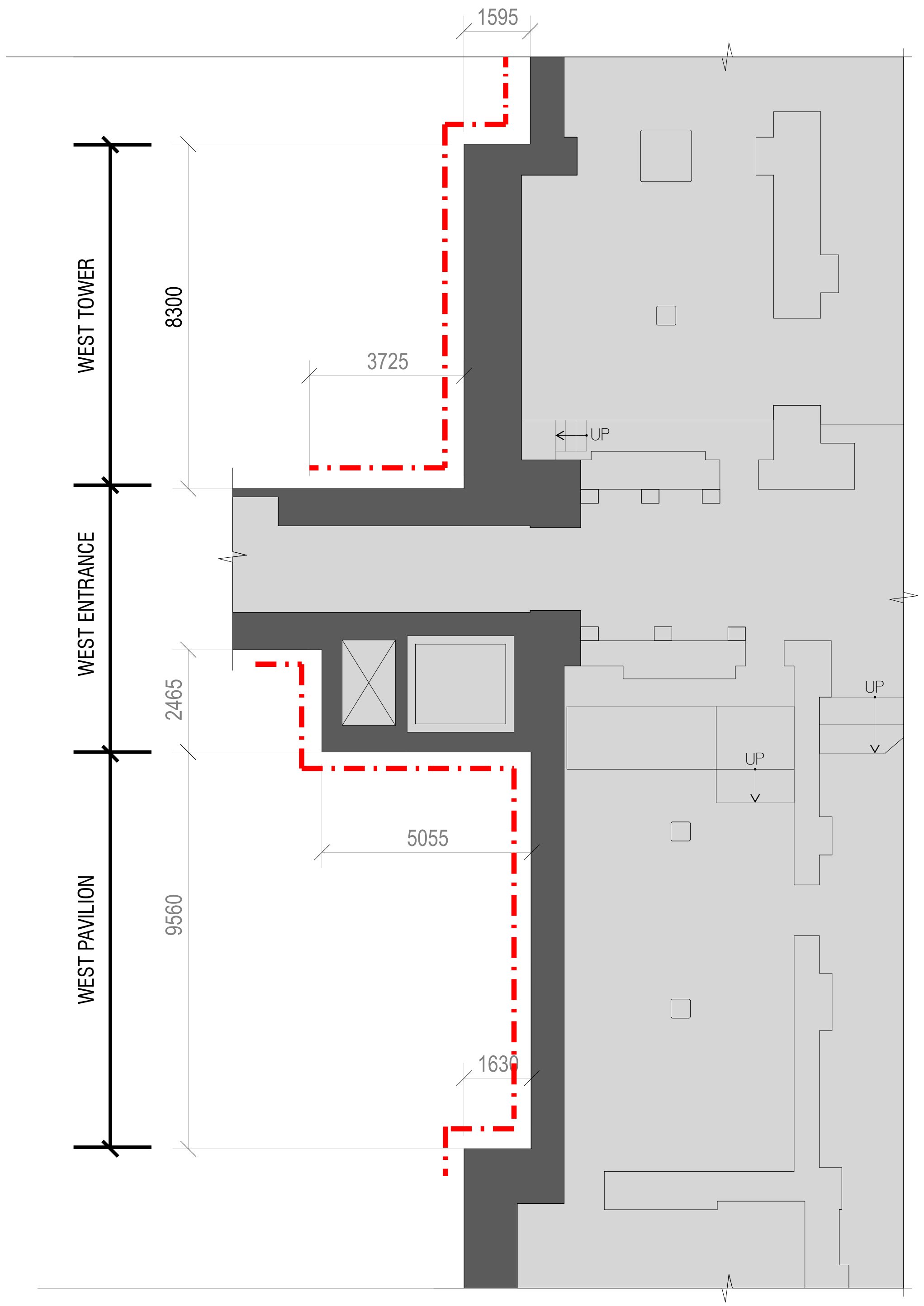
CONSERVATIONS OF FOUNDATION
BASEMENT KEY PLANS



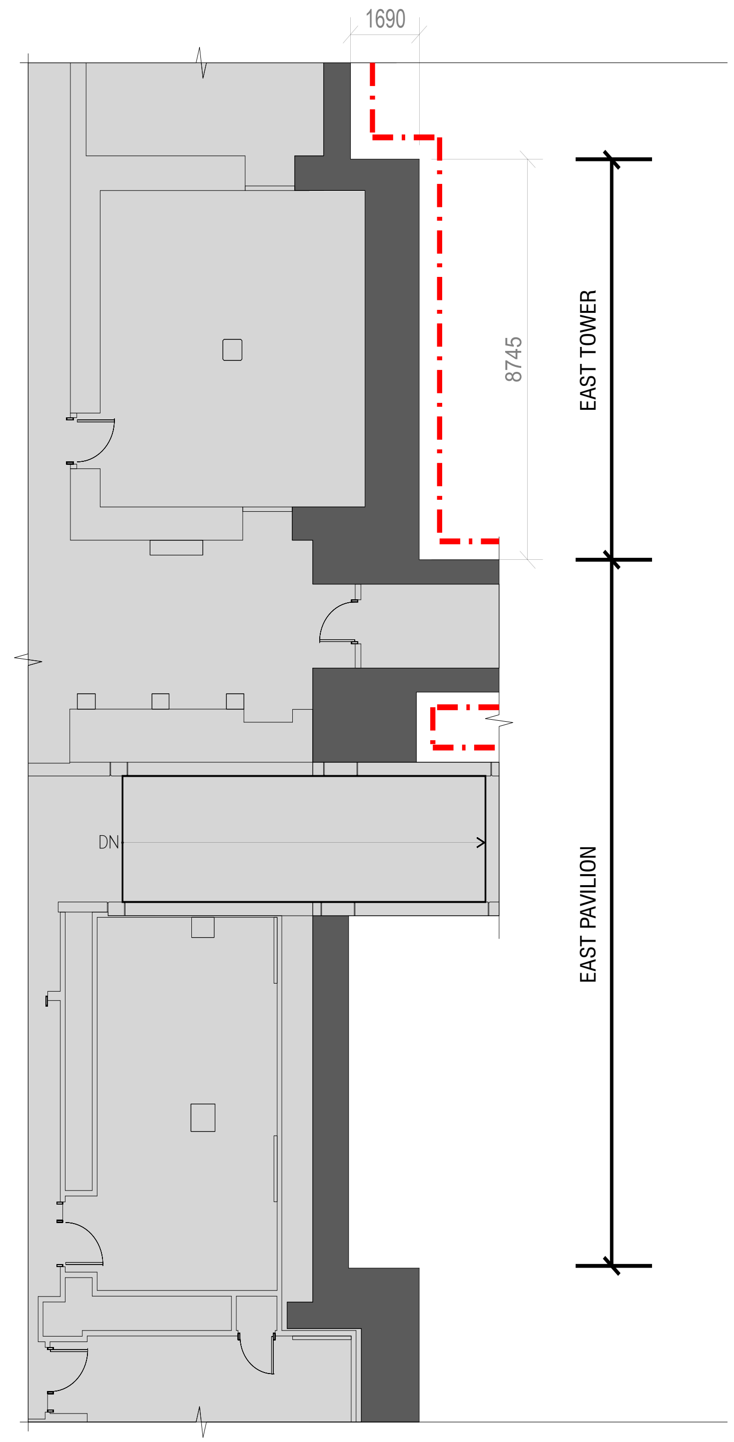
LEGEND

LIMIT OF SCOPE OF WORK

NOTE:
FOR CIVIL WORK, REFER TO APPENDIX VII OF THE SCHEMATIC DESIGN REPORT.



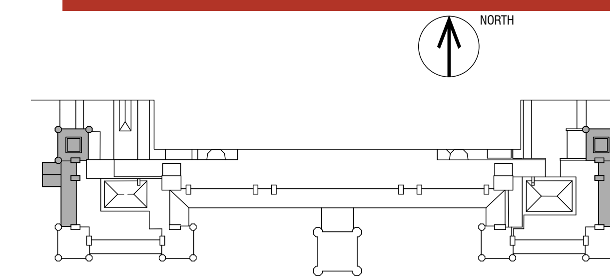
WEST PAVILION - BASEMENT PLAN
NOT TO SCALE



EAST PAVILION - BASEMENT PLAN
NOT TO SCALE

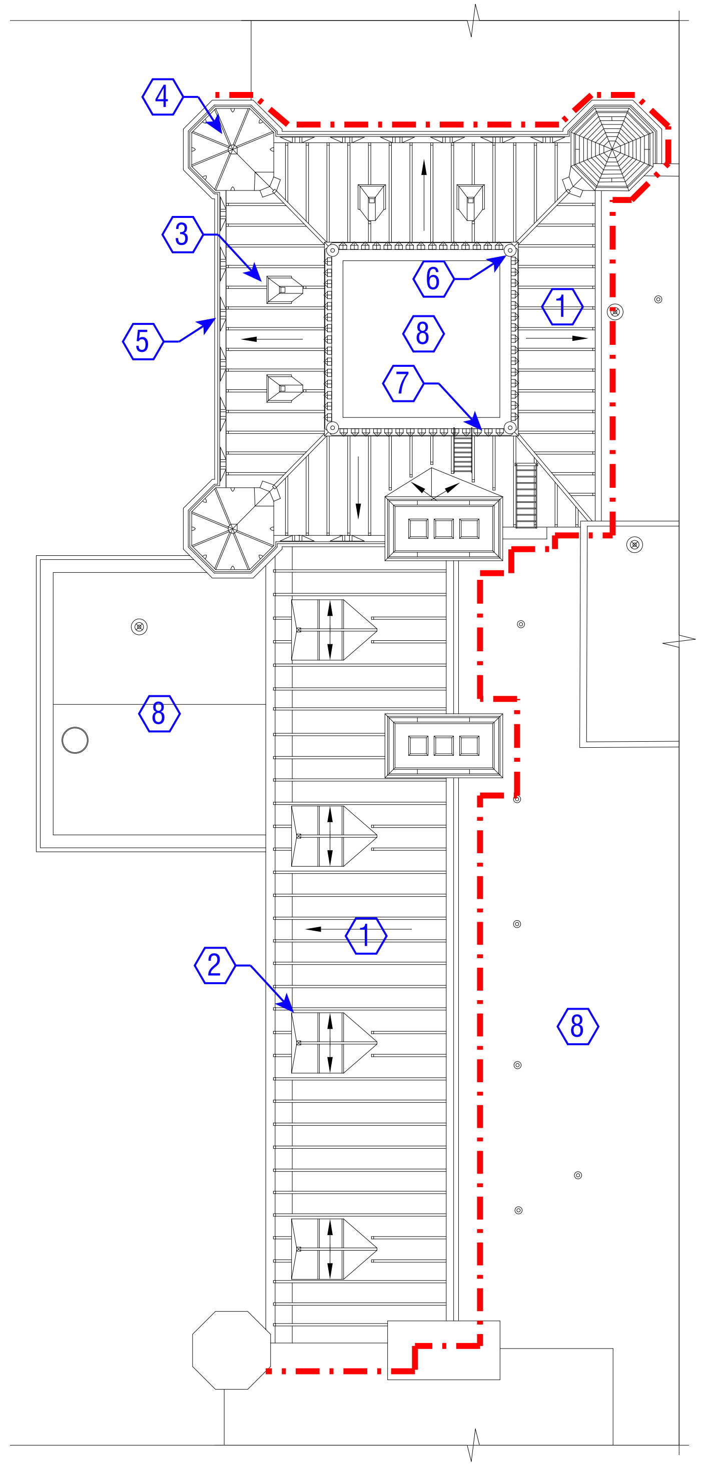
EAST & WEST PAVILIONS

CONSERVATIONS OF ROOF
ROOF KEY PLANS

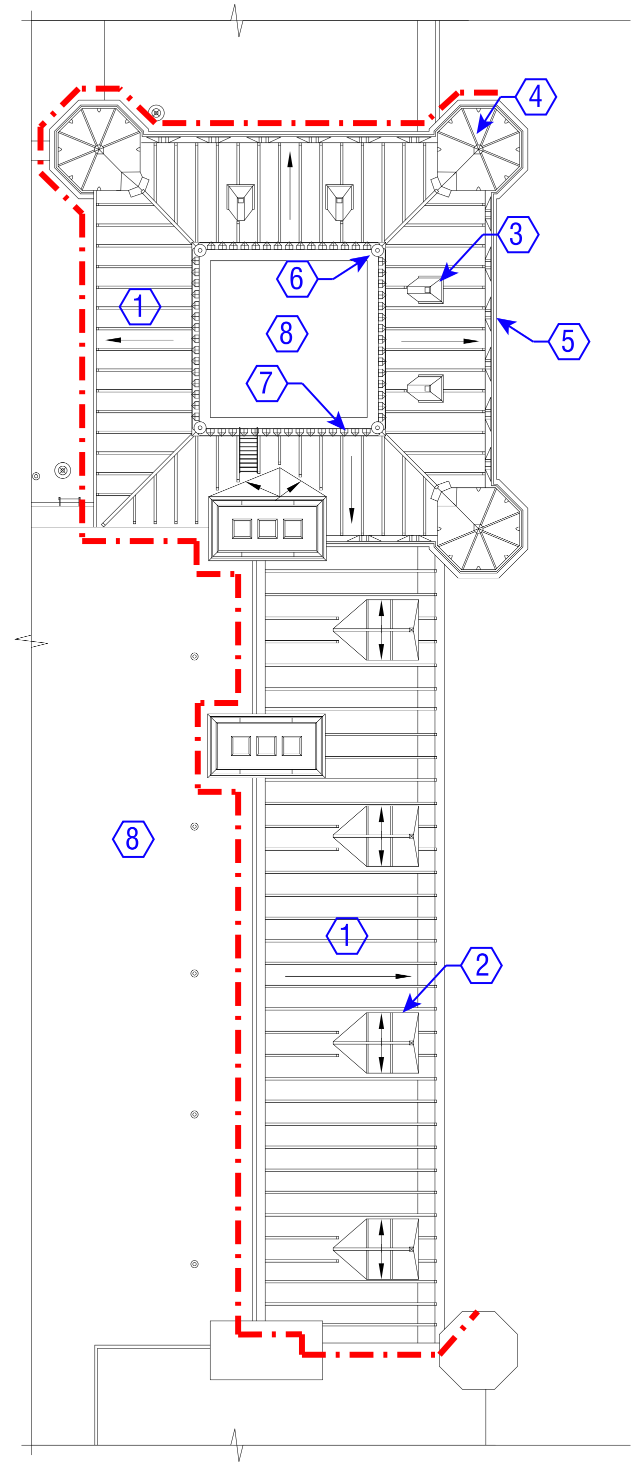


LEGEND

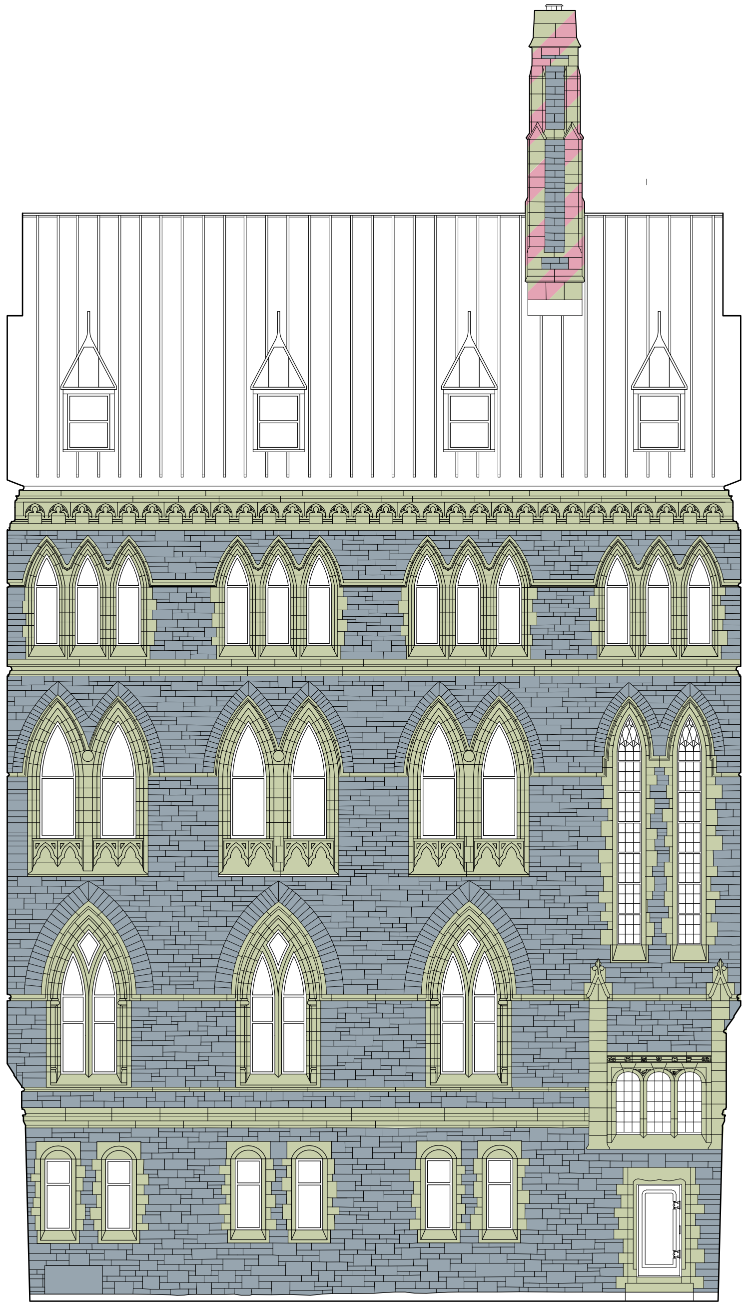
- LIMIT OF SCOPE OF WORK
- 1 COPPER ROOFING
- 2 COPPER CLAD DORMER
- 3 COPPER CLAD DORMER WITH LOUVER
- 4 TURRET LEAD CAP
- 5 TOWER GABLET LEAD CAP
- 6 COPPER FINIAL
- 7 COPPER CRESTING
- 8 FLAT ROOF CONSTRUCTION



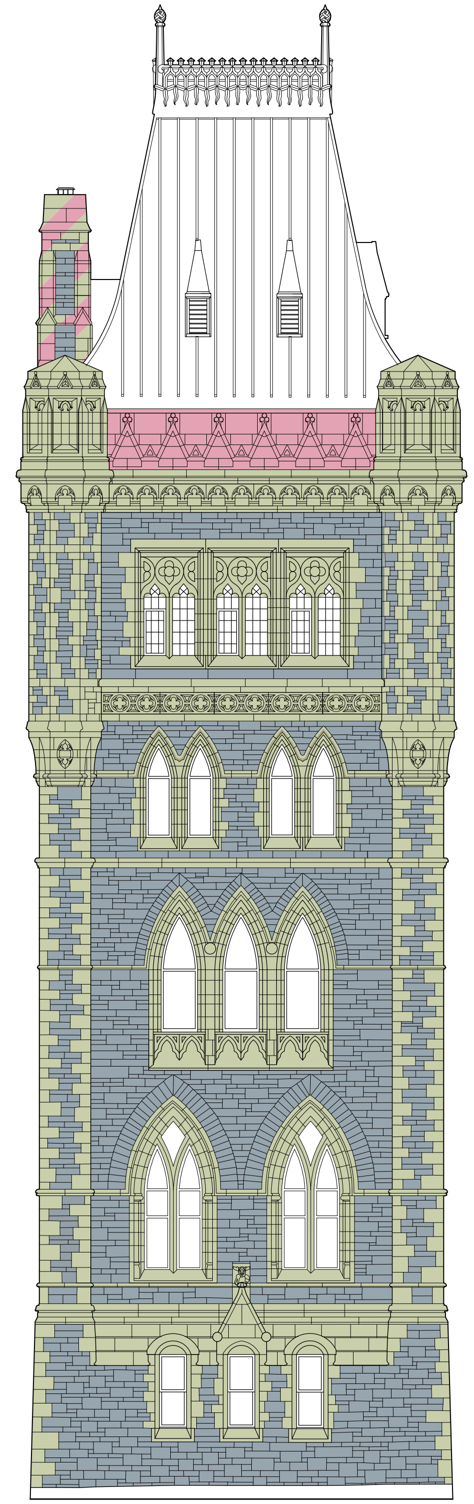
WEST PAVILION - ROOF PLAN
NOT TO SCALE



EAST PAVILION - ROOF PLAN
NOT TO SCALE



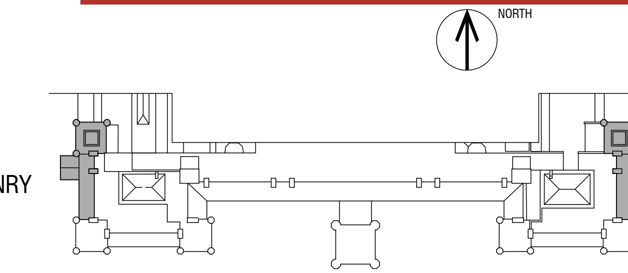
PAVILION - TYPICAL ELEVATION
NOT TO SCALE



TOWER - TYPICAL ELEVATION
NOT TO SCALE

EAST & WEST PAVILIONS

CONSERVATION OF EXISTING MASONRY
MASONRY KEY ELEVATIONS



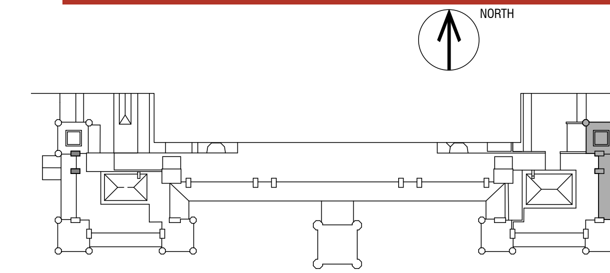
LEGEND

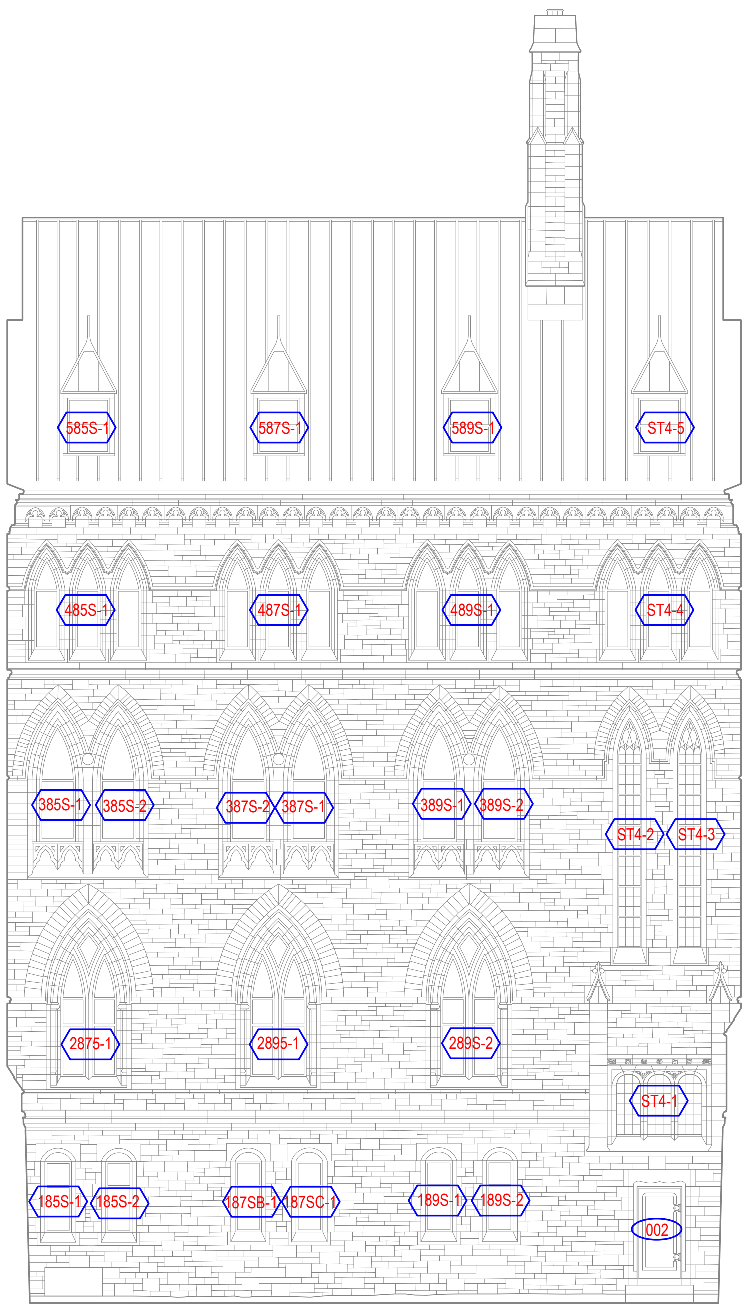
STONE TYPES

- OHIO (BEREA) SANDSTONE
- WALLACE SANDSTONE
- NEPEAN SANDSTONE
- COMBINATION OHIO & WALLACE

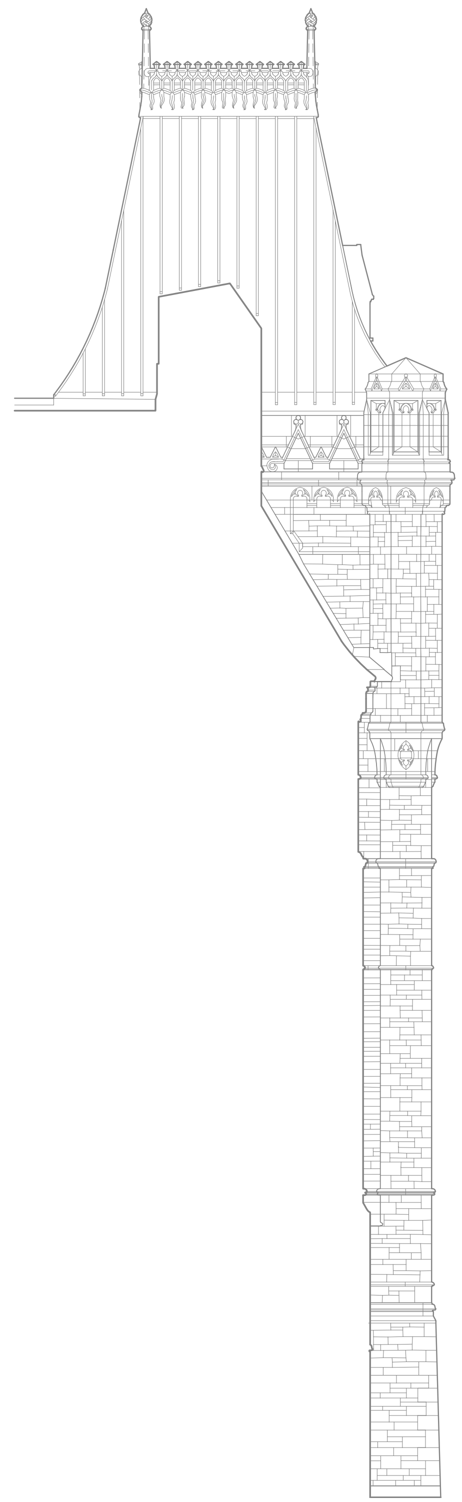
EAST PAVILION

CONSERVATION OF WINDOWS
WINDOW KEY ELEVATIONS

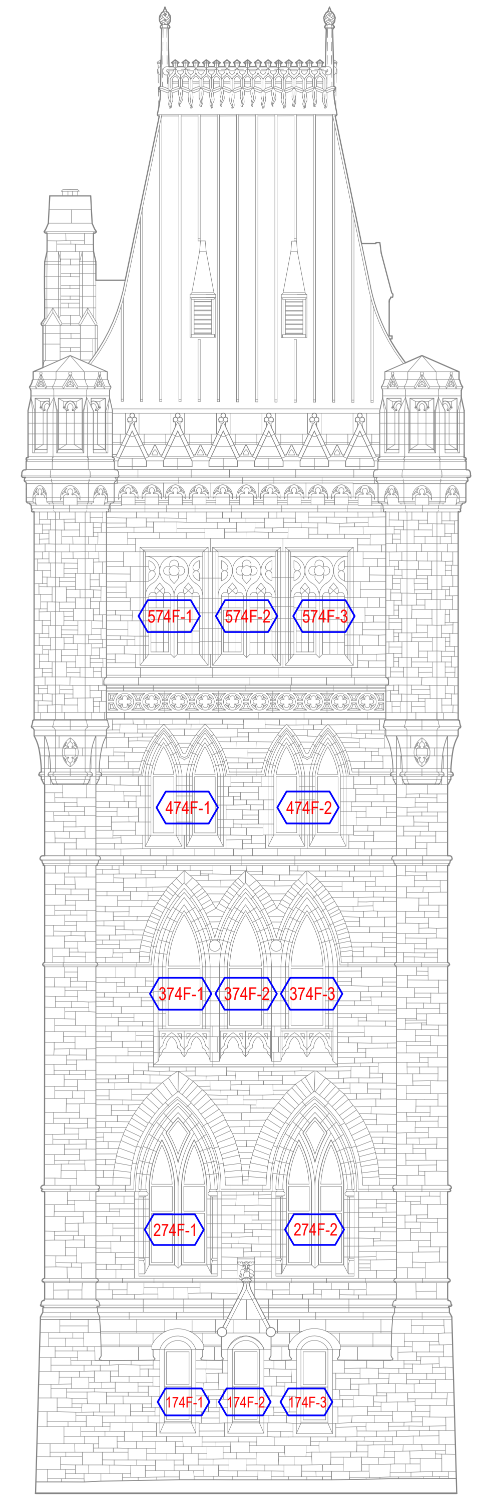




EAST BAY - EAST ELEVATION
NOT TO SCALE



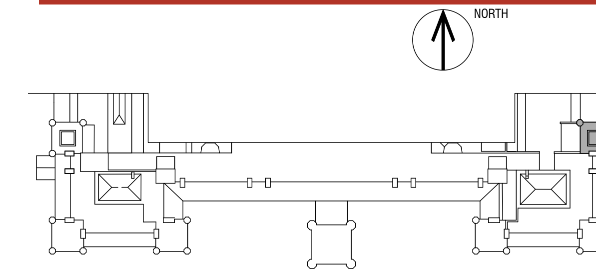
EAST TOWER - SOUTH ELEVATION
NOT TO SCALE

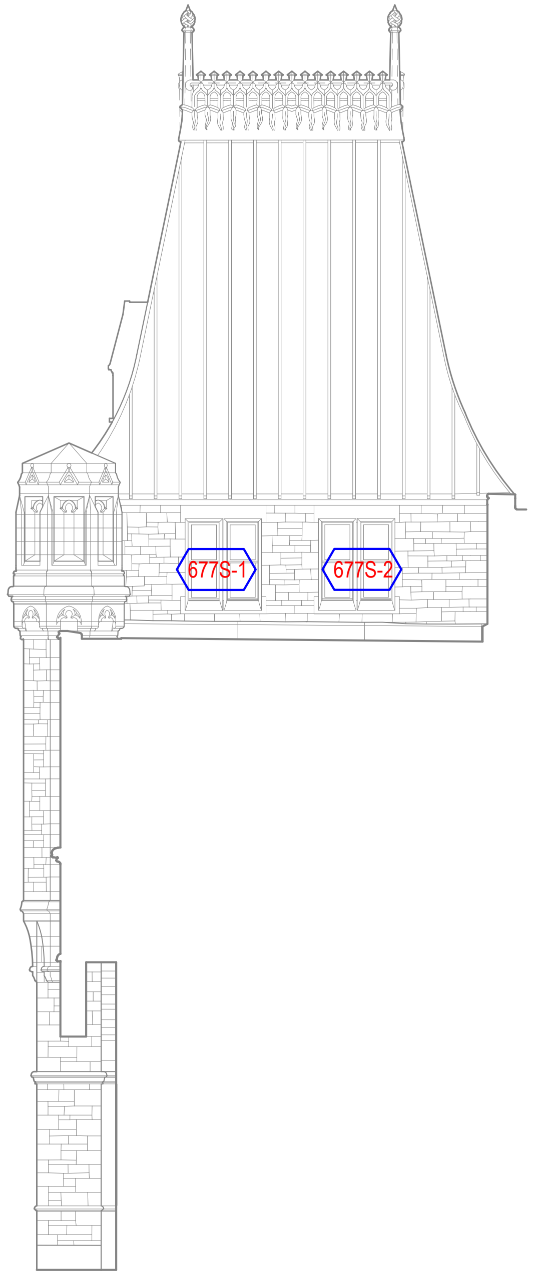


EAST TOWER - EAST ELEVATION
NOT TO SCALE

EAST PAVILION

CONSERVATION OF WINDOWS
WINDOW KEY ELEVATIONS





EAST TOWER - NORTH ELEVATION
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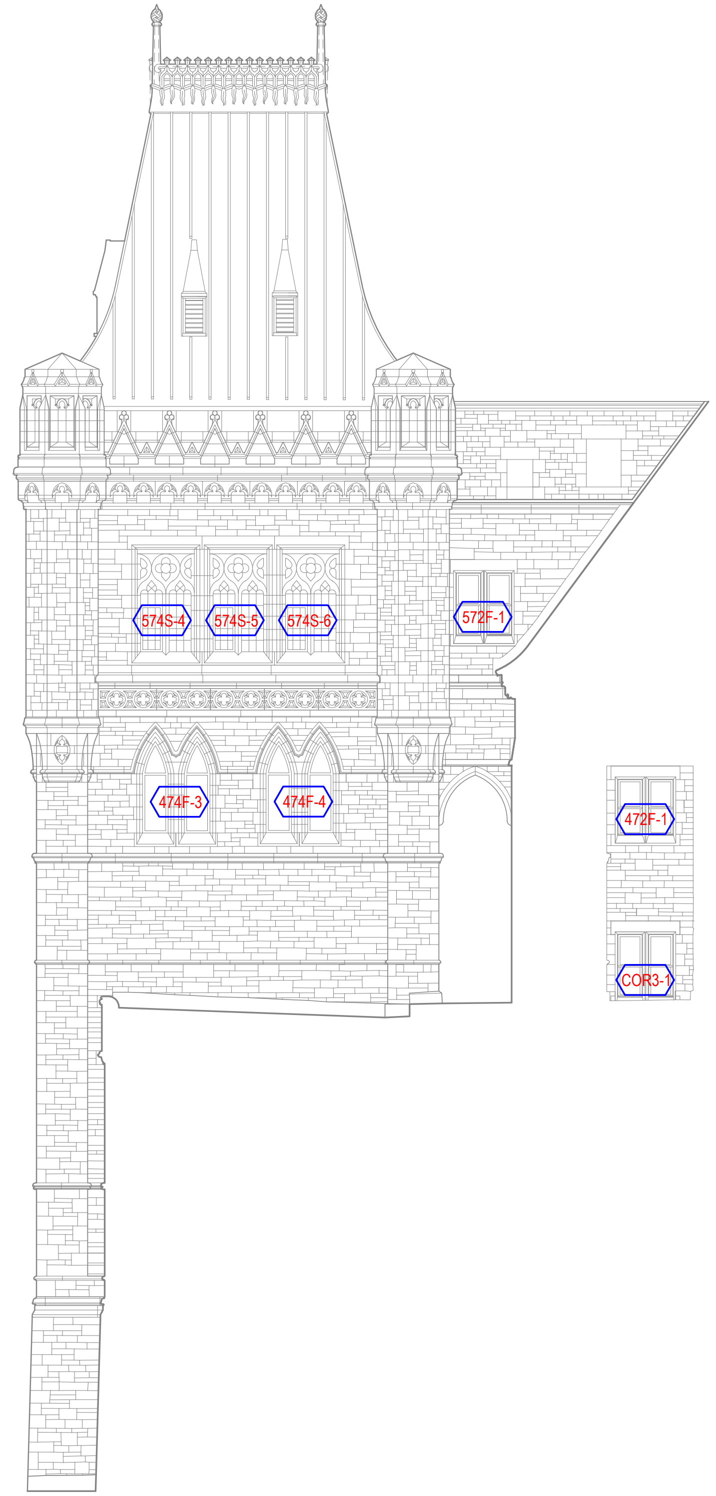
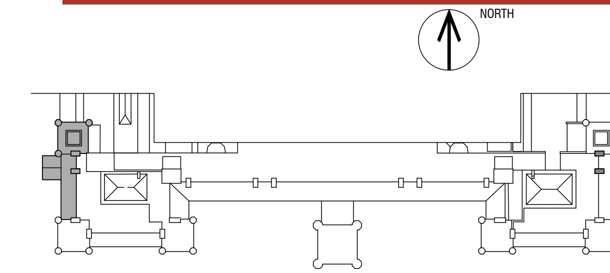
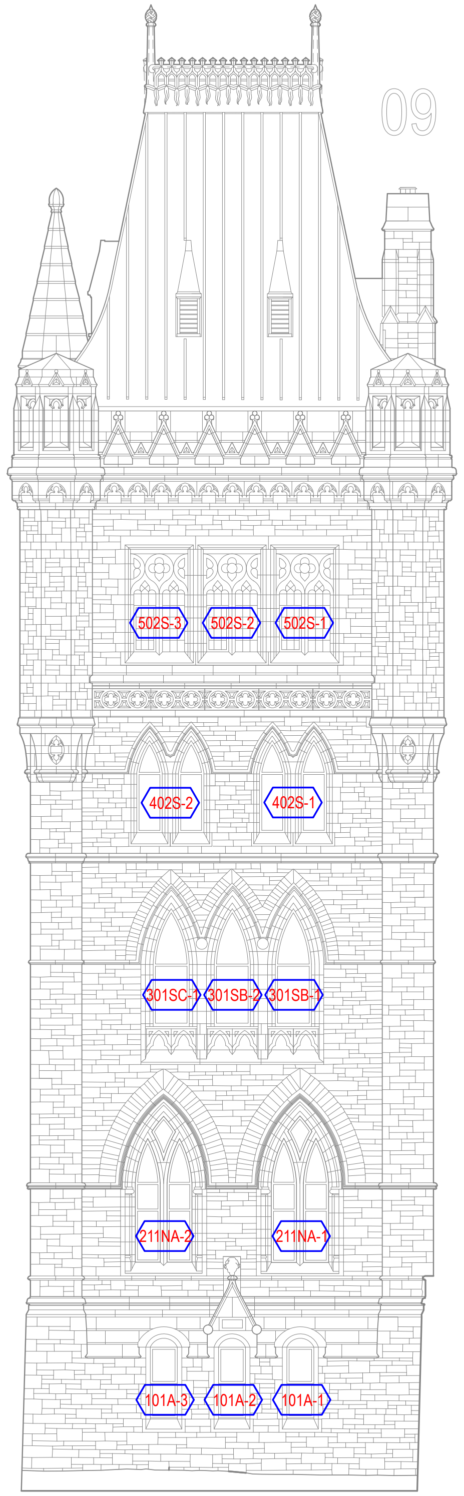


EAST TOWER - WEST ELEVATION
NOT TO SCALE

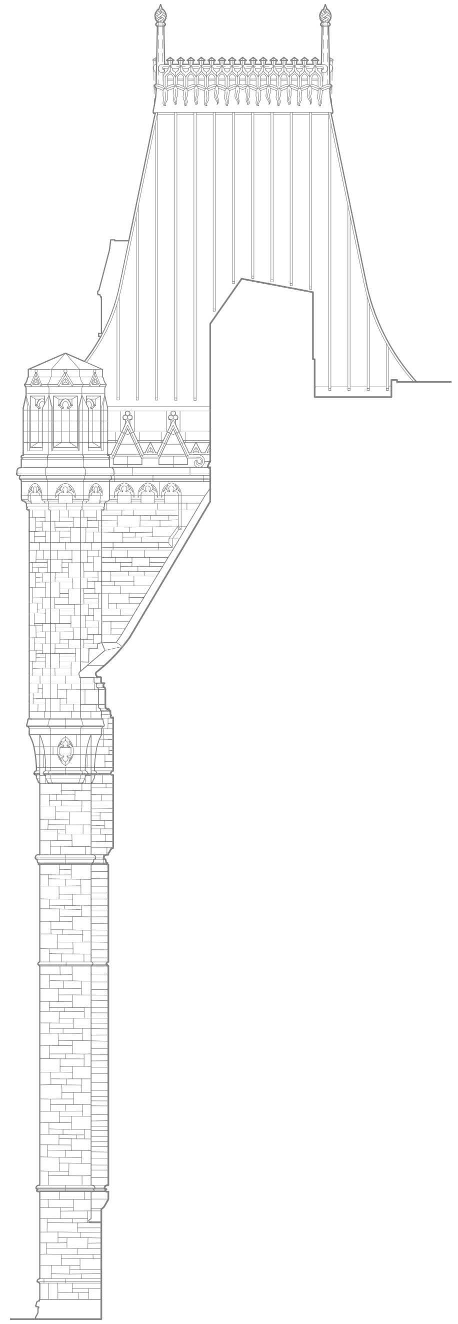
WEST PAVILION

CONSERVATION OF WINDOWS
WINDOW KEY ELEVATIONS

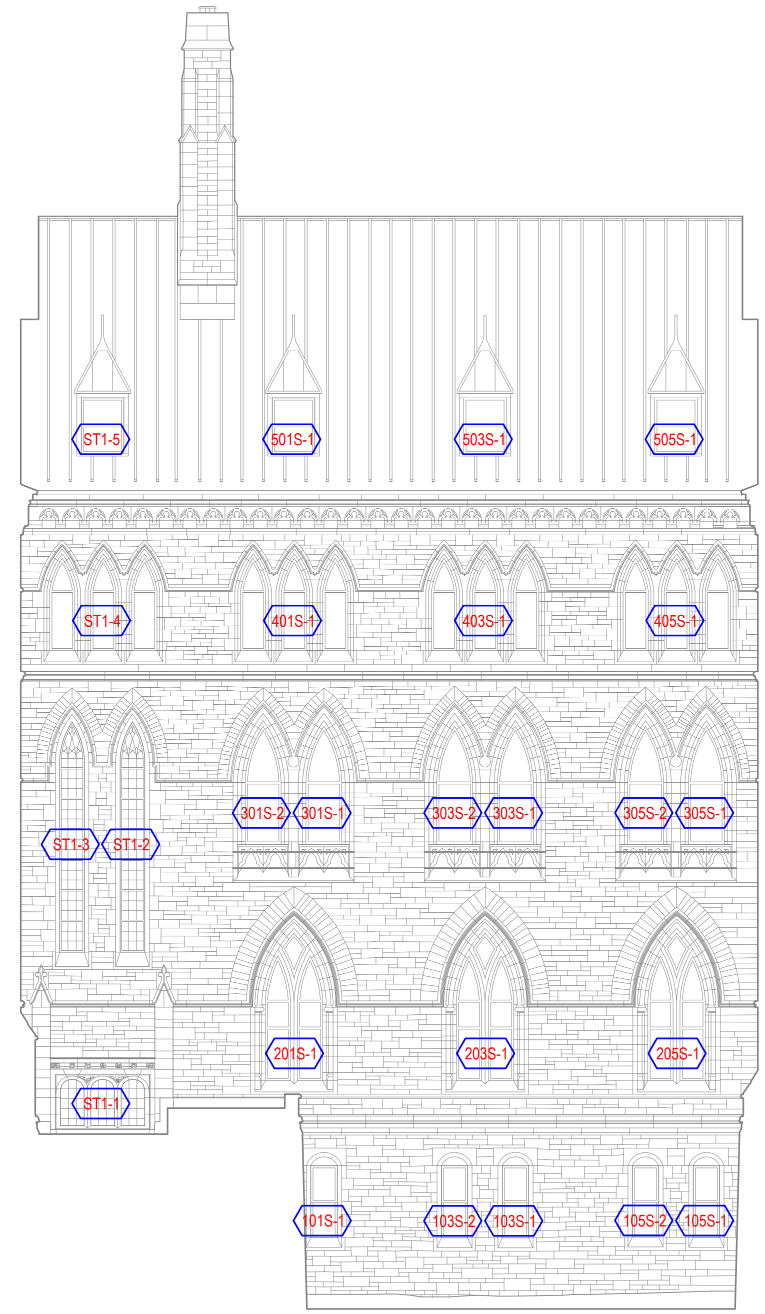




WEST TOWER - WEST ELEVATION
NOT TO SCALE



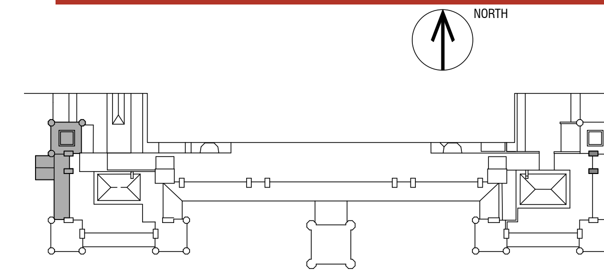
WEST TOWER - SOUTH ELEVATION
NOT TO SCALE

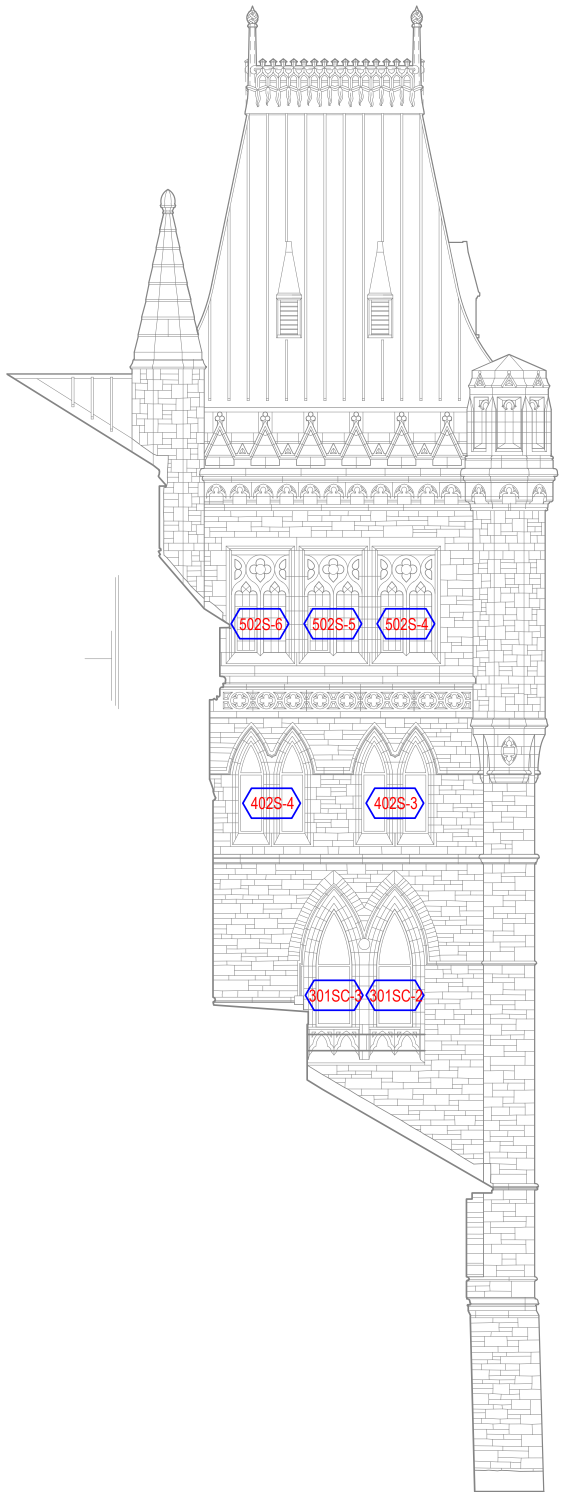


WEST BAY - WEST ELEVATION
NOT TO SCALE

WEST PAVILION

CONSERVATION OF WINDOWS
WINDOW KEY ELEVATIONS





WEST TOWER - NORTH ELEVATION
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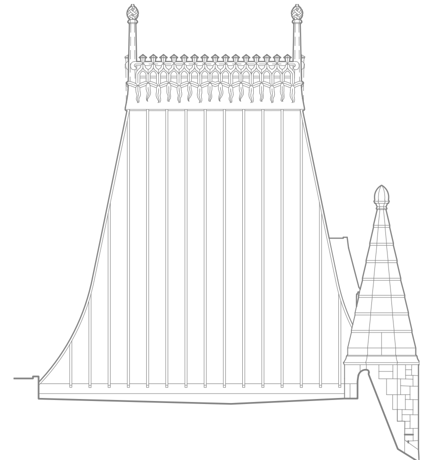
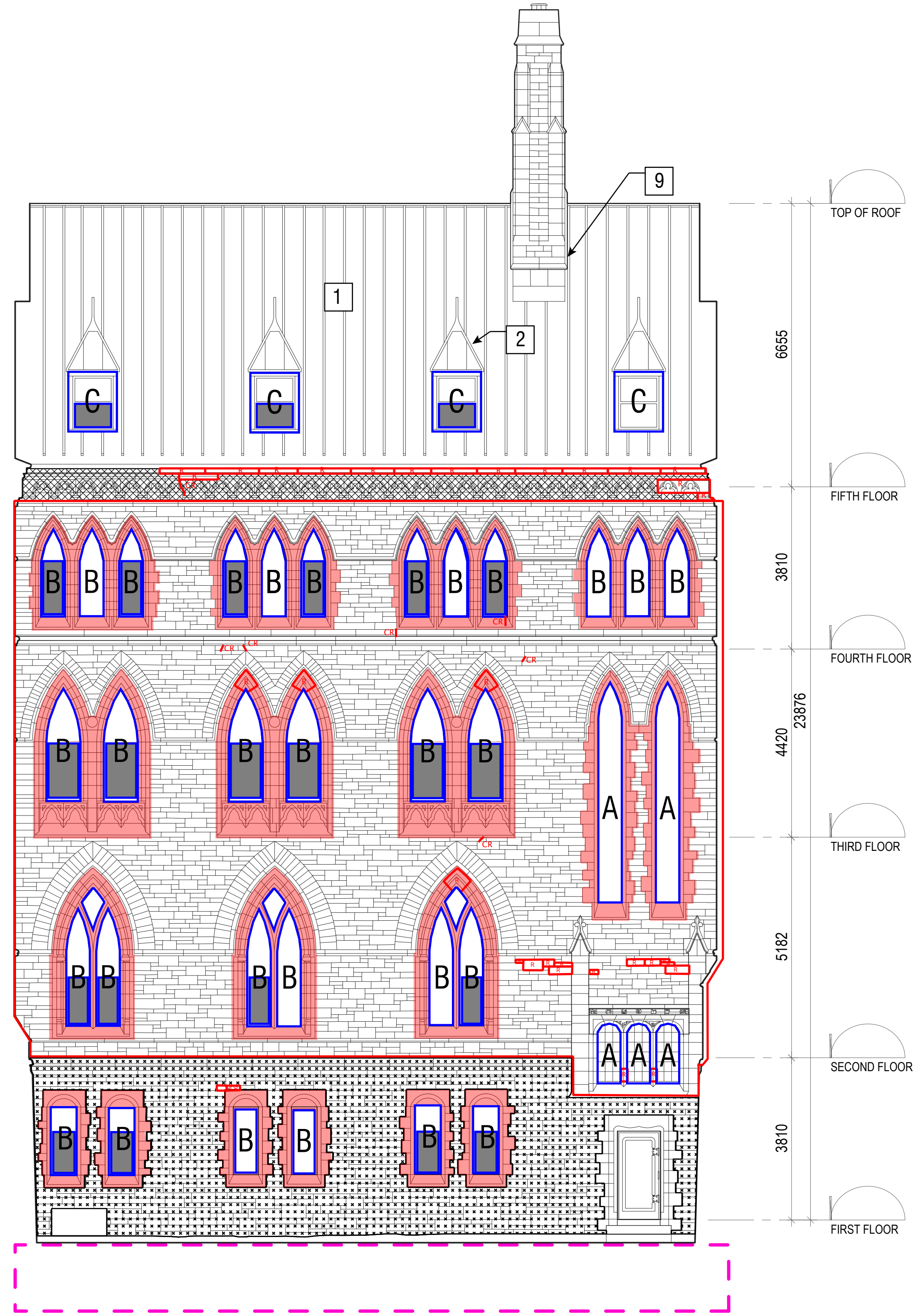


WEST TOWER - EAST ELEVATION
NOT TO SCALE

WEST BAY ENTRANCE
NOT TO SCALE

DESIGN DEVELOPMENT REPORT

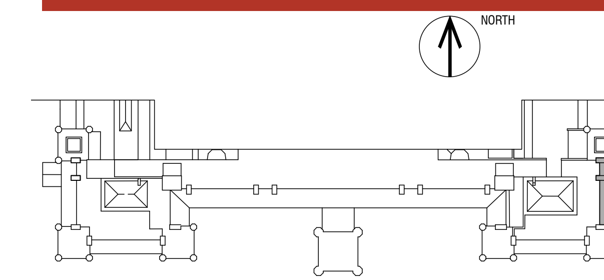


EAST BAY - EAST ELEVATION

NOT TO SCALE

RECOMMENDED
INTERVENTION

EAST BAY



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME COMPLETE REPLACEMENT OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 2 WYTHES OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- DISMANTLING & REBUILDING OF 20% OF INDICATED AREA. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- 10% OF TOTAL SURFACE OF EXTERIOR WALL MIGHT BE DISMANTLED AND REBUILT. WITHIN 10%, ASSUME REPLACEMENT OF 25% OF RUSTICATED NEPEAN SANDSTONE FACE STONES, 5% OF BEREA SANDSTONE (EXCLUDING WINDOWS) & 1 WYTHE OF BRICK BACKWALL.
- POULTICING TO REMOVE SALTS AND RUB BACK. DUTCHMEN REPAIRS WHERE NECESSARY. GROUT INJECTIONS IN ATTIC BRICK BACKWALL OF TOWERS.
- R — STONE REPLACEMENT
- CR — CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

• CRACK CONSOLIDATION	8 UNITS
• DUTCHMAN	2-5 UNITS
• HEAVY EROSION	10m²
• PREVIOUS REPAIR	1.5m²

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

- 100% RE-POINTING OF MASONRY BELOW GRADE (400mm), MIN 38mm DEEP.
- PATCHING AND FILLING CRACKS IN THE CONCRETE WALLS. REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT
- DAMP-PROOFING OF CONCRETE FOUNDATION WALLS.
- INSTALLING DRAINAGE TILES AT FOOTINGS. REFER TO SECTION 7.1.2. OF SCHEMATIC DESIGN REPORT.
- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

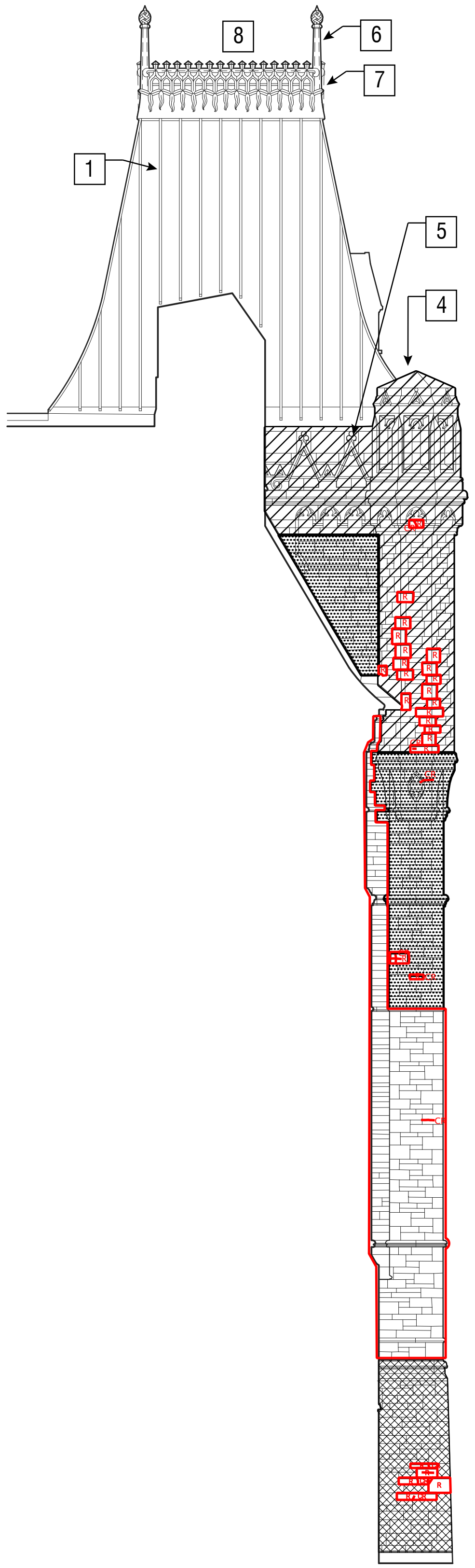
- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
- LEVEL OF FOOTING TO BE DETERMINED.
- REFER TO BASEMENT KEY PLAN FOR LIMIT OF SCOPE OF WORK.

CONSERVATION OF ROOF

1. REPLACEMENT OF COPPER ROOFING WITH 20 OZ. COPPER SHEATHING. PARGING REPAIRS AT EXISTING FLEX-O-CRETE LIGHTWEIGHT CONCRETE ROOF TO LEVEL SURFACE. SELECTIVE REPLACEMENT AND REHABILITATION OF FLAT ROOFING AT THE JUNCTION WITH COPPER ROOFING.
2. REPLACEMENT OF COPPER ROOFING AT DORMERS WITH 20 OZ. COPPER SHEATHING.
3. REPLACEMENT OF COPPER ROOFING AT DORMERS AND LOUVERS.
4. REPLACEMENT OF TOURRET LEAD CAP
5. REPLACEMENT OF TOWER GABLET LEAD CAP
6. REPLICATION OF FINIAL WITH 16 OZ. COPPER.
7. REPLICATION OF CRESTING WITH 16 OZ. COPPER.
8. REPLACEMENT OF COPPER FLASHING AND FLAT ROOFING AT TOWERS AND WEST ENTRANCE.
9. REPLACEMENT OF COPPER FLASHING AT CHIMNEY BASES.

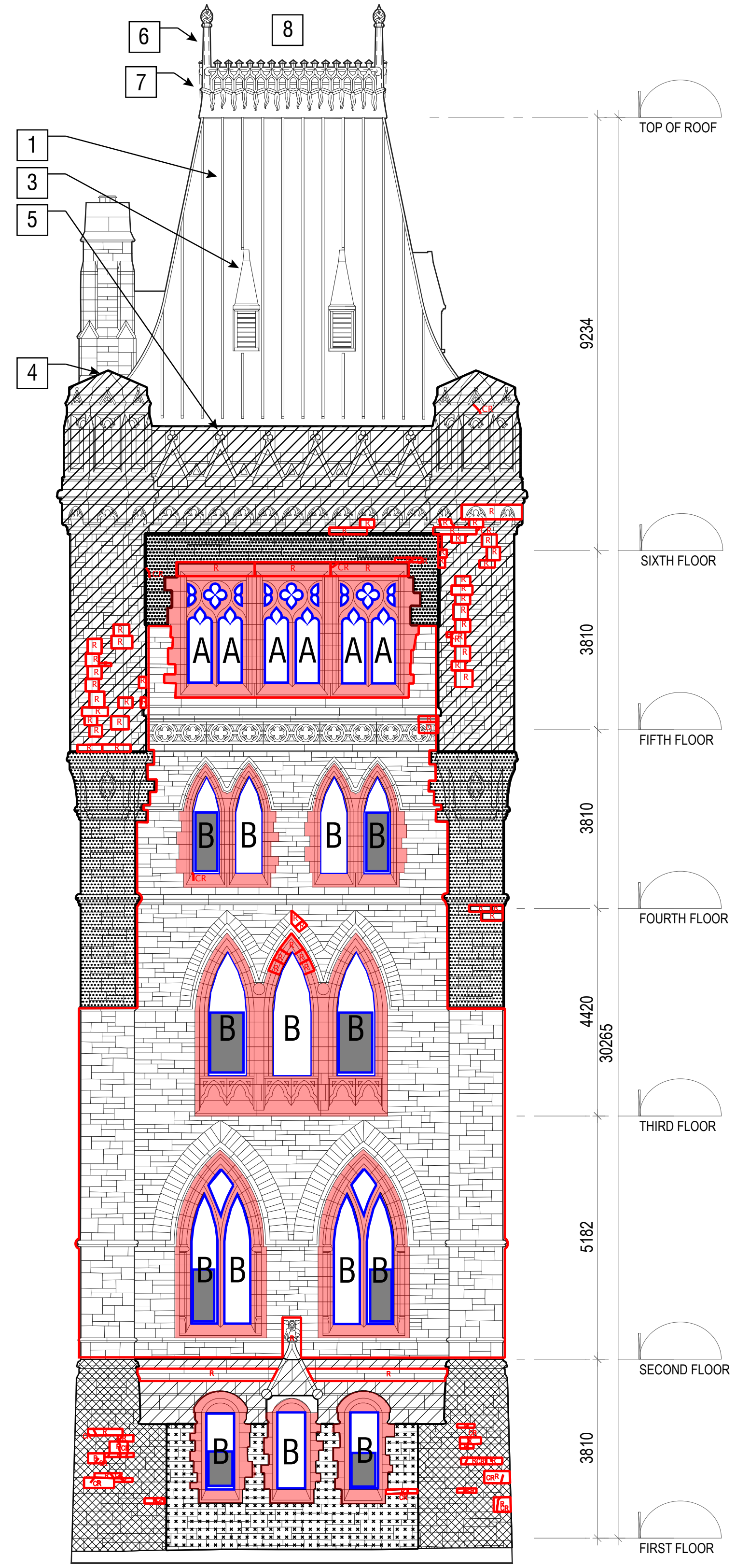
CONSERVATION OF WINDOWS

- A — STEEL AND LEADED GLASS WINDOWS: IN SITU STABILIZATION AND MAINTENANCE.
- B — ALUMINIUM WINDOWS: IN SITU MAINTENANCE.
- C — REPLACEMENT OF ALUMINIUM WINDOWS WITH NEW STEEL WINDOW UNITS AS PER SOUTH FACADE REPLICA OF THE ORIGINAL.
- REPLACEMENT OF WINDOW PANES WITH TEMPORARY PANES CONTAINING SEALED COLLARS FOR VENTILATION. REINSTALLATION OF ORIGINAL PANES AT END OF PROJECT.



EAST TOWER - SOUTH ELEVATION

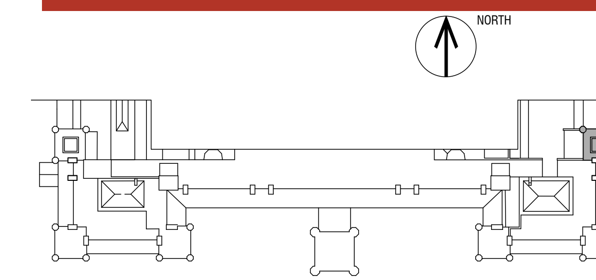
NOT TO SCALE



EAST TOWER - EAST ELEVATION

NOT TO SCALE

DESIGN DEVELOPMENT REPORT



RECOMMENDED
INTERVENTION

EAST TOWER

LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

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• PREVIOUS REPAIR	1.5m²

MASONRY WINDOW JAMBS:

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SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

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NOTES:

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- C — REPLACEMENT OF ALUMINIUM WINDOWS WITH NEW STEEL WINDOW UNITS AS PER SOUTH FACADE REPLICA OF THE ORIGINAL.
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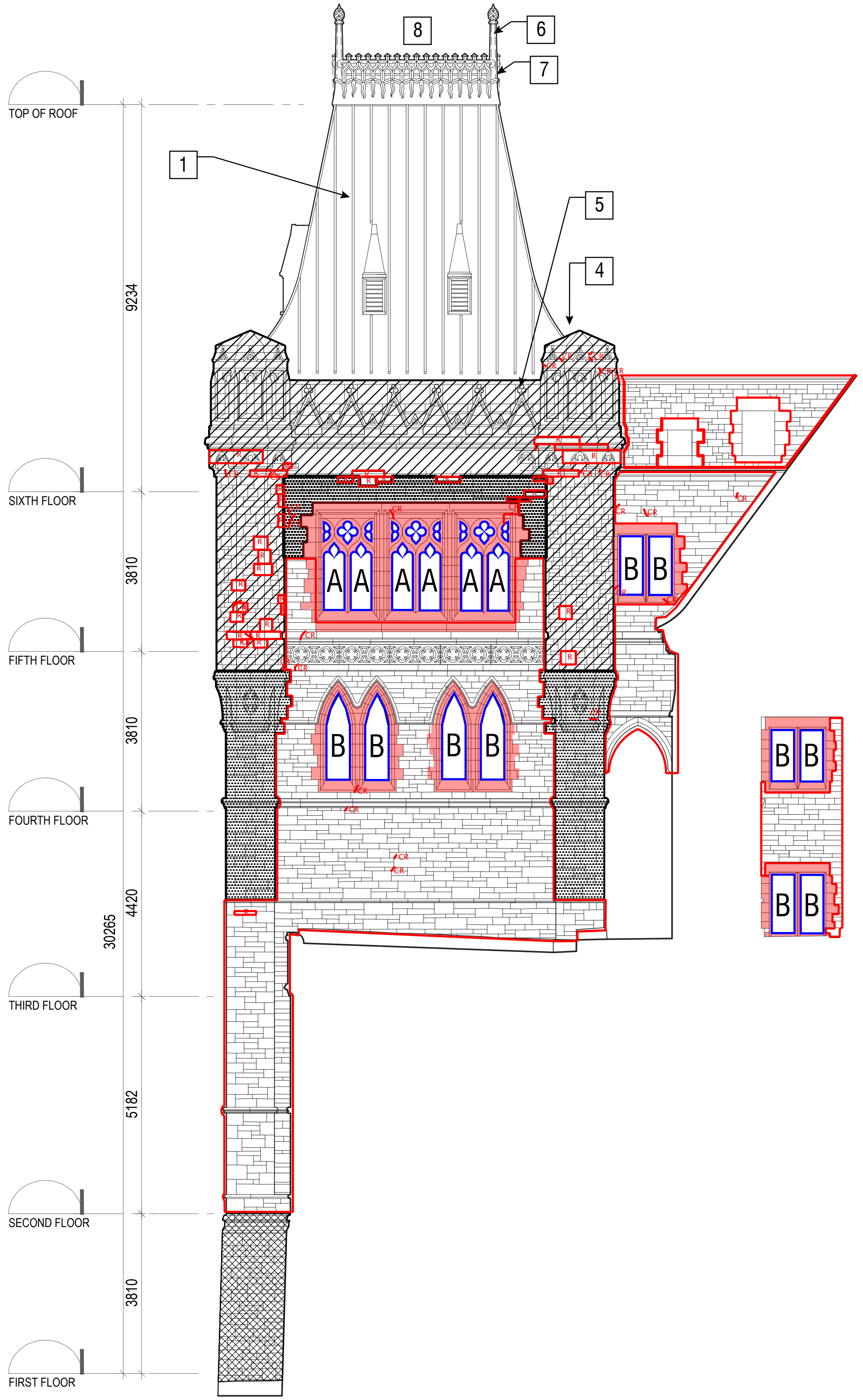
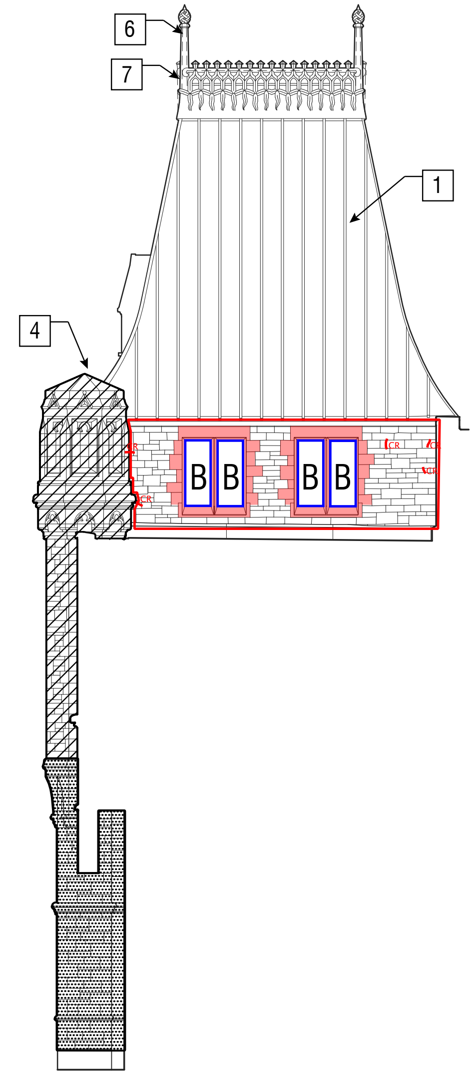


EAST TOWER - NORTH ELEVATION

NOT TO SCALE

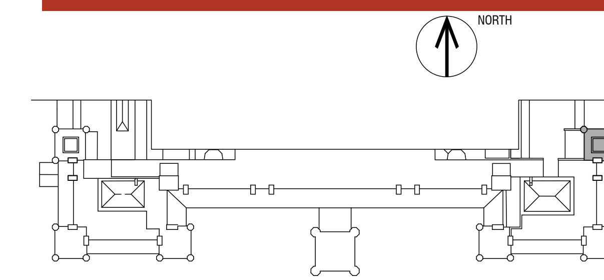


EAST TOWER - WEST ELEVATION

NOT TO SCALE

RECOMMENDED
INTERVENTION

EAST TOWER



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME COMPLETE REPLACEMENT OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 2 WYTHES OF BRICK BACKWALL & 25% OF FACE STONES.
- COMPLETE DISMANTLING & REBUILDING OF MASONRY ASSEMBLY. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- DISMANTLING & REBUILDING OF 20% OF INDICATED AREA. ASSUME REPLACEMENT OF 1 WYTHE OF BRICK BACKWALL & 25% OF FACE STONES.
- 10% OF TOTAL SURFACE OF EXTERIOR WALL MIGHT BE DISMANTLED AND REBUILT. WITHIN 10%, ASSUME REPLACEMENT OF 25% OF RUSTICATED NEPEAN SANDSTONE FACE STONES, 5% OF BEREA SANDSTONE (EXCLUDING WINDOWS) & 1 WYTHE OF BRICK BACKWALL.
- POULTICING TO REMOVE SALTS AND RUB BACK. DUTCHMEN REPAIRS WHERE NECESSARY. GROUT INJECTIONS IN ATTIC BRICK BACKWALL OF TOWERS.

R STONE REPLACEMENT

CR CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

• CRACK CONSOLIDATION	8 UNITS
• DUTCHMAN	2-5 UNITS
• HEAVY EROSION	10m²
• PREVIOUS REPAIR	1.5m²

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

- 100% RE-POINTING OF MASONRY BELOW GRADE (400mm), MIN 38mm DEEP.
- PATCHING AND FILLING CRACKS IN THE CONCRETE WALLS. REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT
- DAMP-PROOFING OF CONCRETE FOUNDATION WALLS.
- INSTALLING DRAINAGE TILES AT FOOTINGS. REFER TO SECTION 7.1.2. OF SCHEMATIC DESIGN REPORT.
- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
- LEVEL OF FOOTING TO BE DETERMINED.
- REFER TO BASEMENT KEY PLAN FOR LIMIT OF SCOPE OF WORK.

CONSERVATION OF ROOF

1 REPLACEMENT OF COPPER ROOFING WITH 20 OZ. COPPER SHEATHING. PARGING REPAIRS AT EXISTING FLEX-O-CRETE LIGHTWEIGHT CONCRETE ROOF TO LEVEL SURFACE. SELECTIVE REPLACEMENT AND REHABILITATION OF FLAT ROOFING AT THE JUNCTION WITH COPPER ROOFING.

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3 REPLACEMENT OF COPPER ROOFING AT DORMERS AND LOUVERS.

4 REPLACEMENT OF TOURRET LEAD CAP

5 REPLACEMENT OF TOWER GABLET LEAD CAP

6 REPLICATION OF FINIAL WITH 16 OZ. COPPER.

7 REPLICATION OF CRESTING WITH 16 OZ. COPPER.

8 REPLACEMENT OF COPPER FLASHING AND FLAT ROOFING AT TOWERS AND WEST ENTRANCE.

9 REPLACEMENT OF COPPER FLASHING AT CHIMNEY BASES.

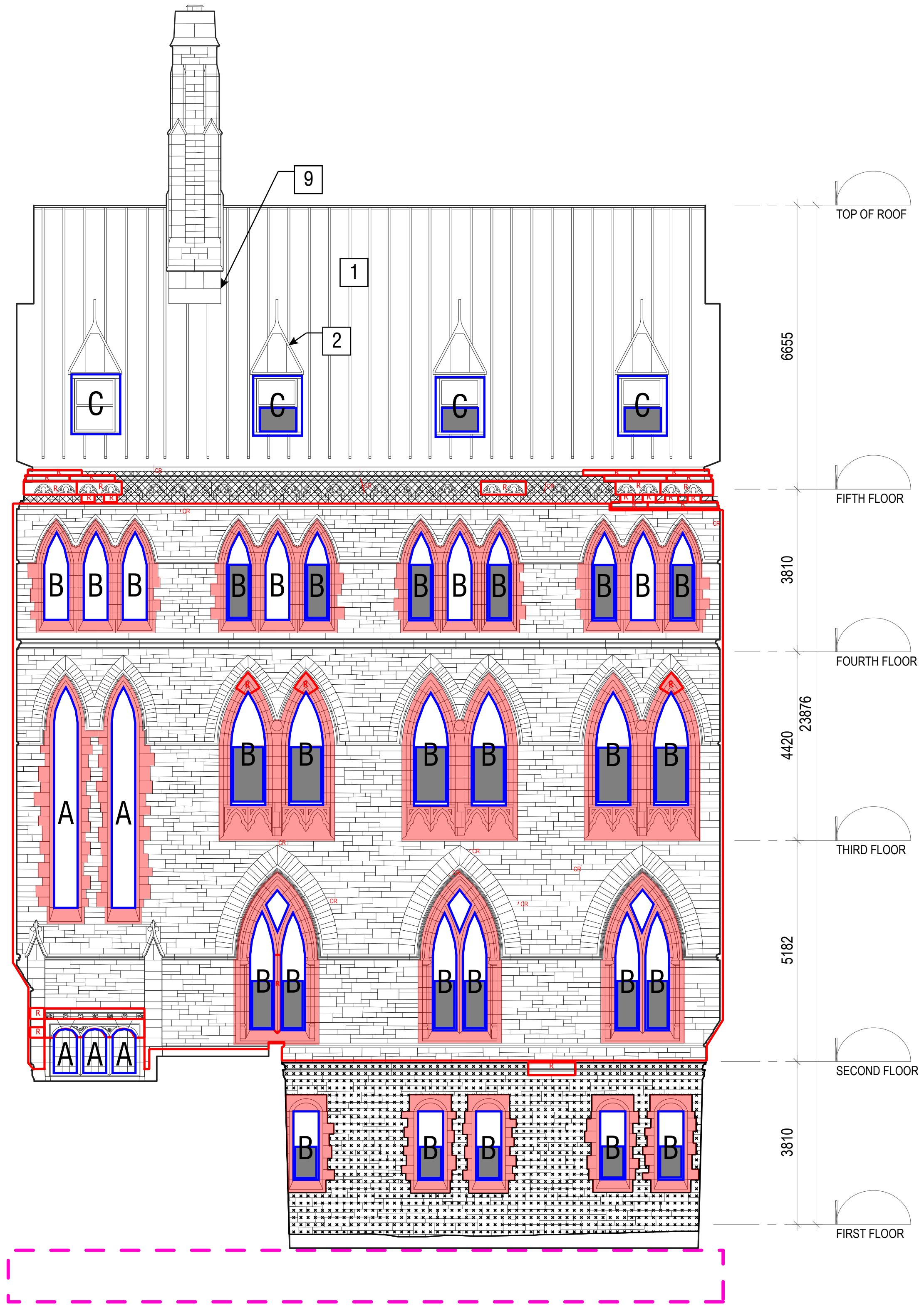
CONSERVATION OF WINDOWS

A STEEL AND LEADED GLASS WINDOWS: IN SITU STABILIZATION AND MAINTENANCE.

B ALUMINIUM WINDOWS: IN SITU MAINTENANCE.

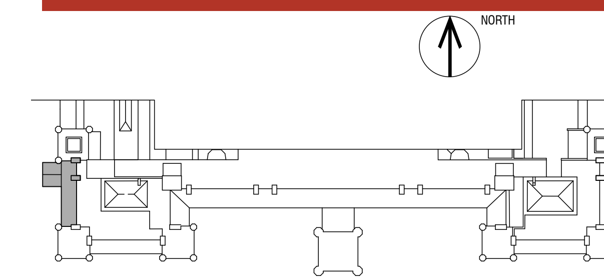
C REPLACEMENT OF ALUMINIUM WINDOWS WITH NEW STEEL WINDOW UNITS AS PER SOUTH FACADE REPLICA OF THE ORIGINAL.

REPLACEMENT OF WINDOW PANES WITH TEMPORARY PANES CONTAINING SEALED COLLARS FOR VENTILATION. REINSTALLATION OF ORIGINAL PANES AT END OF PROJECT.



WEST BAY - WEST ELEVATION
NOT TO SCALE

DESIGN DEVELOPMENT REPORT



RECOMMENDED
INTERVENTION

WEST BAY

LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

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- R — STONE REPLACEMENT
- CR — CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

• CRACK CONSOLIDATION	8 UNITS
• DUTCHMAN	2-5 UNITS
• HEAVY EROSION	10m²
• PREVIOUS REPAIR	1.5m²

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

- 100% RE-POINTING OF MASONRY BELOW GRADE (400mm), MIN 38mm DEEP.
- PATCHING AND FILLING CRACKS IN THE CONCRETE WALLS. REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT
- DAMP-PROOFING OF CONCRETE FOUNDATION WALLS.
- INSTALLING DRAINAGE TILES AT FOOTINGS. REFER TO SECTION 7.1.2. OF SCHEMATIC DESIGN REPORT.
- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
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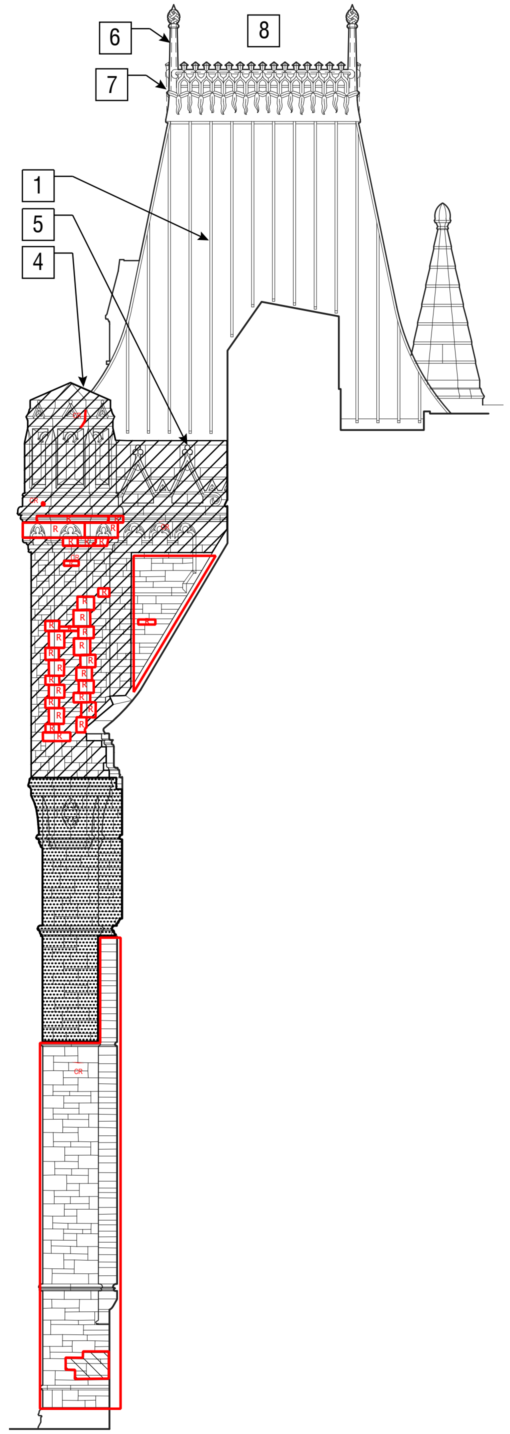
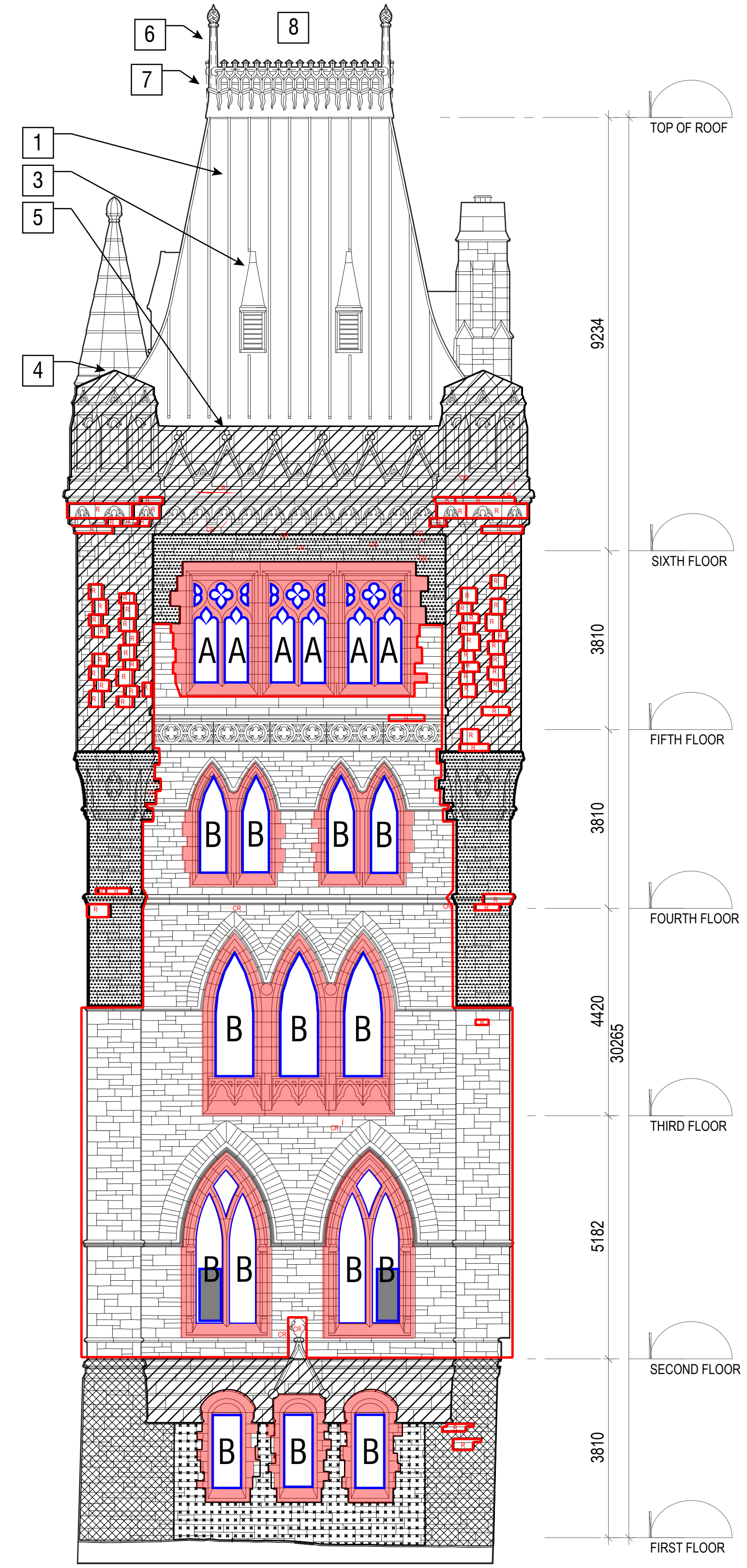
DESIGN DEVELOPMENT REPORT



WEST TOWER - SOUTH ELEVATION

NOT TO SCALE

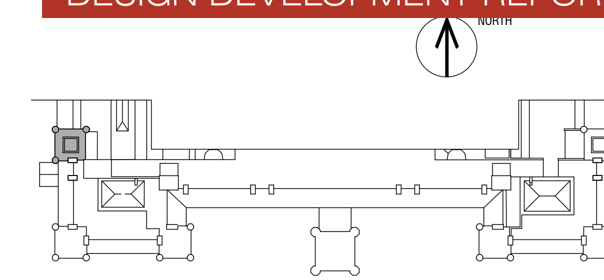


WEST TOWER - WEST ELEVATION

NOT TO SCALE

RECOMMENDED
INTERVENTION

WEST TOWER



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT FOR STRUCTURAL STABILIZATION

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- CR — CRACKS IN STONE

100% RE-POINTING OF MASONRY ABOVE GRADE, MIN 38mm DEEP.

SURFACE REPAIRS:

• CRACK CONSOLIDATION	8 UNITS
• DUTCHMAN	2-5 UNITS
• HEAVY EROSION	$10m^2$
• PREVIOUS REPAIR	$1.5m^2$

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

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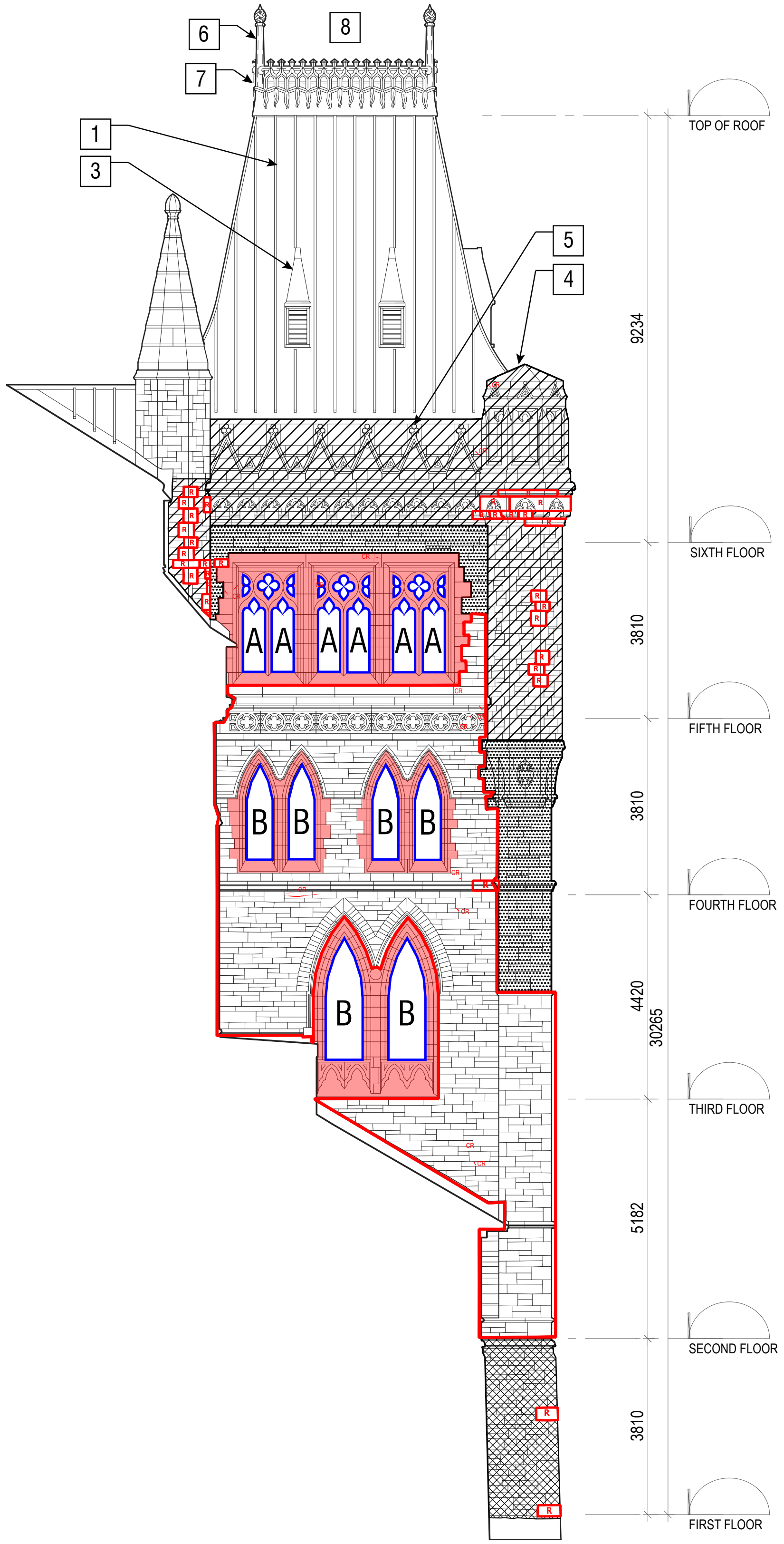
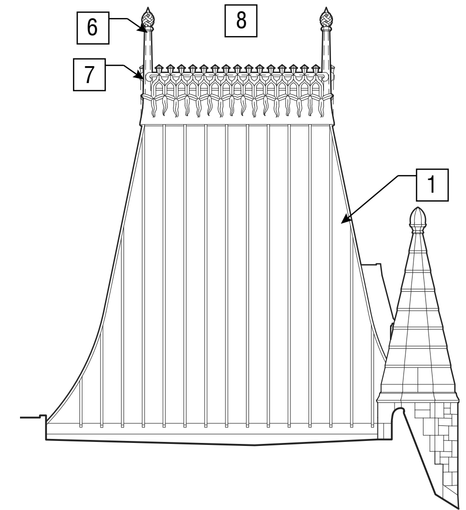


WEST TOWER - NORTH ELEVATION

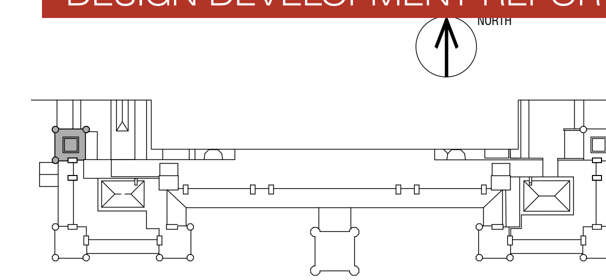
NOT TO SCALE



WEST TOWER - EAST ELEVATION

NOT TO SCALE

RECOMMENDED
INTERVENTION



WEST TOWER

LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

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SURFACE REPAIRS:

- CRACK CONSOLIDATION 8 UNITS
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- HEAVY EROSION 10m²
- PREVIOUS REPAIR 1.5m²

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

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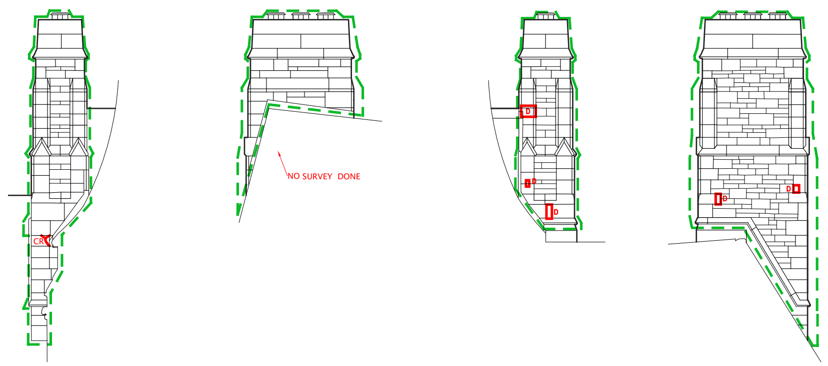
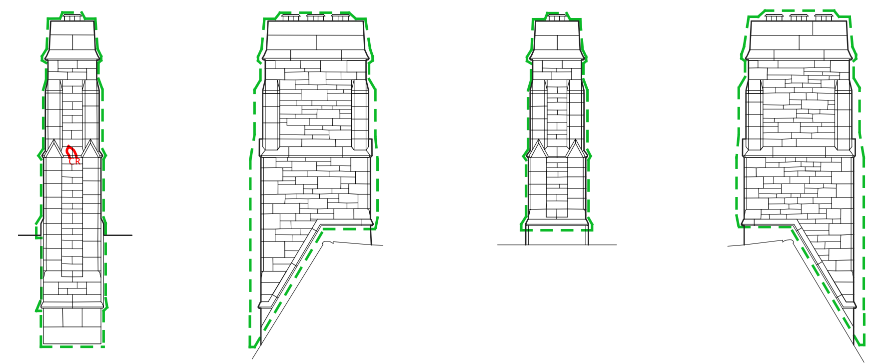


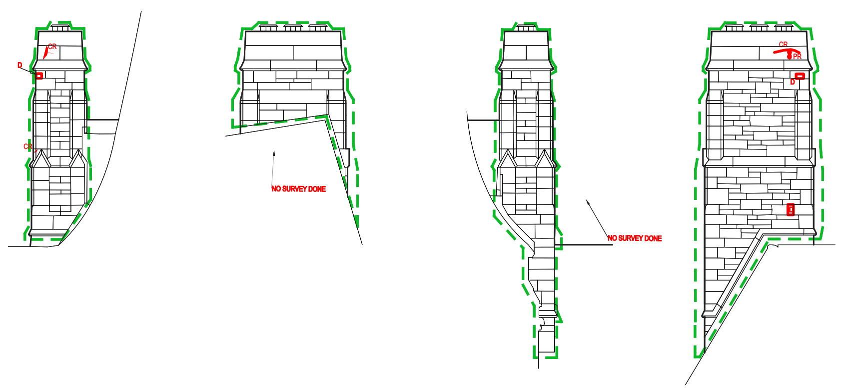
EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

EAST CHIMNEY #8
NOT TO SCALE



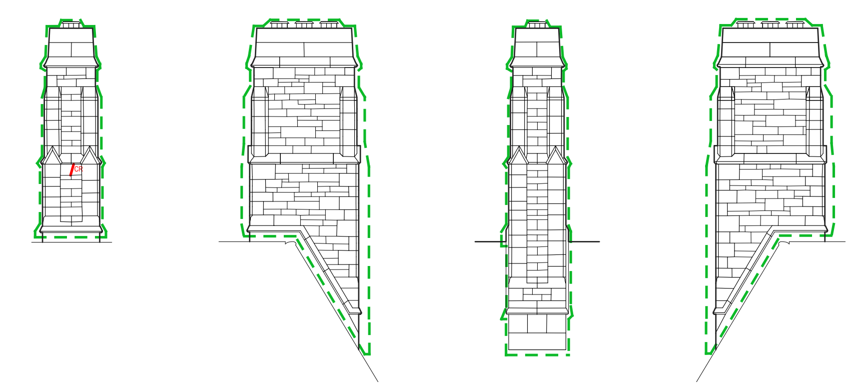
EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

EAST CHIMNEY #9
NOT TO SCALE



EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST CHIMNEY #9
NOT TO SCALE



EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST CHIMNEY #8
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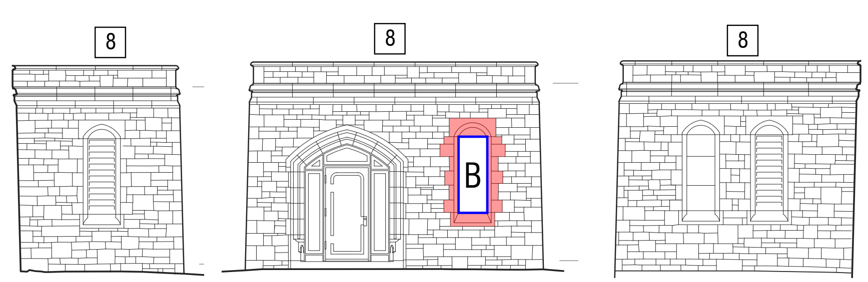
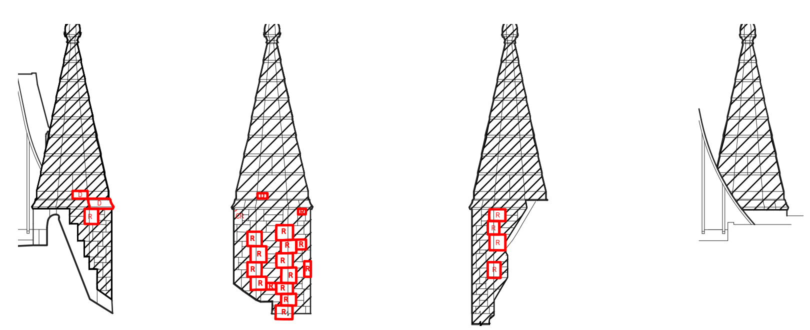


NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST ENTRANCE
NOT TO SCALE



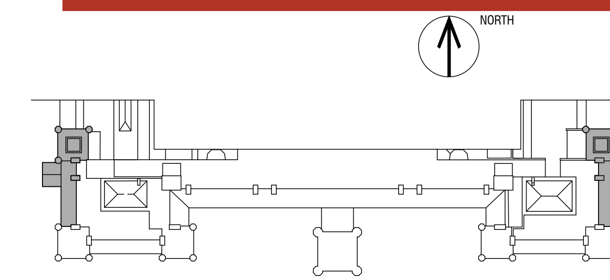
EAST ELEVATION | NORTH ELEVATION | WEST ELEVATION | SOUTH ELEVATION

WEST TOWER - PINNACLE
NOT TO SCALE

DESIGN DEVELOPMENT REPORT

RECOMMENDED
INTERVENTION

EAST & WEST PAVILIONS



LEGEND

CONSERVATION OF EXTERIOR MASONRY

DISMANTLING & REBUILDING & STONE REPLACEMENT.

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• PREVIOUS REPAIR	1.5m^2

MASONRY WINDOW JAMBS:

- TEMPORARY REPAIRS INCLUDING MECHANICAL CONSOLIDATION, SURFACE REPAIRS & POULTICING TO REMOVE SALTS.

SCULPTURED ELEMENTS

- INTERVENTIONS TO BE CONFIRMED THROUGH FURTHER INVESTIGATION.

CONSERVATION OF FOUNDATION

- 100% RE-POINTING OF MASONRY BELOW GRADE (400mm), MIN 38mm DEEP.
- PATCHING AND FILLING CRACKS IN THE CONCRETE WALLS. REFER TO SECTION 7.3.5. OF SCHEMATIC DESIGN REPORT
- DAMP-PROOFING OF CONCRETE FOUNDATION WALLS.
- INSTALLING DRAINAGE TILES AT FOOTINGS. REFER TO SECTION 7.1.2. OF SCHEMATIC DESIGN REPORT.
- REPLACING THE BACKFILL WITH NEW DRAINAGE MATERIAL.

NOTES:

- FOUNDATIONS ARE ASSUMED TO BE CAST IN-PLACE CONCRETE WALL AND FOOTING ON BEDROCK. PRESENCE OF RUBBLE FOUNDATION WALL NEEDS TO BE CONFIRMED.
- LEVEL OF FOOTING TO BE DETERMINED.
- REFER TO BASEMENT KEY PLAN FOR LIMIT OF SCOPE OF WORK.

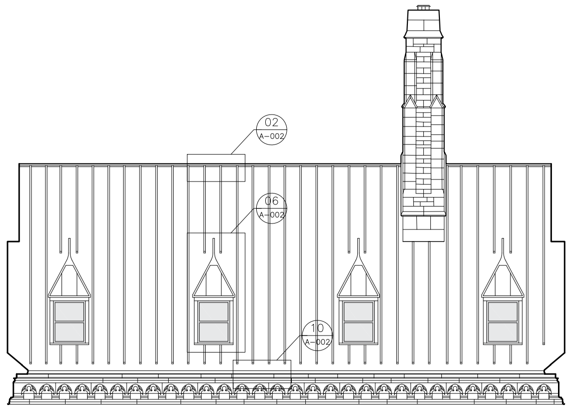
CONSERVATION OF ROOF

1. REPLACEMENT OF COPPER ROOFING WITH 20 OZ. COPPER SHEATHING. PARGING REPAIRS AT EXISTING FLEX-O-CRETE LIGHTWEIGHT CONCRETE ROOF TO LEVEL SURFACE. SELECTIVE REPLACEMENT AND REHABILITATION OF FLAT ROOFING AT THE JUNCTION WITH COPPER ROOFING.
2. REPLACEMENT OF COPPER ROOFING AT DORMERS WITH 20 OZ. COPPER SHEATHING.
3. REPLACEMENT OF COPPER ROOFING AT DORMERS AND LOUVERS.
4. REPLACEMENT OF TOURRET LEAD CAP
5. REPLACEMENT OF TOWER GABLET LEAD CAP
6. REPLICATION OF FINIAL WITH 16 OZ. COPPER.
7. REPLICATION OF CRESTING WITH 16 OZ. COPPER.
8. REPLACEMENT OF COPPER FLASHING AND FLAT ROOFING AT TOWERS AND WEST ENTRANCE.
9. REPLACEMENT OF COPPER FLASHING AT CHIMNEY BASES.

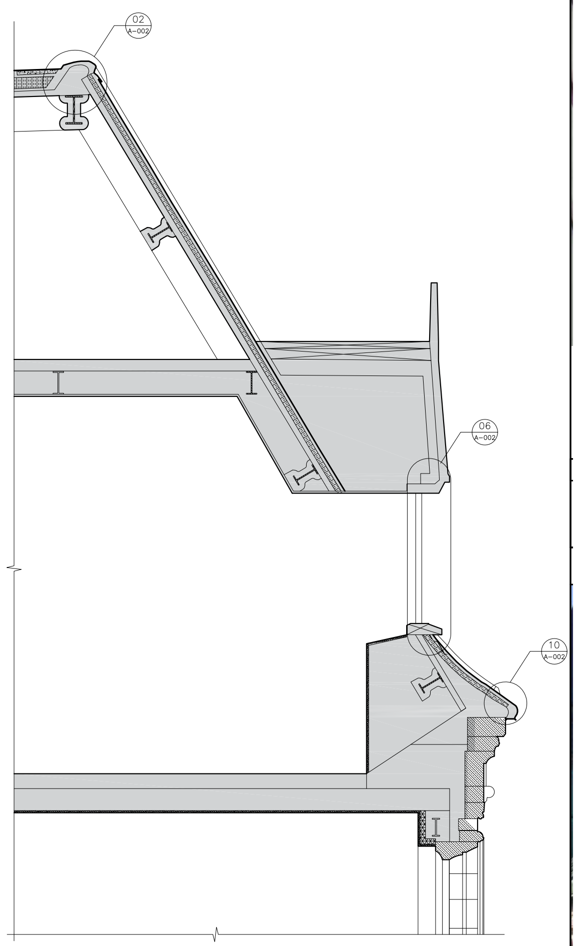
CONSERVATION OF WINDOWS

- A — STEEL AND LEADED GLASS WINDOWS: IN SITU STABILIZATION AND MAINTENANCE.
- B — ALUMINIUM WINDOWS: IN SITU MAINTENANCE.
- C — REPLACEMENT OF ALUMINIUM WINDOWS WITH NEW STEEL WINDOW UNITS AS PER SOUTH FACADE REPLICA OF THE ORIGINAL.
- REPLACEMENT OF WINDOW PANES WITH TEMPORARY PANES CONTAINING SEALED COLLARS FOR VENTILATION. REINSTALLATION OF ORIGINAL PANES AT END OF PROJECT.

PAVILION ROOF INTERVENTIONS



01 PAVILION ELEVATION 1:75

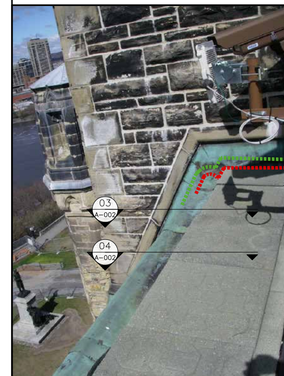


05 BAY SECTION 1:20

A) EXISTING

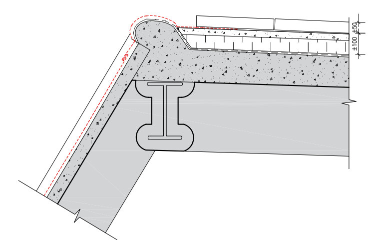
B) PROPOSAL

3-ROOF PARAPET



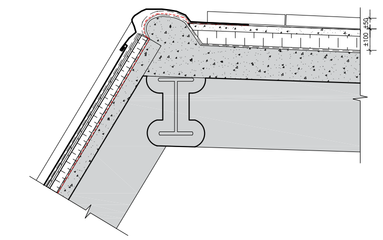
02 TOWER ELEVATION PICTURE NONE

GENERAL EXISTING COMPOSITION
-20oz. Copper sheathing
-SBS Membrane
-Existing Lightweight Concrete
-Existing Fire Protection



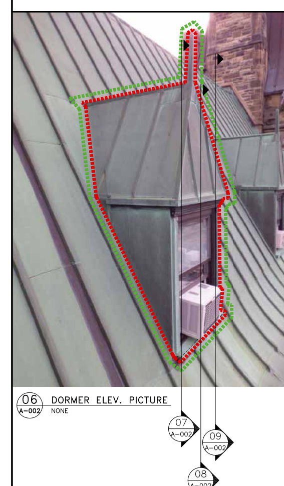
03 EXISTING ROOF PARAPET SECTION 1:5

GENERAL ROOF PROPOSAL COMPOSITION
- New copper 20oz. sheathing
-SBS elastomer bitumen membrane
-19 mm plywood
- 38 mm rigid insulation
- SBS Membrane
-Existing lightweight concrete
-Existing Fire Protection



04 PROPOSAL ROOF PARAPET SECTION 1:5

4-DORMERS

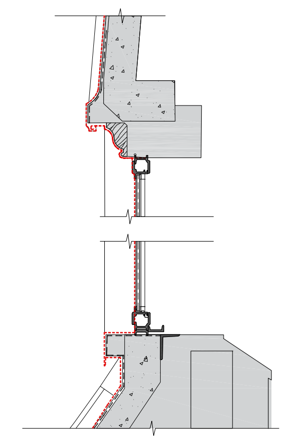


06 DORMER ELEV. PICTURE NONE

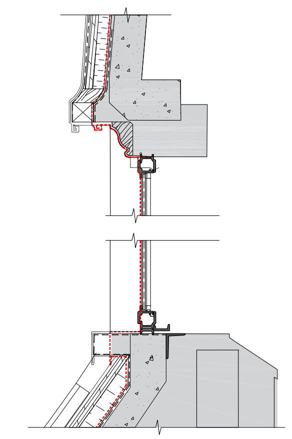
LEYENDE

EXISTING ROOF LINE

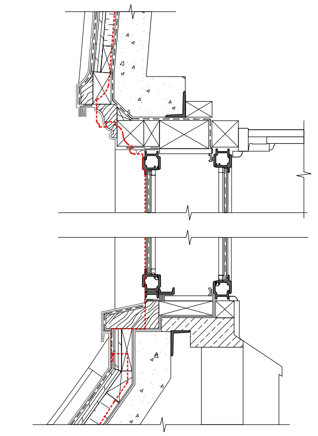
NEW ROOF LINE



07 SECTION EXISTING DORMER 1:5

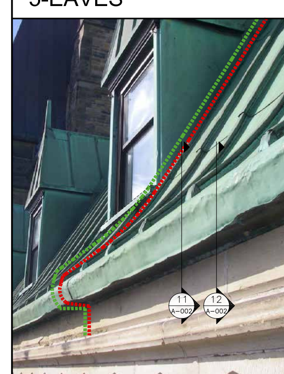


08 PROPOSAL SECTION DORMER (using same window) 1:5

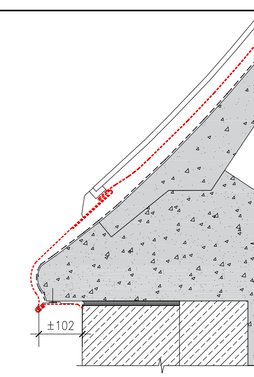


09 PROPOSAL SECTION DORMER (new smaller window) 1:5

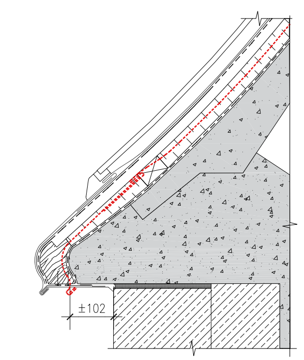
5-EAVES



10 EAVE ELEVATION PICTURE NONE

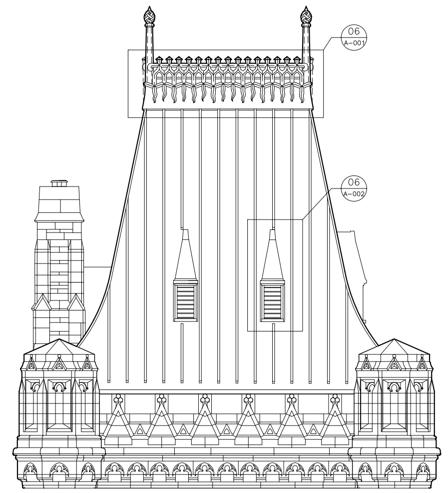


11 ROOF EAVES EXISTING SECTION 1:5

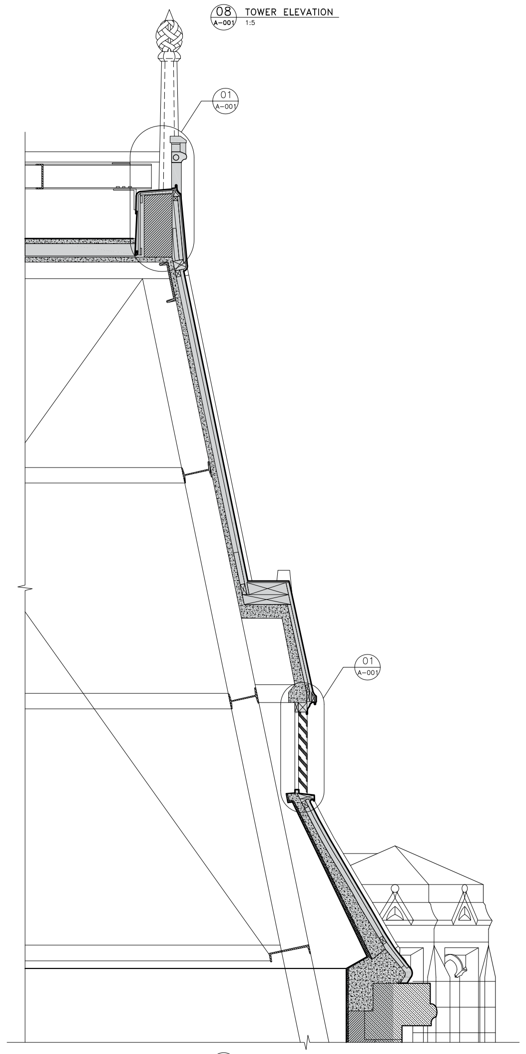


12 ROOF EAVES PROPOSAL SECTION 1:5

TOWER ROOF INTERVENTIONS



08 TOWER ELEVATION



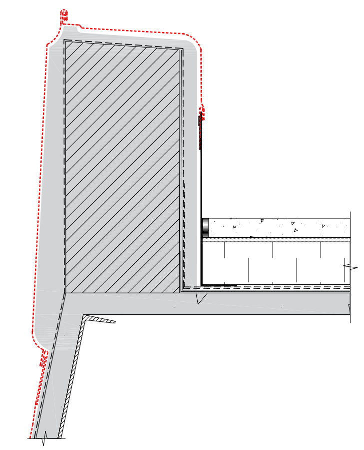
07 TOWER SECTION

A) EXISTING

1- PARAPET / CRESTING

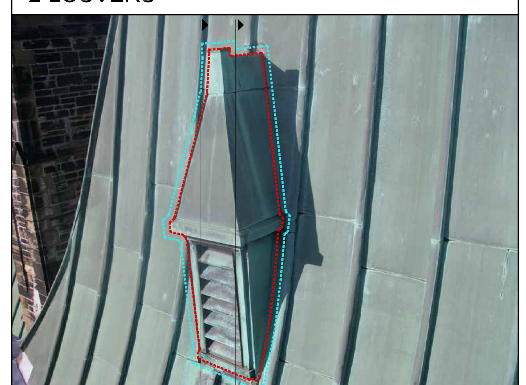
06 PARAPET/CRESTING ELEVATION PICTURE

GENERAL EXISTING COMPOSITION
-20oz. Copper sheathing
-SBS Membrane
-Existing Lightweight Concrete
-Existing Fire Protection

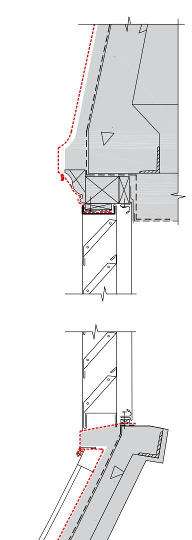


04 PARAPET CRESTING EXISTING SECTION

2-LOUVERS



05 LOWER ELEVATION PICTURE



03 LOUVER EXISTING SECTION

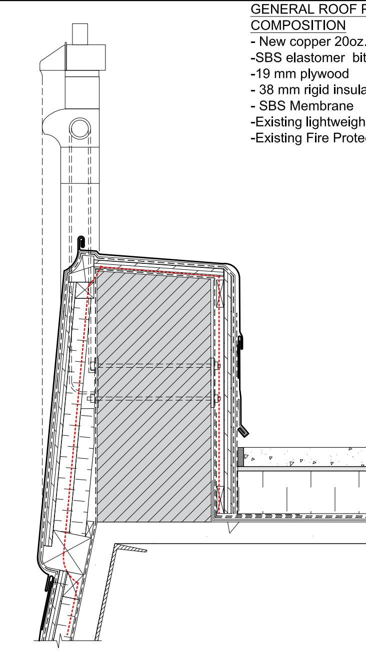
LEYENDE

EXISTING ROOF LINE

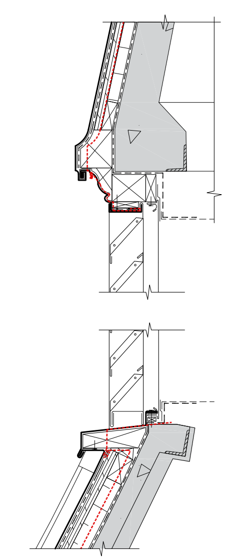
NEW ROOF LINE

B) PROPOSAL

GENERAL ROOF PROPOSAL COMPOSITION
- New copper 20oz. sheathing
-SBS elastomer bitumen membrane
-19 mm plywood
- 38 mm rigid insulation
- SBS Membrane
-Existing lightweight concrete
-Existing Fire Protection



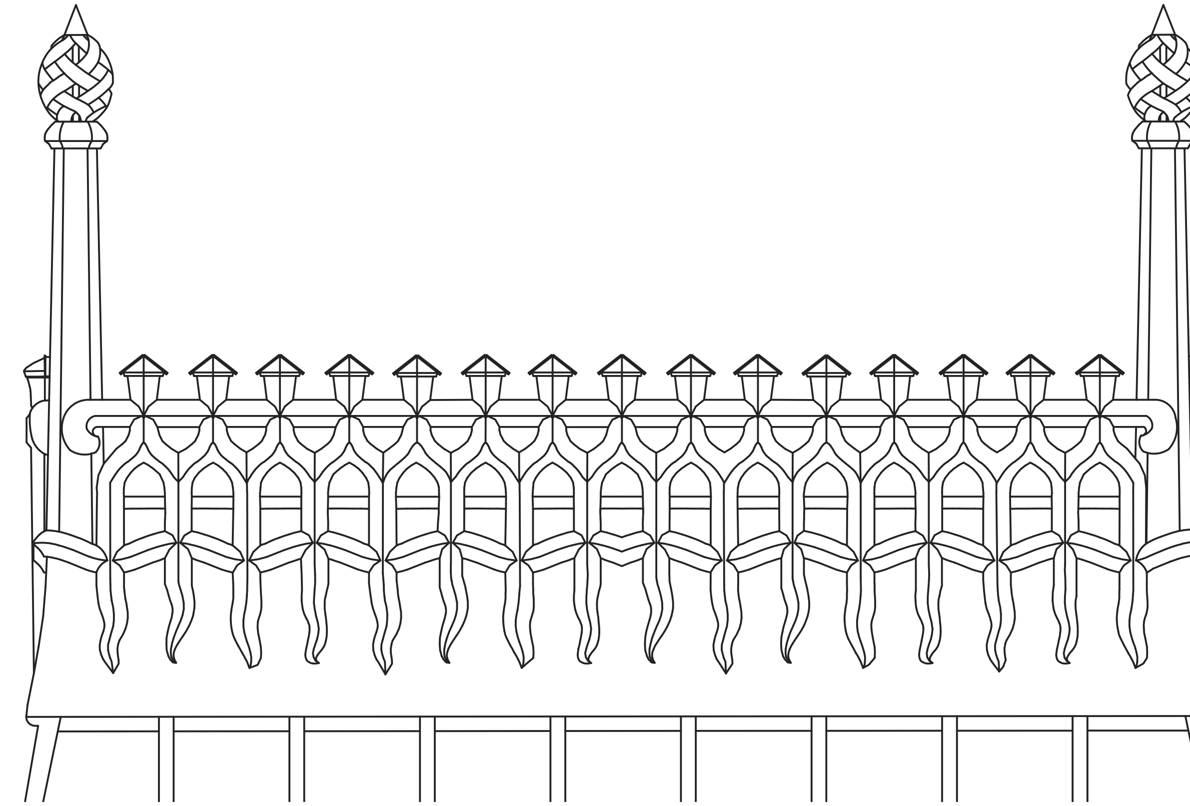
02 PARAPET CRESTING PROPOSAL SECTION

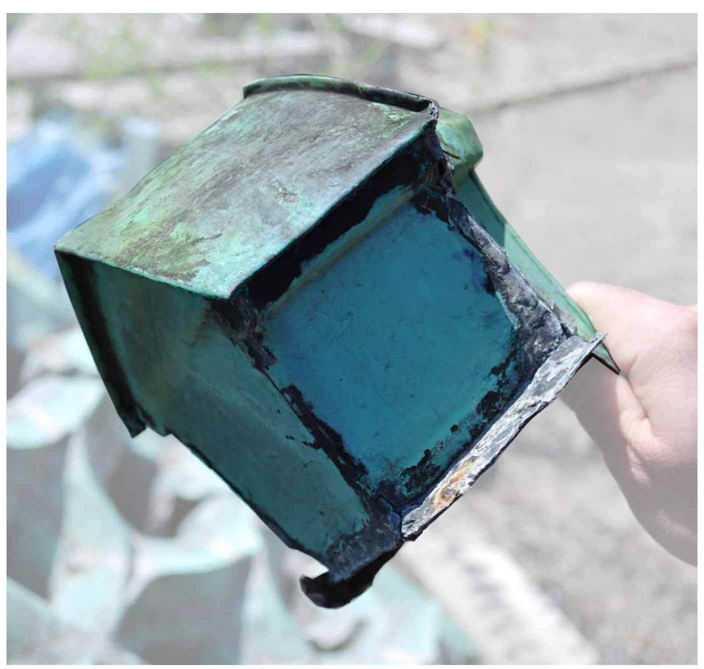


01 LOUVER PROPOSAL SECTION

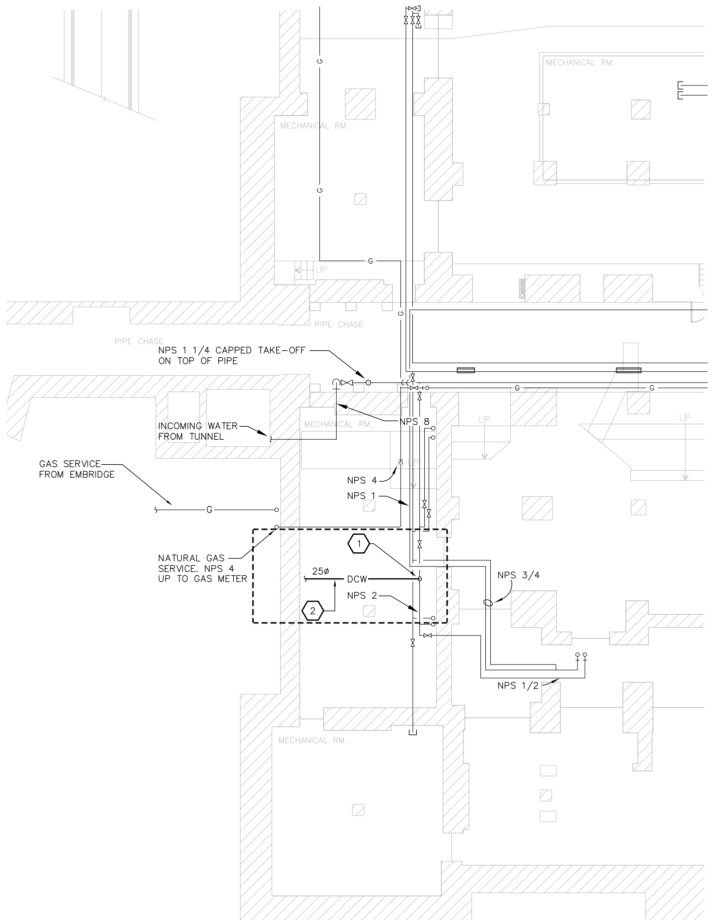
The original cresting and finials were removed and stored outdoors when they became so damaged they presented a falling hazard. Originally constructed out of copper and filled with concrete, the replicas will most likely be made of copper with a metal endoskeleton acting as a reinforcing agent.

The replicas will be based on surveys of the old cresting that has been conserved by PWGSC, and the drawings that were provided by PWGSC.



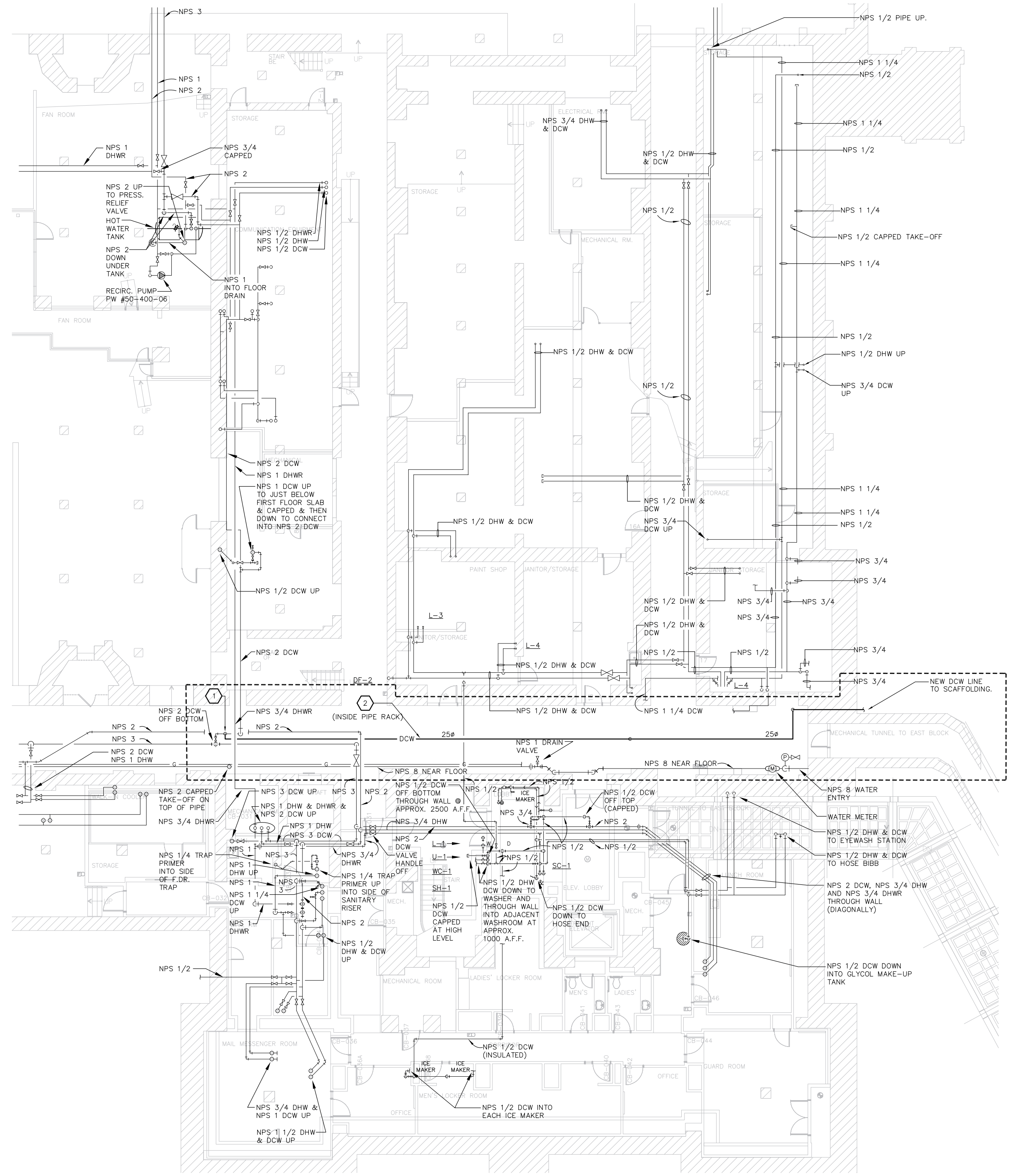


APPENDIX V
PROPOSED INTERVENTIONS
MECHANICAL & ELECTRICAL



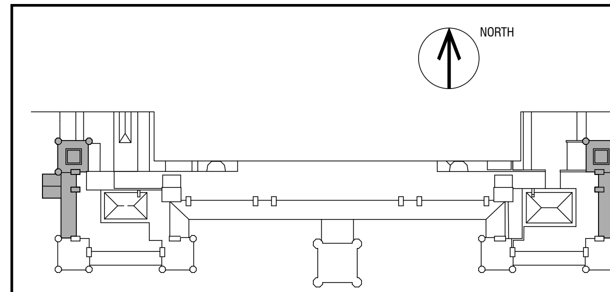
WEST PAVILION - PLUMBING & HEATING

NOT TO SCALE



EAST PAVILION - PLUMBING & HEATING

NOT TO SCALE



EAST & WEST TOWER BASEMENT

MECHANICAL

Plumbing & Heating

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1 NEW CONNECTION ON TO EXISTING AT THIS POINT.

2 COORDINATE PASSAGE OF NEW PIPING WITH EXISTING CONDITIONS.

CENTRE BLOCK East and West Pavilions Rehabilitation

May 2013

M-100

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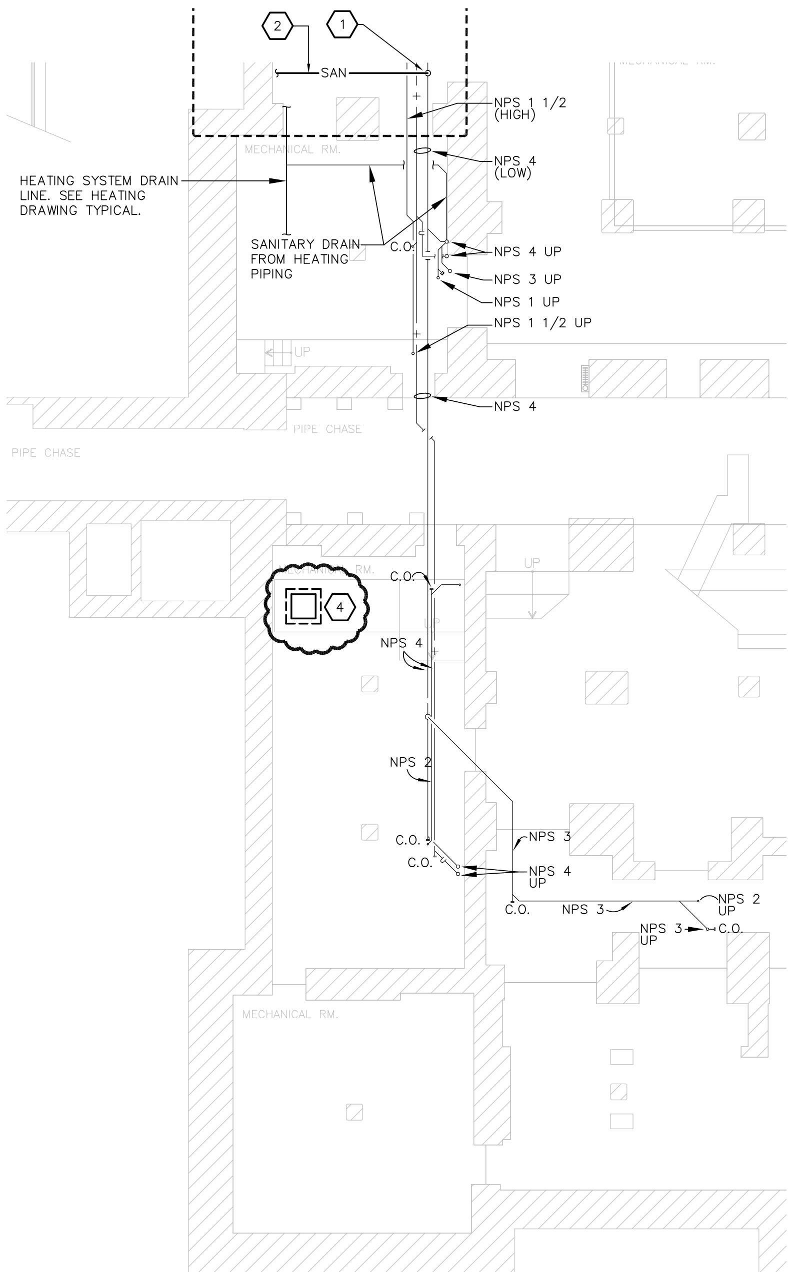
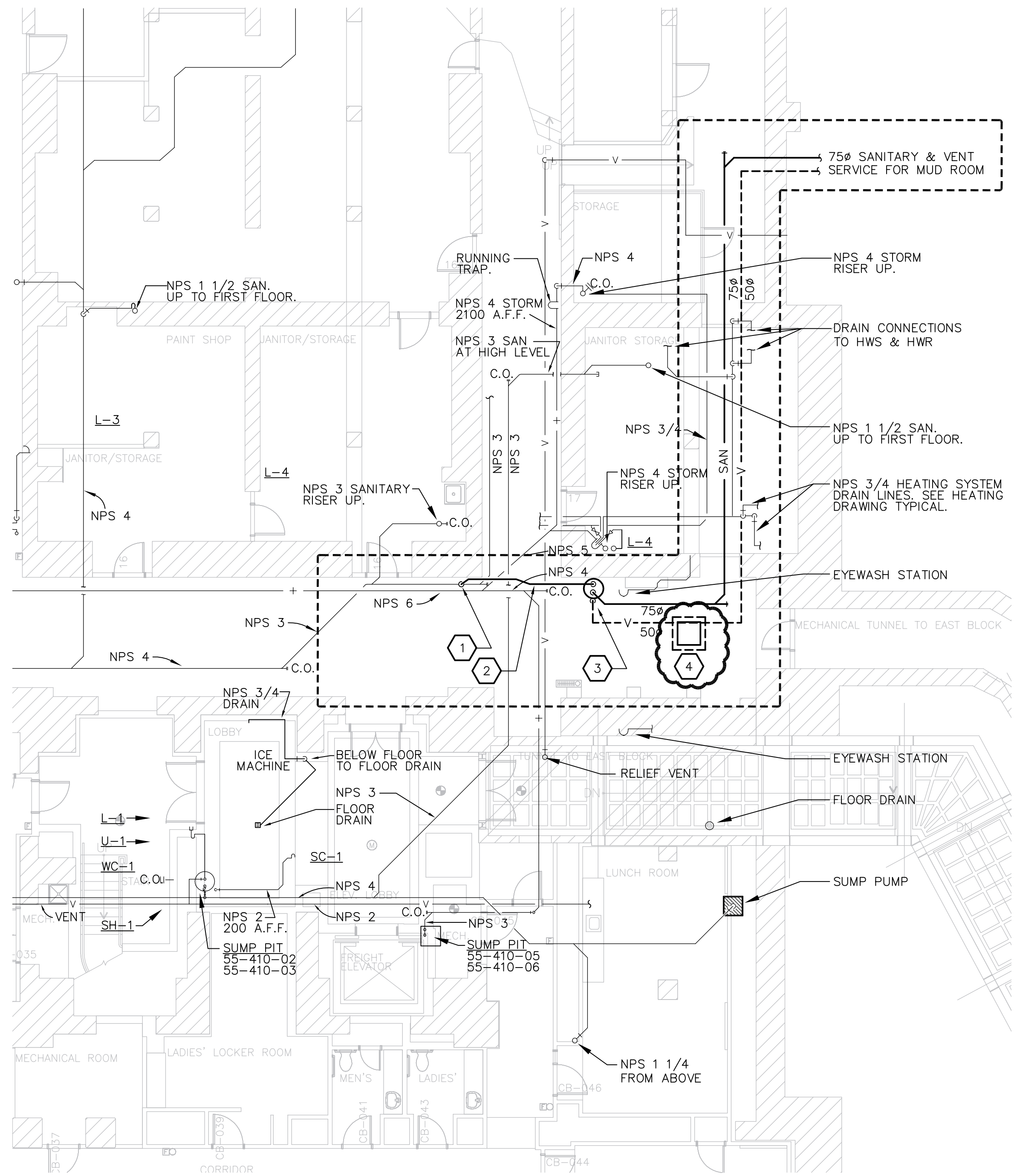


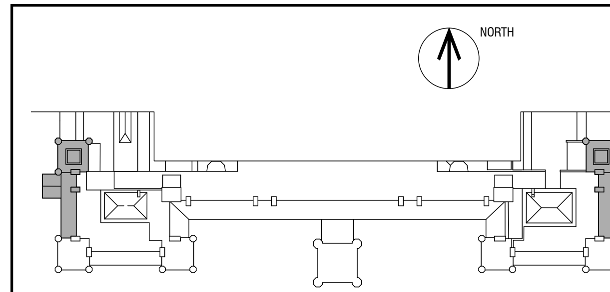
WEST PAVILION - PLUMBING & HEATING

NOT TO SCALE



EAST PAVILION - PLUMBING & HEATING

NOT TO SCALE



WEST PAVILION BASEMENT

MECHANICAL

Plumbing & Heating

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1. NEW CONNECTION ON TO EXISTING AT THIS POINT.
2. COORDINATE PASSAGE OF NEW PIPING WITH EXISTING CONDITIONS.
3. PROVIDE A TEMPORARY SANITARY PUMPING STATION MOUNTED ON A HOUSE KEEPING PAD. PUMPING PACKAGE MODEL MRG20 2HP GRINDER PUMP FROM MYERS, CATCH BASIN 600mmø X 1525mm HIGH (5'), INLET SIZE 75ø AND OUTLET 32ø, VENT 50ø. PACKAGE TO BE COMPLETE WITH ALARM PANEL (NEMA 4 RATED), POLYPROPYLENE COVER. PUMP CAPACITY OF 151 L/MIN @ 15.3 METERS OF HEAD PRESSURE. ELECTRICAL CONNECTION 240/1/60 (15A)..
4. POSSIBLE LOCATIONS FOR WEEPING TILES DRAINAGE SUMP PUMPS.

CENTRE BLOCK East and West Pavilions Rehabilitation

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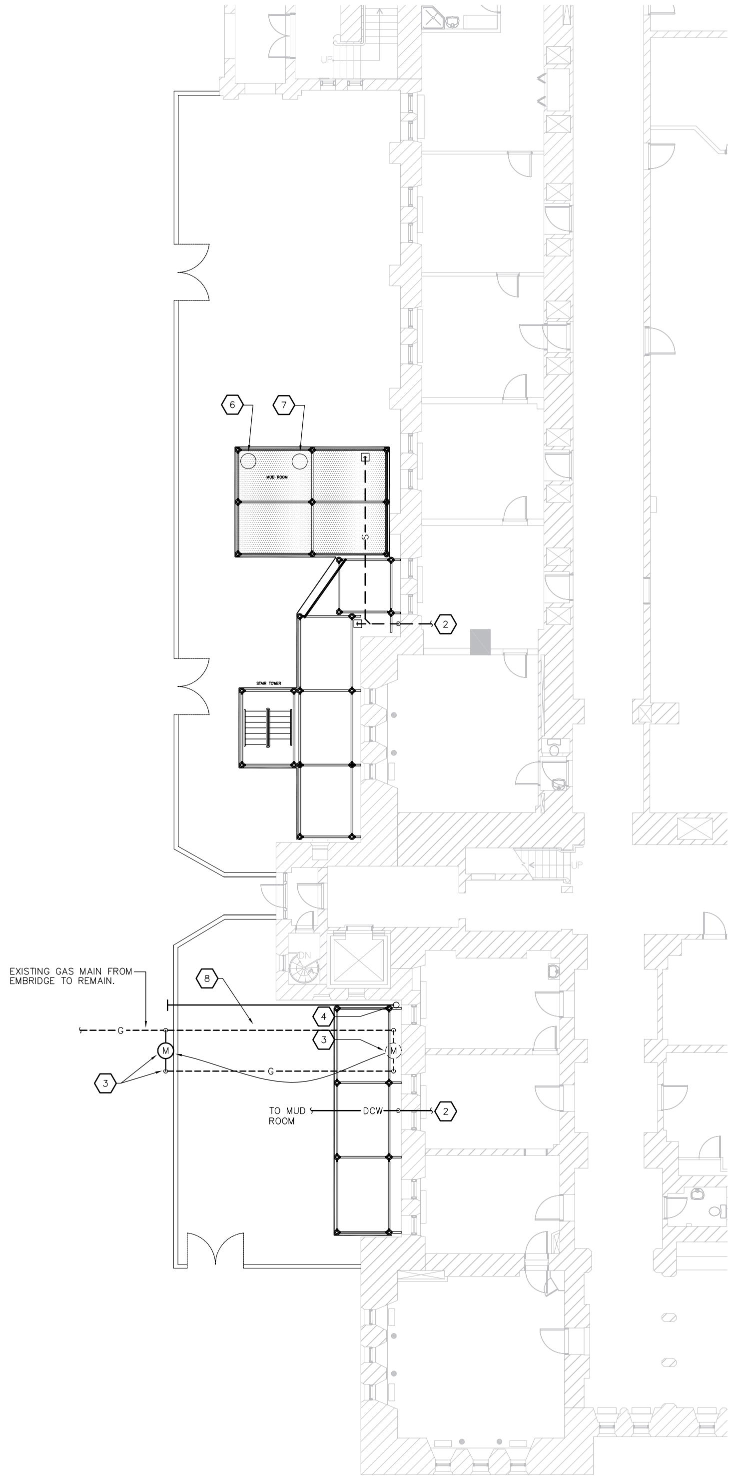
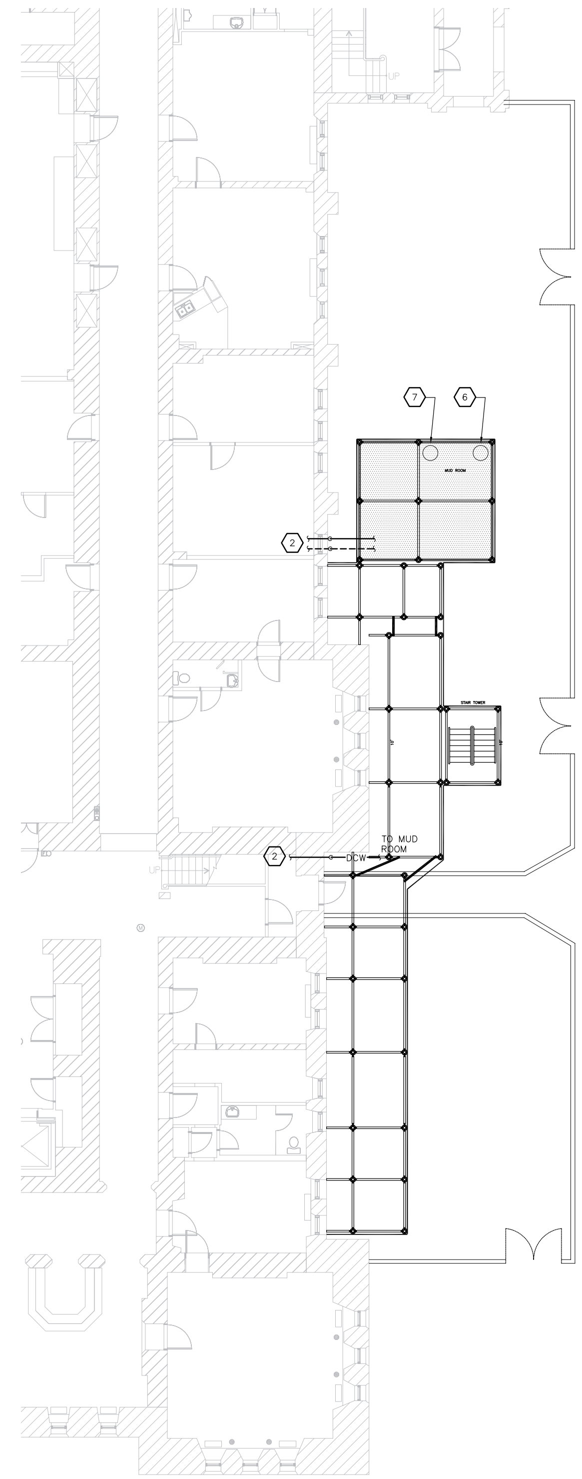


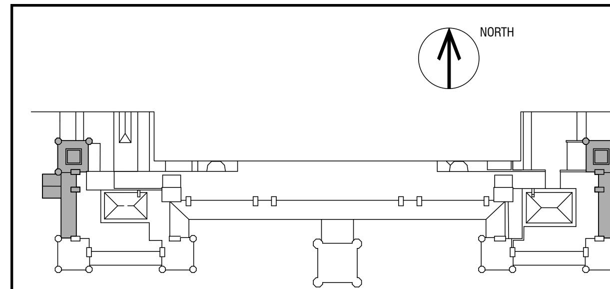
WEST PAVILION - PLUMBING & HEATING

NOT TO SCALE



EAST PAVILION - PLUMBING & HEATING

NOT TO SCALE



EAST & WEST PAVILION FIRST FLOOR

MECHANICAL

Plumbing & Heating

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1. NEW CONNECTION ON TO EXISTING AT THIS POINT.
2. SEE BASEMENT DRAWING FOR CONTINUATION.
3. EXISTING GAS SERVICE FROM EMBRIDGE TO BE RELOCATED OUTSIDE OF MUD ROOM.
4. EXISTING 50# PRV VENT PIPE TO BE EXTENDED OUTSIDE OF WORK SPACE AND THERMALLY INSULATED.
5. EXISTING GAS LINE TO BE RECONNECTED TO GAS METER. COORDINATE PASSAGE WITH SCAFFOLDING BASE.
6. FOR CURING OF MORTAR, THE TEMPERATURE HAS TO BE BETWEEN A MINIMUM OF 10°C AND A MAXIMUM OF 25°C. THEREFORE A DOMESTIC HOT WATER HEATER (ELECTRIC OR GAS FIRED) WILL BE REQUIRED IN MUD ROOM OR ANOTHER HEATED ENCLOSURE NEXT TO THE SCAFFOLDINGS.
7. PROVIDE FOR A GLYCOL HEATING SYSTEM COMPLETE WITH A GAS FIRED BOILER AND HEATING LOOP FOR SCAFFOLDING HEATING IN WINTER MONTHS.
8. NEW TEMPORARY UNDERGROUND SERVICE CONNECTION UPSTREAM OF EXISTING GAS METER.

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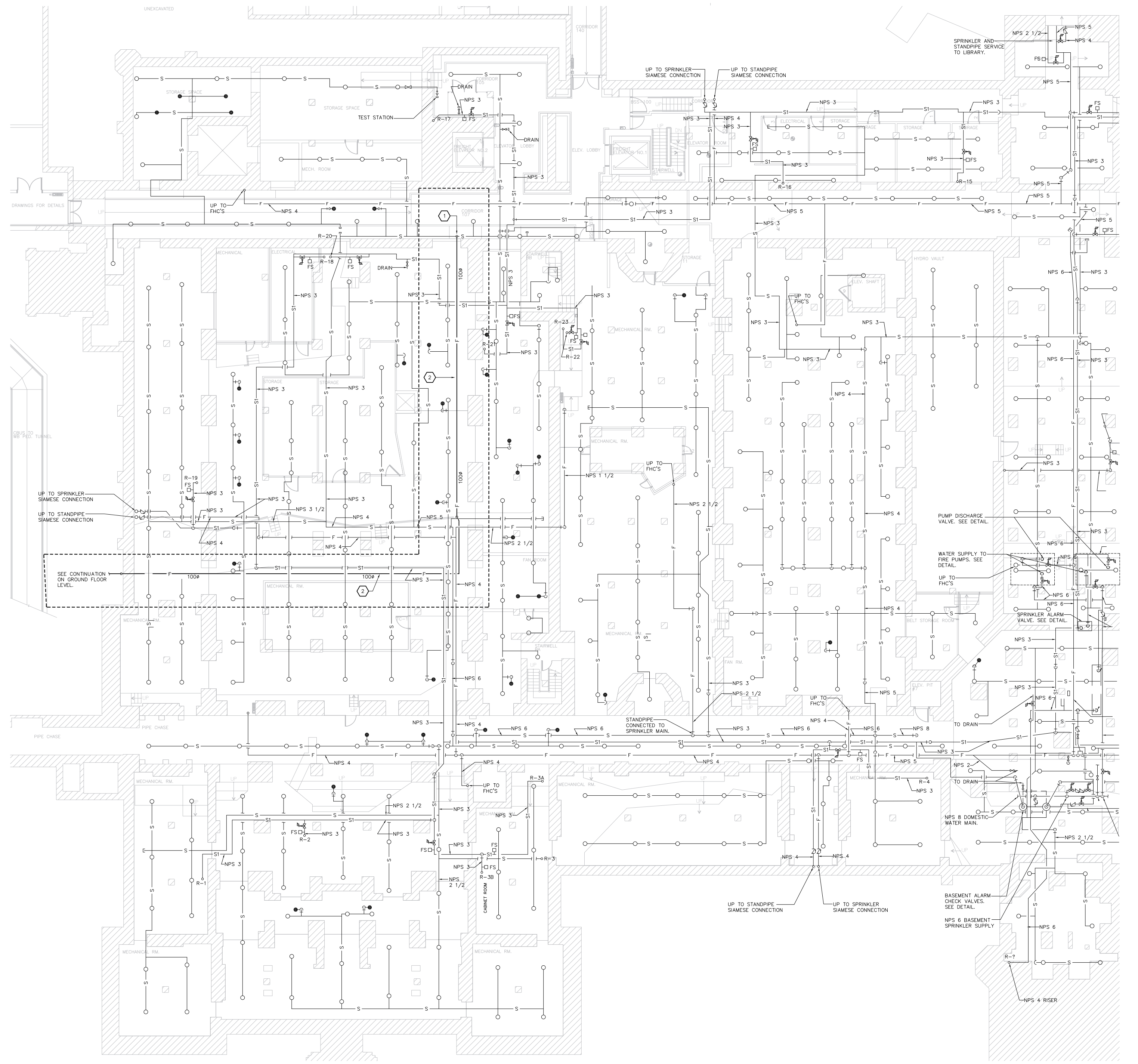
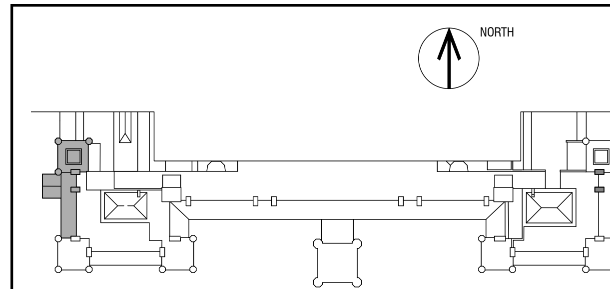


WEST PAVILION - FIRE PROTECTION

NOT TO SCALE



WEST PAVILION BASEMENT

MECHANICAL

Fire Protection

GENERAL NOTES:

1. FOR SHUT DOWN OF MAIN FIRE PROTECTION LINE, WORK WILL HAVE TO BE COORDINATED WITH THE OWNER. SHUTOFF VALVES ARE IN THE MAIN FIRE PUMP ROOM IN THE C–BUS.
2. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1 NEW CONNECTION ON TO EXISTING AT THIS POINT.

2 COORDINATE PASSAGE OF TEMPORARY SPRINKLER PIPING ABOVE EXISTING DUCTWORK. MAINTAIN PIPING A STRAIT AS POSSIBLE WITH A MINIMUM AMOUNT OF LEVEL CHANGE.

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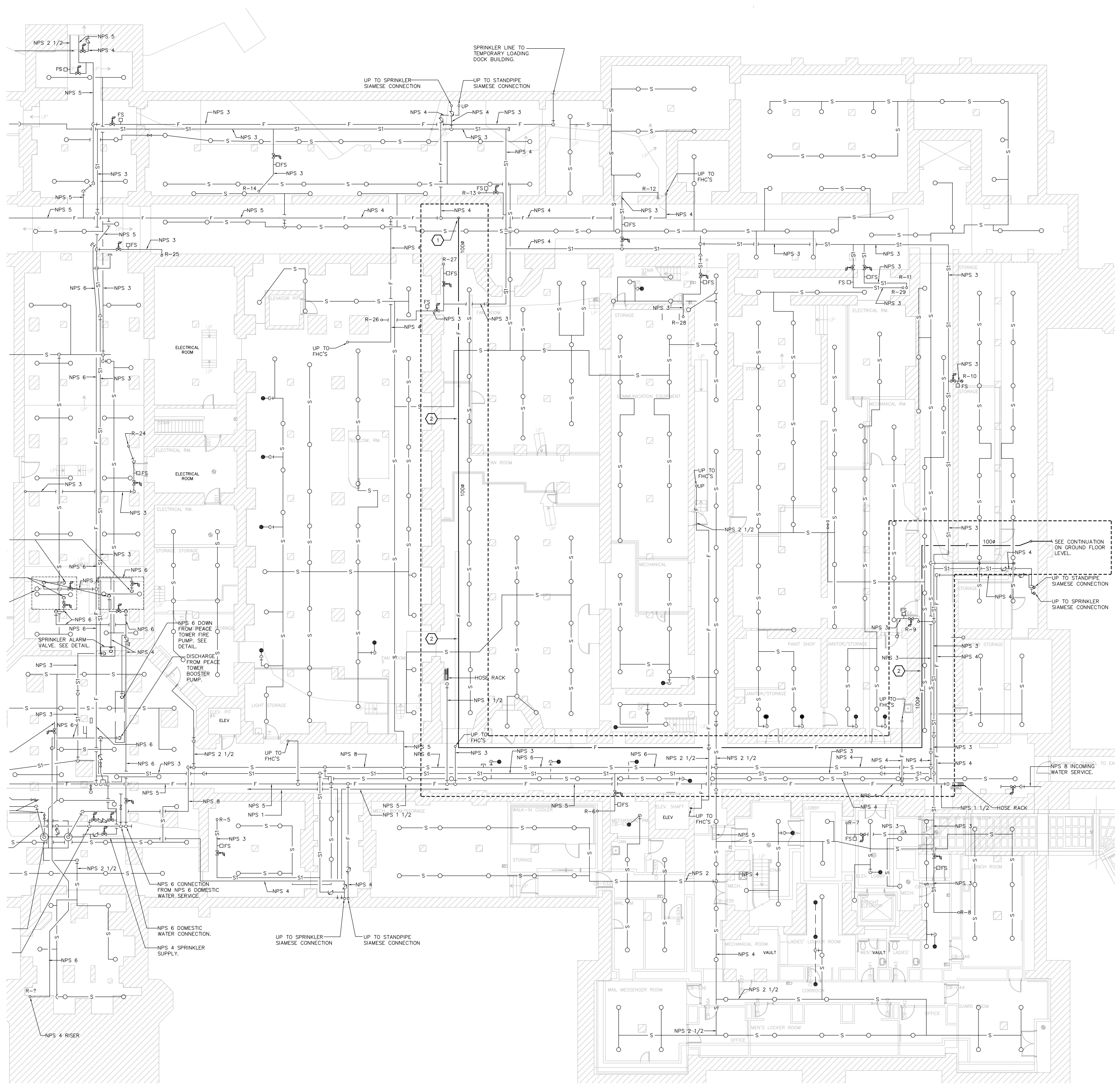
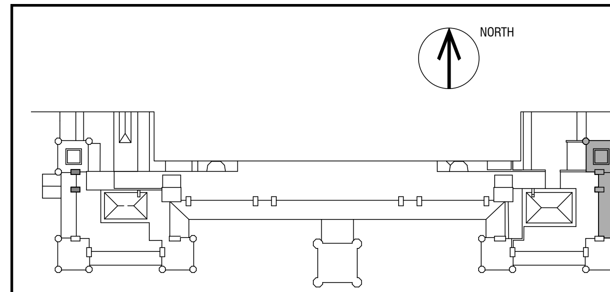


EAST PAVILION - FIRE PROTECTION

NOT TO SCALE



EAST PAVILIONS BASEMENT

MECHANICAL

Fire Protection

GENERAL NOTES:

1. FOR SHUT DOWN OF MAIN FIRE PROTECTION LINE, WORK WILL HAVE TO BE COORDINATED WITH THE OWNER. SHUTOFF VALVES ARE IN THE MAIN FIRE PUMP ROOM IN THE C-BUS.
2. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1 NEW CONNECTION ON TO EXISTING AT THIS POINT.

2 COORDINATE PASSAGE OF TEMPORARY SPRINKLER PIPING ABOVE EXISTING DUCTWORK. MAINTAIN PIPING A STRAIT AS POSSIBLE WITH A MINIMUM AMOUNT OF LEVEL CHANGE.

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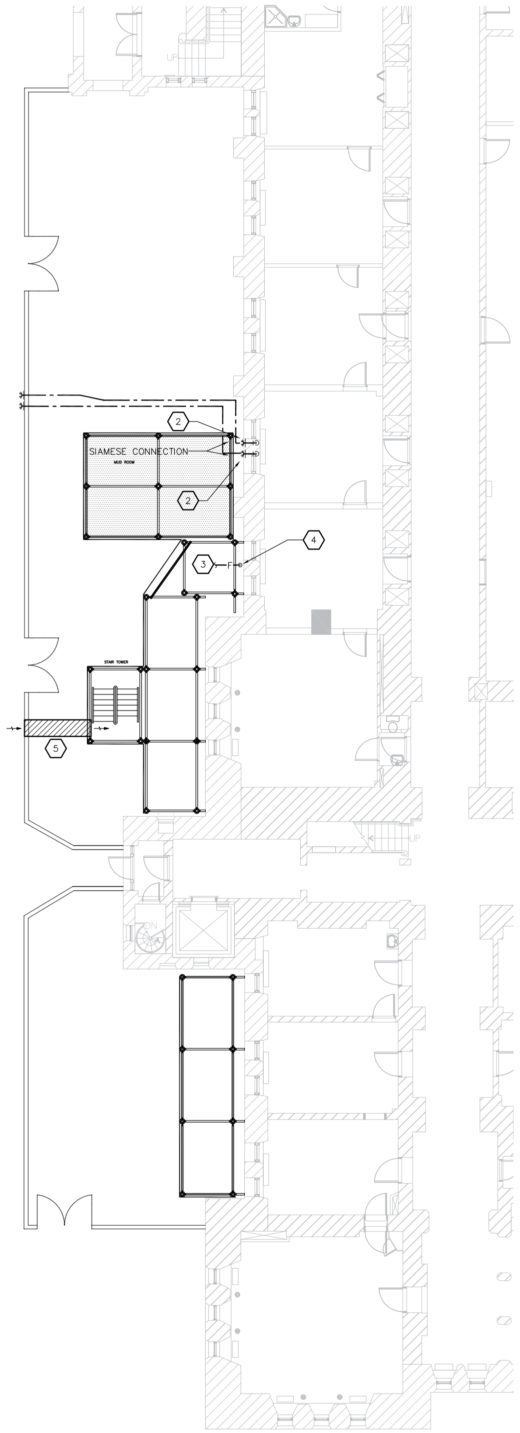
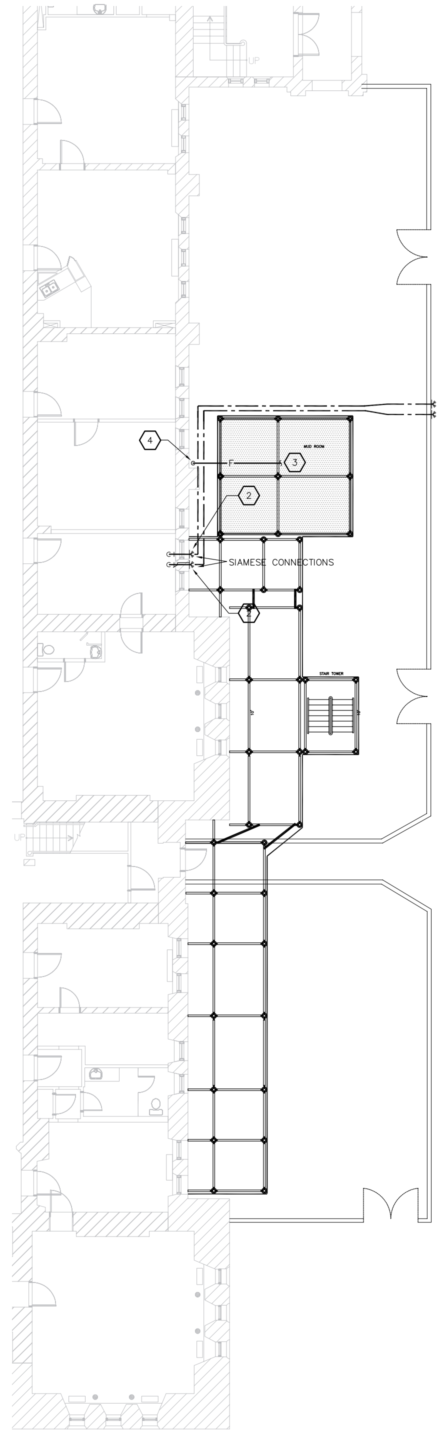


WEST PAVILION - FIRE PROTECTION
NOT TO SCALE



EAST PAVILION - FIRE PROTECTION
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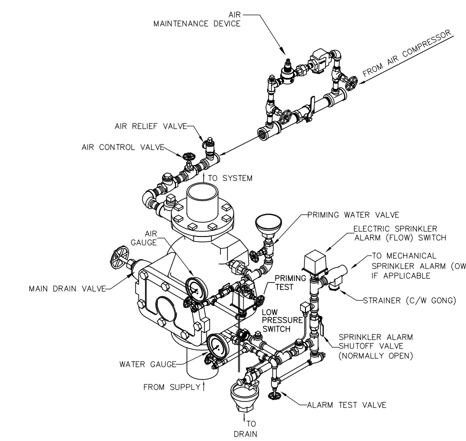
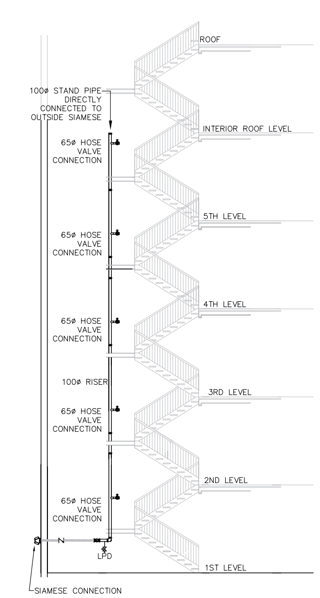
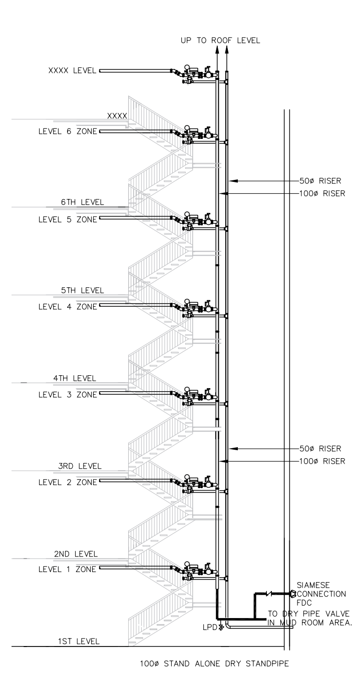


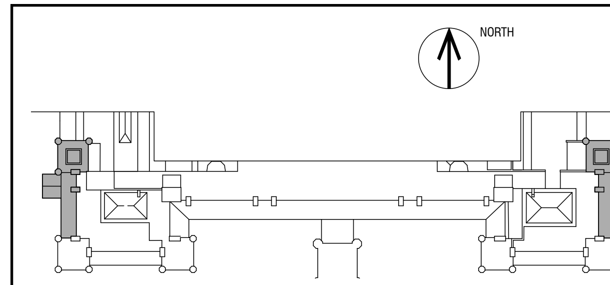
DRY PIPE VALVE ASSEMBLY DETAIL
NOT TO SCALE



WEST PAVILION - FIRE PROTECTION SCHEMATIC
NOT TO SCALE



EAST PAVILION - FIRE PROTECTION SCHEMATIC
NOT TO SCALE



EAST & WEST PAVILIONS FIRST FLOOR

MECHANICAL

Fire Protection

GENERAL NOTES:

1. FOR SHUT DOWN OF MAIN FIRE PROTECTION LINE, WORK WILL HAVE TO BE COORDINATED WITH THE OWNER. SEE BASEMENT DRAWINGS FOR POSITION OF SHUTOFF VALVES.
2. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1 NEW CONNECTION ON TO EXISTING AT THIS POINT.

2 EXISTING SIAMESE CONNECTION TO BE REMOVED AND RELOCATED ON OUTSIDE WALL OF TEMPORARY SCAFFOLDING, SEE DRAWING FOR NEW POSITION.

3 SPRINKLER SYSTEM TO BE DESIGNED BY CONTRACTOR'S PROFESSIONAL ENGINEER AND INSTALLED IN THE PROPOSED MUD ROOM, INTERLOCKED WITH THE CENTRE BLOCK FIRE ALARM SYSTEM

4 100ø STANDPIPE FROM CENTRE BLOCK FIRE PUMP LINE IN BASEMENT. SEE BASEMENT DRAWING.

5 LIMIT TO SMOKE MOVEMENT. THE CONTRACTOR IS TO PROVIDE AND IMPLEMENT MEANS TO LIMIT SMOKE MOVEMENT MEETING OBC 3.2.6.2 (3) WITH A VENT TO THE OUTDOORS OR OPERABLE AREA NEAR THE BOTTOM OF THE STAIR SHAFT, NOT LESS THAN 1.8 SQUARE METERS. NO MECHANICAL VENTILATION REQUIRED.

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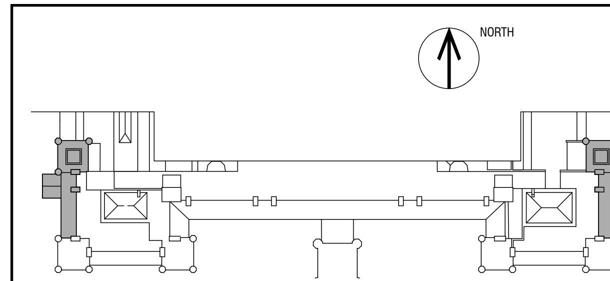
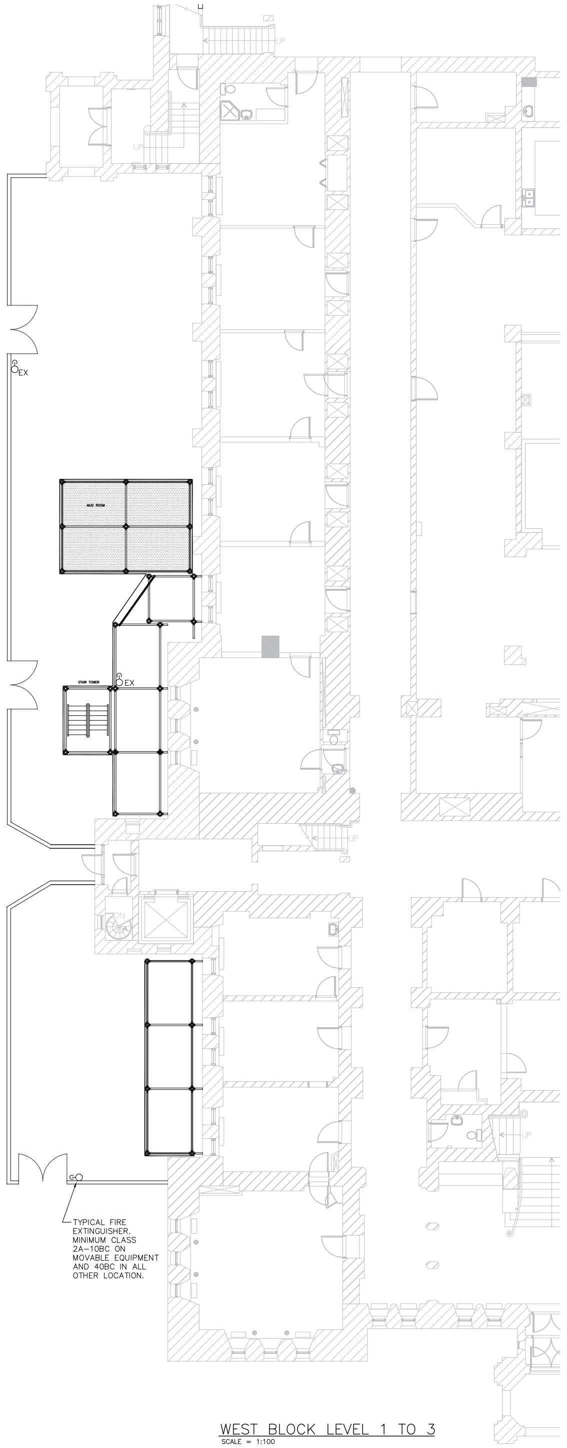
EAST & WEST PAVILIONS DETAILS

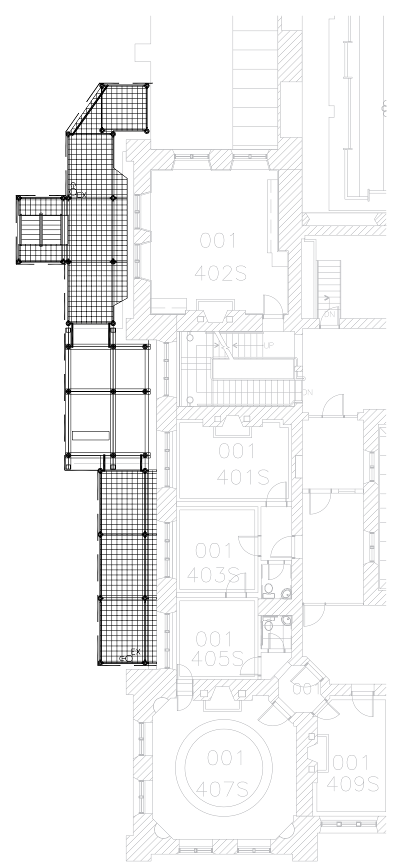
MECHANICAL

Fire Extinguishers

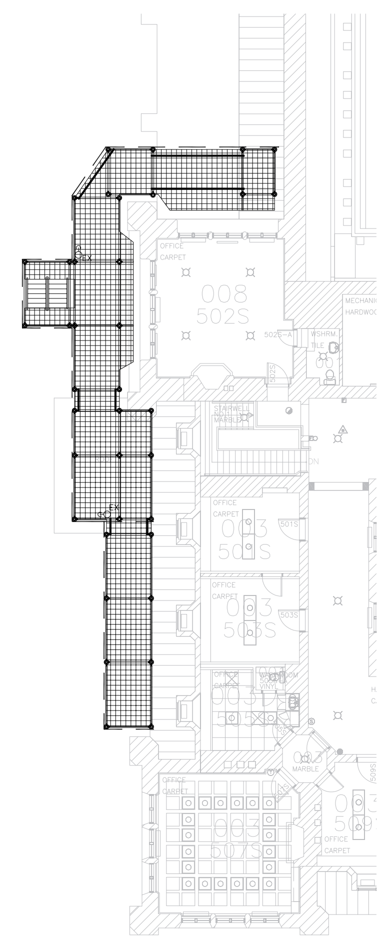




WEST PAVILION - FIRE EXTINGUISHERS level 1-3
NOT TO SCALE



WEST PAVILION - FIRE EXTINGUISHERS level 4
NOT TO SCALE



WEST PAVILION - FIRE EXTINGUISHERS level 5-12
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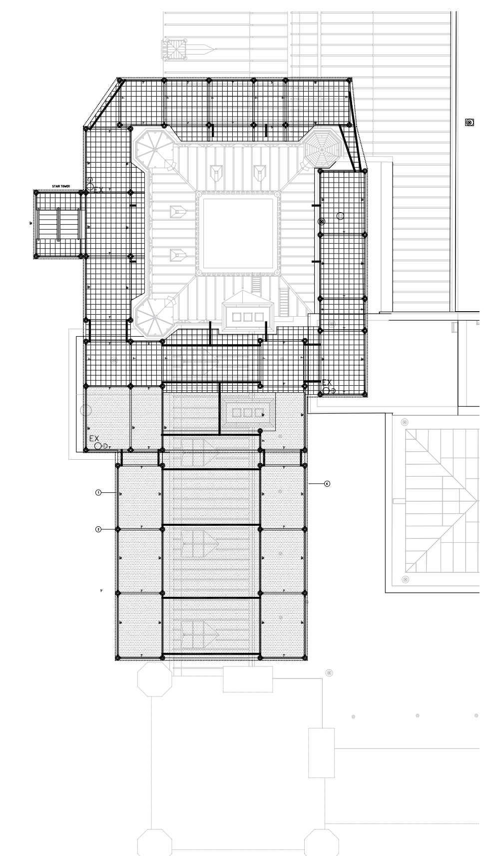

WEST PAVILION - FIRE EXTINGUISHERS roof
NOT TO SCALE

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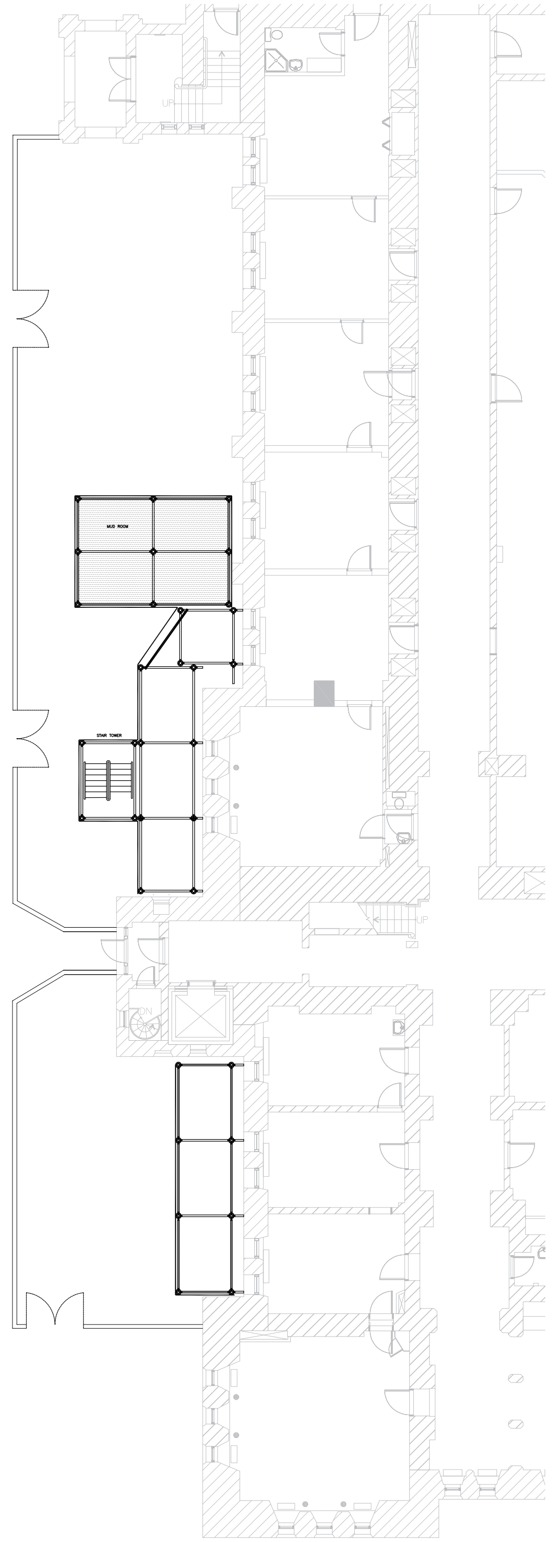
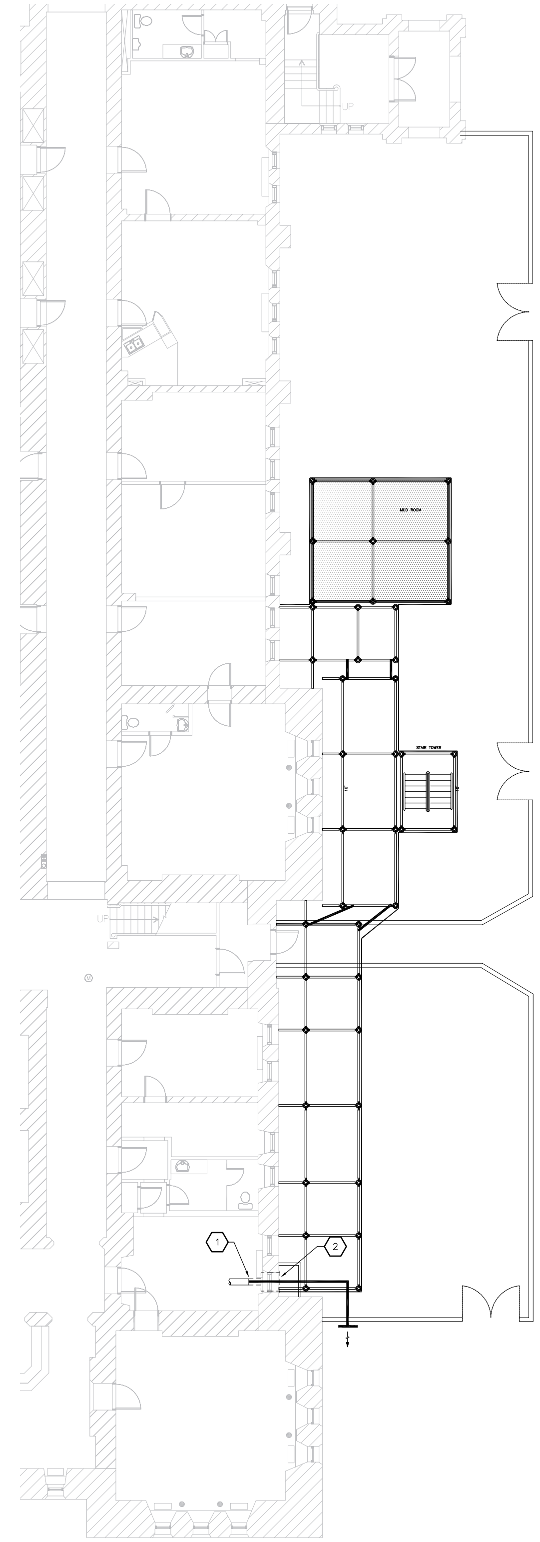
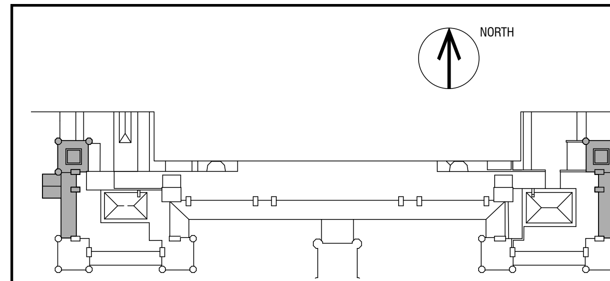


WEST PAVILION - VENTILATION
NOT TO SCALE



EAST PAVILION - VENTILATION
NOT TO SCALE



EAST & WEST PAVILIONS FIRST FLOOR

MECHANICAL

Ventilation

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

NOTES:

1 NEW CONNECTION ON TO EXISTING AT THIS POINT.

2 EXISTING EXHAUST OUTLET TO BE REMOVED AND EXISTING 255ø CONDUIT TO BE EXTENDED OUTSIDE OF WORK SPACE. SEE DRAWING FOR NEW LOCATION.

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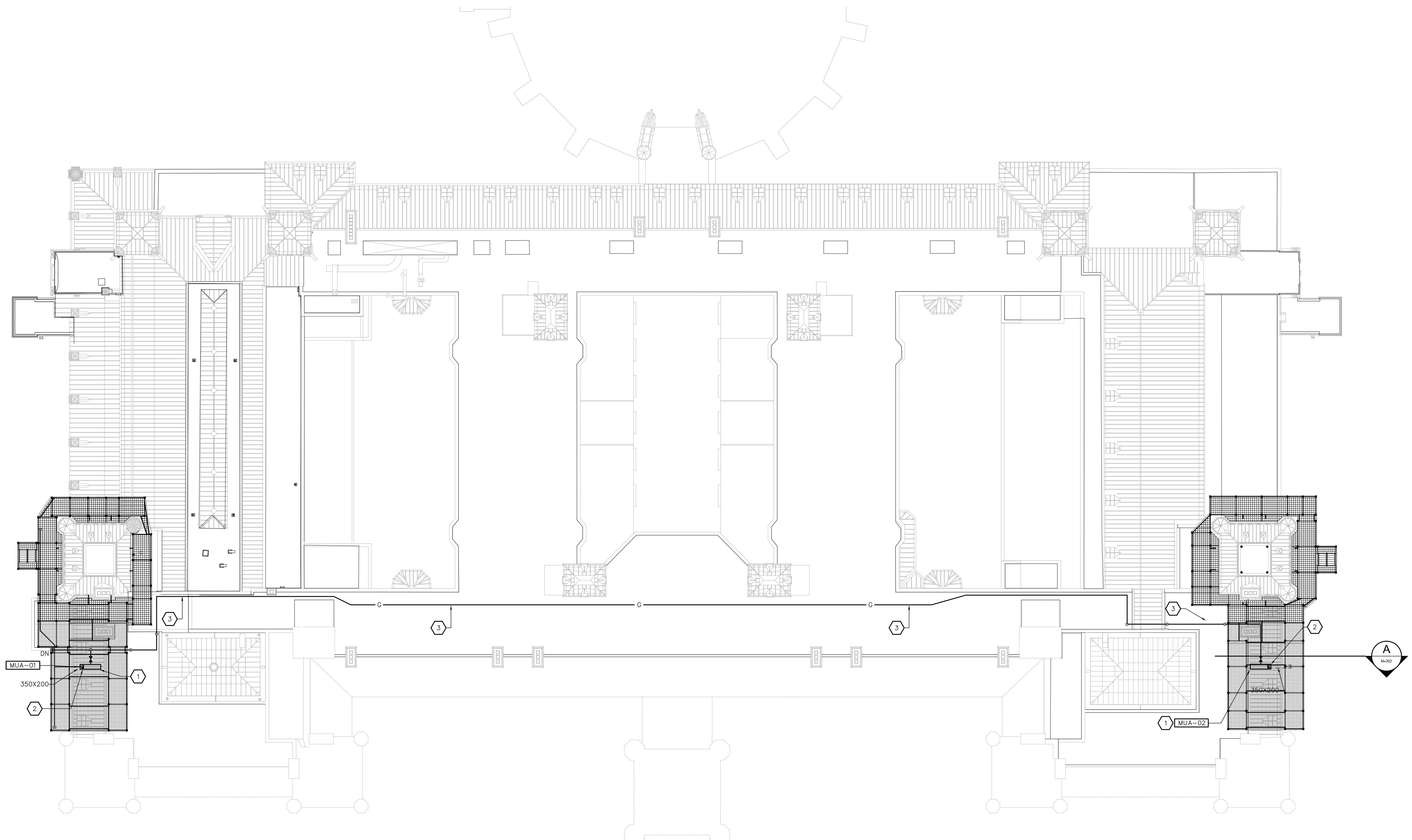
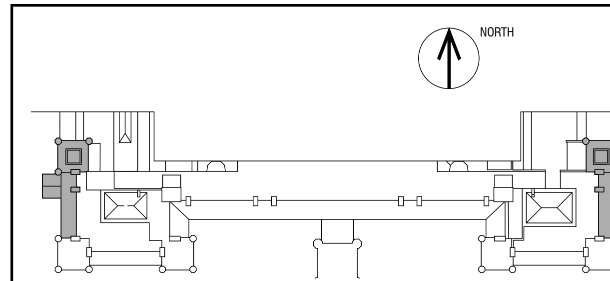


EAST & WEST PAVILION - VENTILATION
NOT TO SCALE



EAST & WEST PAVILIONS ROOF

MECHANICAL

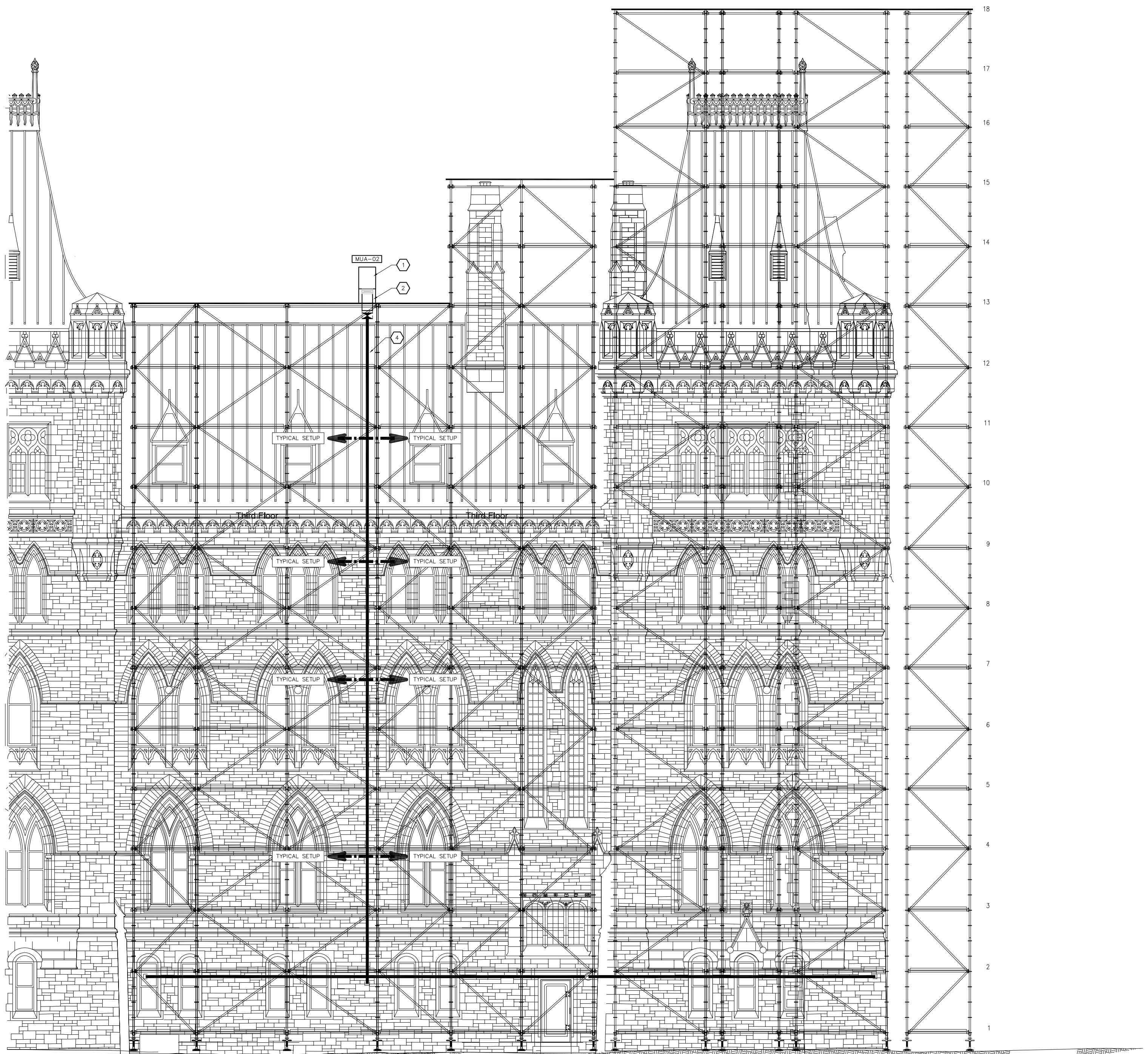
Ventilation

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

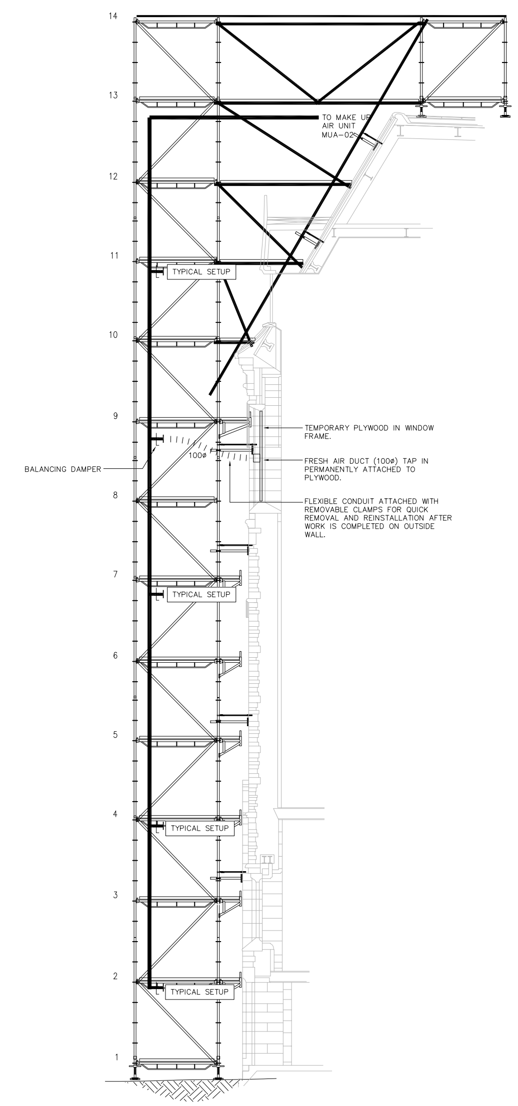
NOTES:

1. PROVIDE AND INSTALL A TEMPORARY MAKE-UP AIR UNIT, SEE SPECIFICATIONS FOR DESCRIPTION. MAKE-UP AIR UNIT TO BE INSTALLED ON 455mm HIGH BASE AND TIDE DOWN WITH ANCHORS SCFFOLDING, INSTALLATION TO RESPECT SEISMIC RESTRAINTS CODES & STANDARDS..
2. PROVIDE FIRST SECTION OF CONDUIT FROM UNITS UP TO 0.5 METERS INSIDE SCAFFOLDING. DESIGN OF CONTINUATION FROM THIS POINT BY CONTRACTOR.
3. COORDINATE PASSAGE OF NEW TEMPORARY GAS LINE ON THE ROOF WITH EXISTING CONDITIONS. PROVIDE BY PIPE SUPPORTS THAT ARE NOT ANCHORED TO ROOF, SUCH AS QUICK BLOCK E/Z SLEEPER. ANCHOR PIPING FOR SEISMIC MOVEMENT WITH AIRCRAFT CABLES RATED FOR APPLICATION AND ANCHOR POINTS TO BE COORDINATED WITH STRUCTURAL ENGINEER.

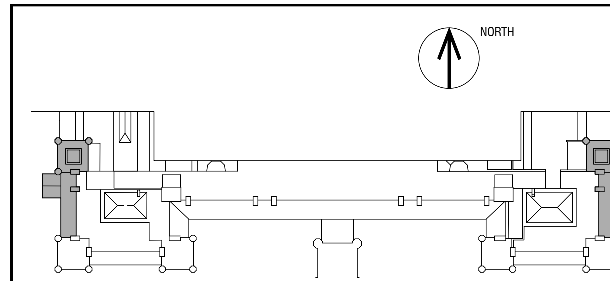


EAST PAVILION SCAFOLD ELEVATION

EAST PAVILION - VENTILATION
NOT TO SCALE



EAST PAVILION - VENTILATION
NOT TO SCALE



EAST PAVILIONS ELEVATION AND SECTION

MECHANICAL

Ventilation

GENERAL NOTES:

1. ALL EXISTING PIPE SIZE ON PIPING ARE IN IMPERIAL UNITS. PIPE SIZE OF NEW PIPING IN METRIC.

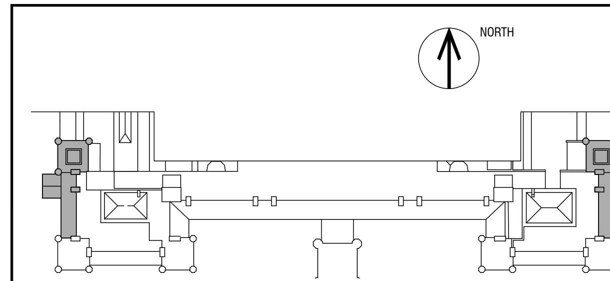
NOTES:

1 PROVIDE AND INSTALL A TEMPORARY MAKE–UP AIR UNIT, SEE SPECIFICATIONS FOR DESCRIPTION. MAKE–UP AIR UNIT TO BE INSTALLED ON 455mm HIGH BASE AND TIED DOWN WITH ANCHORS SCAFFOLDING, INSTALLATION TO RESPECT SEISMIC RESTRAINTS CODES & STANDARDS..

2 350X205 CONDUIT C/W 50mm THERMAL INSULATION. DOWN TO SCAFFOLDING.

3 COORDINATE PASSAGE OF NEW TEMPORARY GAS LINE ON THE ROOF WITH EXISTING CONDITIONS. PROVIDE BY PIPE SUPPORTS THAT ARE NOT ANCHORED TO ROOF, SUCH AS QUICK BLOCK E/Z SLEEPER. ANCHOR PIPING FOR SEISMIC MOVEMENT WITH AIRCRAFT CABLES RATED FOR APPLICATION AND ANCHOR POINTS TO BE COORDINATED WITH STRUCTURAL ENGINEER.

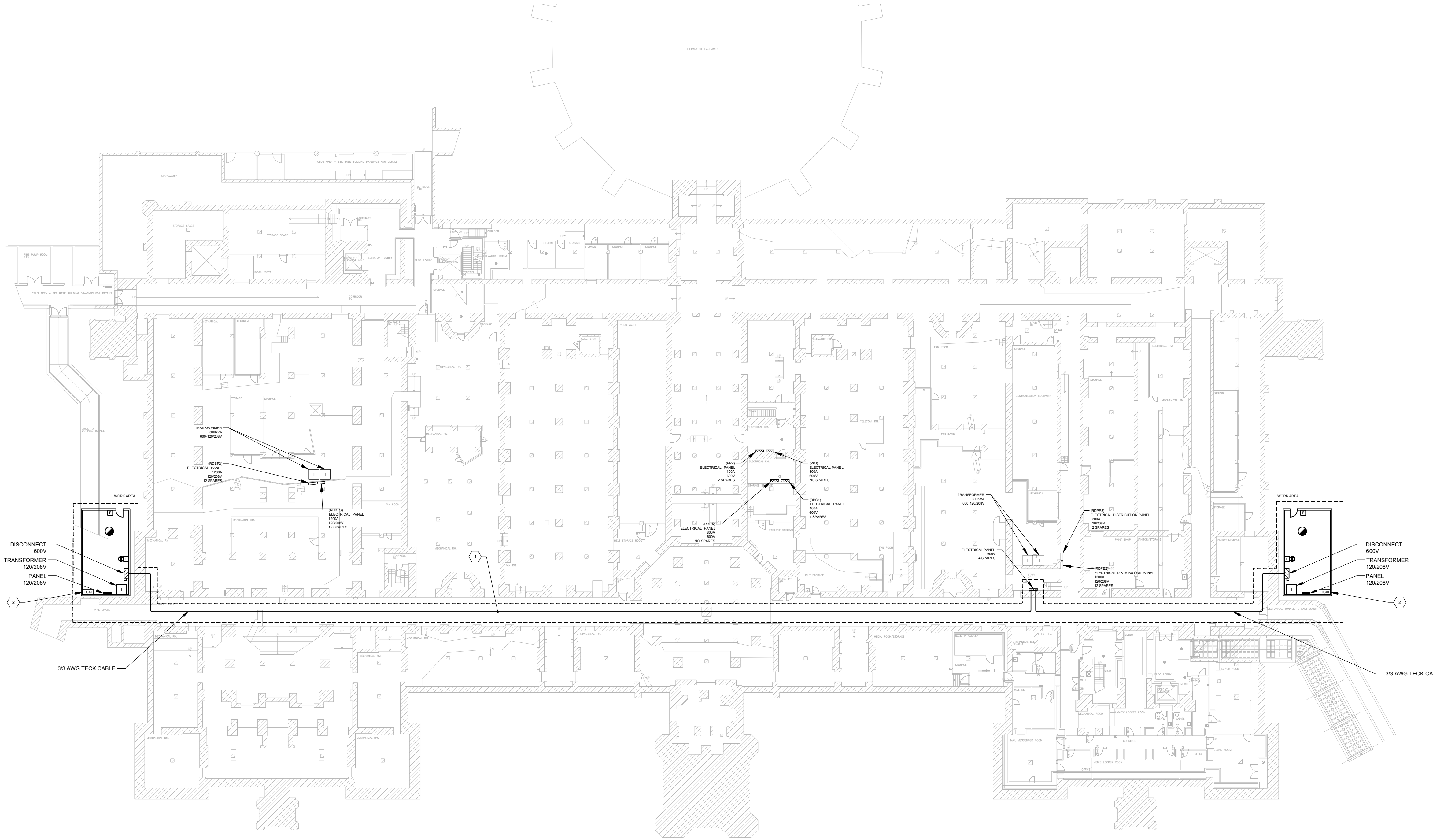
4 FRESH AIR DISTRIBUTION CONDUITS DESIGNED BY CONTRACTOR'S ENGINEERING SERVICES, DESIGN TO MEET PERFORMANCE SPECIFICATIONS.



EAST & WEST PAVILIONS BASEMENT

ELECTRICAL

SERVICES



EAST & WEST PAVILION - VENTILATION

NOT TO SCALE

GENERAL NOTES:

1. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR THE REMOVAL OF ALL ELECTRICAL AND AUDIOVISUAL EQUIPMENT THAT MAY AFFECT THE REPAIRS ON THE EAST AND WEST PAVILIONS. THE ELECTRICAL CONTRATOR IS ALSO RESPONSIBLE FOR THE EXISTING ELECTRICAL EQUIPMENT AFFECTED BY THE RENOVATIONS IN THE CONSTRUCTION ZONE TO BE FONCTIONNAL AT THE END OF WORK.
2. CONTRATOR TO PROVIDE ALL ELECTRICAL SERVICES AND FIRE ALARM COMPONENTS REQUIRED WITHIN THE MUD ROOMS AND THE SCAFFOLDING AREA. INCLUDING BUT NOT LIMITED TO:

   - LIGHTING WITHIN THE SCAFFOLDINGS AND MUD ROOMS FOR WORK PERFORMED OVERNIGHT
   - POWER TOOLS
   - HOISTS / MATERIAL ELEVATING DEVICES
   - HOT WATER HEATERS (GAS OR ELECTRIC)
   - ROOF TOP GAS FIRED MAKEUP AIR UNITS
   - GAS FIRED GLYCOL BOILERS
   - GLYCOL HEATING FORCE FLOW UNITS
   - GLYCOL HEATING CIRCULATING PUMPS
   - GENERAL CONSTRUCTION OUTLETS / SERVICES
   - SCAFFOLDING'S VENTILATION
   - MUD ROOM VENTILATION

   THE CAPACITY REQUIREMENTS AND SOURCE AVAILABILITY ARE TO BE EVALUATED BY THE CONTRACTOR.

NOTES:

1 TECK CABLE TO BE PROPERLY ATTACHED TO CEILING OR WALL.

2 FIRE ALARM PANEL TO COMMUNICATE WITH SIMPLEX FIRE ALARM PANEL PANEL LOCATED INSIDE PARLEMENT.

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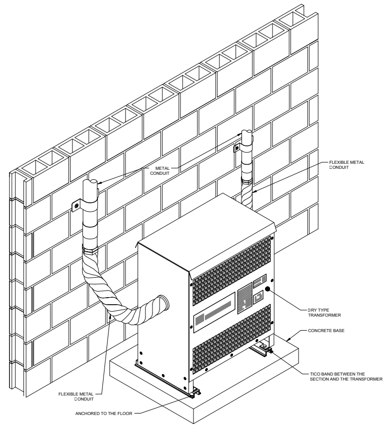
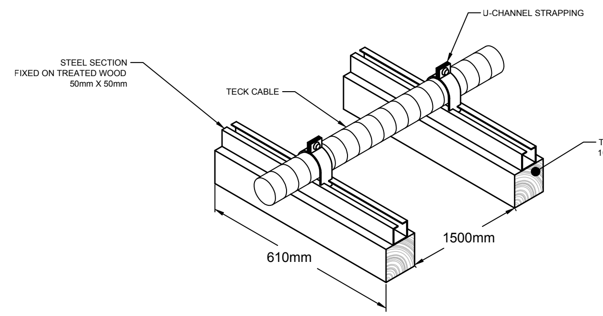
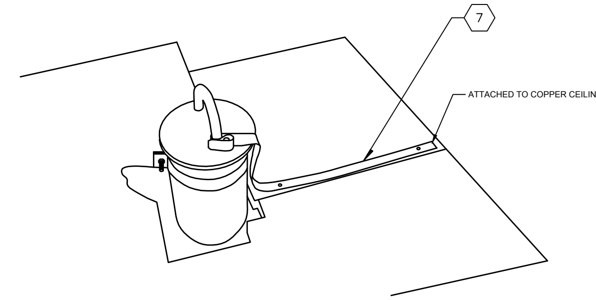


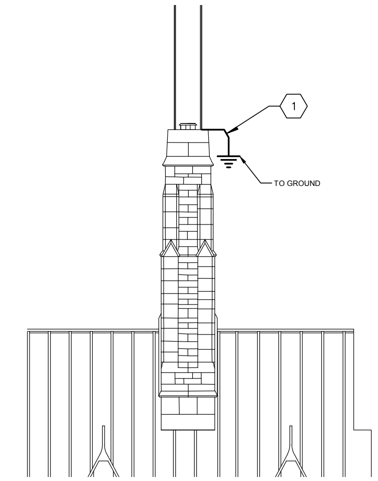
TYPICAL ARRANGEMENT OF A FLOOR TRANSFORMER
NOT TO SCALE



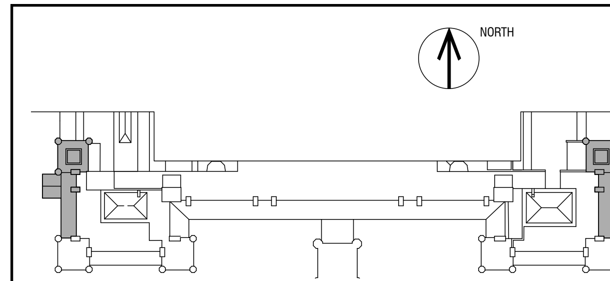
TYPICAL INSTALLATION OF TECH CABLE
NOT TO SCALE



TYPICAL INSTALLATION OF BONDING WIRES ON ROOF
NOT TO SCALE



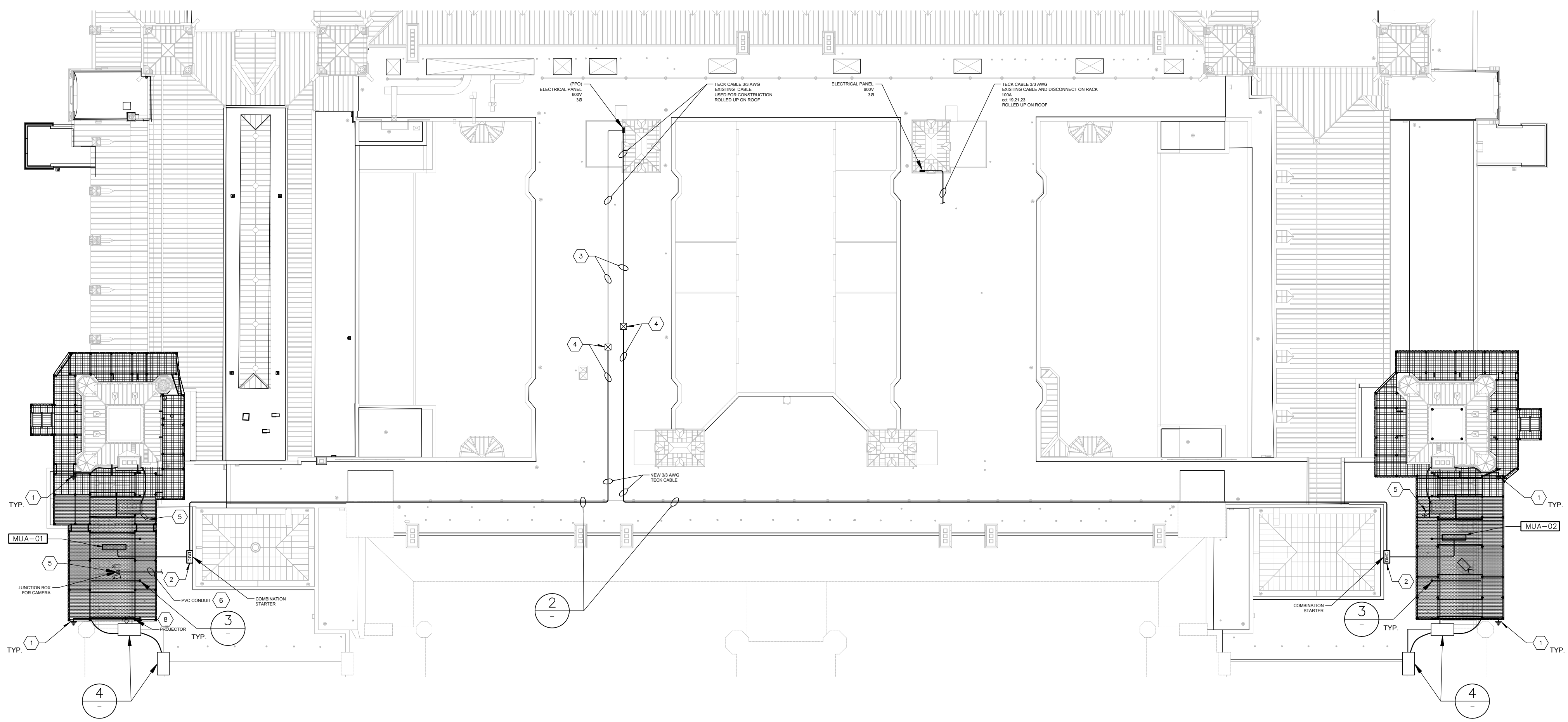
LIGHTNING ARRESTOR
NOT TO SCALE



EAST & WEST PAVILIONS SIXTH FLOOR

ELECTRICAL

Existing & Modified



EAST & WEST PAVILION - ELECTRICAL
NOT TO SCALE

GENERAL NOTES:

1. BONDING AND GROUNDING WIRES TO BE TESTED UPON COMPLETION OF WORK.
2. ENSURE PROPER BONDING ALL TEMPORARY AND NEW EQUIPMENT INSTALLED ON ROOF.
3. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR THE REMOVAL OF ALL ELECTRICAL AND AUDIOVISUAL EQUIPMENT THAT MAY AFFECT THE REPAIRS ON THE EAST AND WEST PAVILIONS. THE ELECTRICAL CONTRATOR IS ALSO RESPONSIBLE FOR THE EXISTING ELECTRICAL EQUIPMENT AFFECTED BY THE RENOVATIONS IN THE CONSTRUCTION ZONE TO BE FONCTIONNAL AT THE END OF WORK.
4. CONTRATOR TO PROVIDE ALL ELECTRICAL SERVICES AND FIRE ALARM COMPONENTS REQUIRED WITHIN THE MUD ROOMS AND THE SCAFFOLDING AREA. INCLUDING BUT NOT LIMITED TO:

   - LIGHTING WITHIN THE SCAFFOLDINGS AND MUD ROOMS FOR WORK PERFORMED OVERNIGHT
   - POWER TOOLS
   - HOISTS / MATERIAL ELEVATING DEVICES
   - HOT WATER HEATERS (GAS OR ELECTRIC)
   - ROOF TOP GAS FIRED MAKEUP AIR UNITS
   - GAS FIRED GLYCOL BOILERS
   - GLYCOL HEATING FORCE FLOW UNITS
   - GLYCOL HEATING CIRCULATING PUMPS
   - GENERAL CONSTRUCTION OUTLETS / SERVICES
   - SCAFFOLDING'S VENTILATION
   - MUD ROOM VENTILATION

   THE CAPACITY REQUIREMENTS AND SOURCE AVAILABILITY ARE TO BE EVALUATED BY THE CONTRACTOR.
5. HEATING CABLES ON ROOF ARE NO LONGER IN USE AND ARE TO BE REMOVED AND NOT REINSTALLED.
6. COORDINATE WITH SECURITY BEFORE DISCONNECTION, REMOVAL AND DISPLACEMENT OF ANY EQUIPMENT ON ROOF.

NOTES:

1 4/0 AWG BARE GROUND WIRE TO BE REMOVED AND REINSTALLED TEMPORARY DURING CONSTRUCTION AND REPLACED WITH NEW UPON COMPLETION OF WORK.

2 MOTOR STARTER OF TYPE NEMA 3R WITH 600-120V TRANSFORMER INCLUDING MOTOR OVERLOAD SIZED PROPERLY WITH LOAD. 120V COIL. STARTER OVERLOADS AND CONTROL TRANSFORMER TO BE SUPPLIED AND INSTALLED BY DIVISION 26.

3 USE EXISTING TECK CABLE FROM PANEL PPO TO FEED NEW MAKE-UP AIR UNIT.

4 CABLE TO BE EXTENDED TO NEW MAKE-UP AIR UNIT WITH JUNCTION BOX NEMA 3R AND TECK CABLE.

5 CAMERA TO BE REMOVED AND REINSTALLED TEMPORARY DURING CONSTRUCTION. CAMERA TO BE INSTALLED PROPERLY UPON COMPLETION OF WORK.

6 PVC CONDUIT WITHIN POWER AND COMMUNICATION CABLES FOR THE EXISTING CAMERA TO BE LIFTED TEMPORARY DURING CONSTRUCTION AND REINSTALLED PROPERLY UPON COMPLETION OF WORK.

7 BONDING WIRES TO BE REMOVED AND REINSTALLED TEMPORARY DURING CONSTRUCTION. REINSTALLED PROPERLY UPON COMPLETION OF WORK.

8 PROJECTOR TO BE REMOVED AND REINSTALLED TEMPORARY DURING CONSTRUCTION. PROJECTOR TO BE INSTALLED PROPERLY UPON COMPLETION OF WORK.

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APPENDIX VI
PROPOSED INTERVENTIONS
SCAFFOLDING DESIGN

Appendix VI: Proposed Interventions: Scaffolding Design

The Schematic Design report presented three options for a scaffolding system, a traditional frame, a structural steel frame, and a mix of these two options. The recommendation was the mix or hybrid option since the structural steel options was costly and problematic regarding the foundations required and the traditional frame wouldn't allow access to all of the areas of intervention. The system described below is a traditional frame with structural elements located at strategic locations where access is required.

SCAFFOLD SPECIFICATION

General

The scaffold system is based on aluminum hollow tubular modular system scaffold components comprised of vertical standards ; ledgers to support working platforms and braces to support lateral loads. Components are connected with captive wedge lock pins

The scaffold supplier / installer shall produce shop drawings of the complete system bearing certification of a Professional Engineer of Ontario.
The scaffold component systems shall be designed to support superimposed specifed loads with a 4:1 safety factor as
The shop drawings shall provide detail appropriate to the proprietary system being used
The system shall be designed using superimposed loads shown on drawings and shall be reviewed by project consultants.

1. Ledgers:

Ledgers shall be connected on to rosettes of the standards by means of captive wedge pins
Truss ledgers must be used (not single ledgers) for 2.1m and 3.05 m effective width platforms when supporting a fully planked platform.
Other ledgers not supporting work platforms may be single ledgers
The ledgers shall be designed to flexural, shear and deflection criteria of the system with a 4:1 safety factor as specified be the specific system manufacturer
.

2. Standards

Vertical standards shall be comprised of aluminum tubes with rossete rings at 500mm c/c (1'-8") to accept ledger and brace connections

Standards shall be designed to accommodate:
Self weight of system, superimposed dead load of cladding system , working platforms ,etc. as well as live load for working platforms in use as specified in the Design Loads. The maximum allowable compressive capacity of the system shall have a 4:1 safety factor as prescribed by manufacturer.
Standard coupling pin connections components shall be provided to resist tensile loads such as those created by uplift and overturning loads

3. Pipe and clamp

Where modular components are not dimensionally possible to use, Pipe and clamp assemblies are to be constructed using aluminum or steel pipe secured at each junction to a standard, ledger or another pipe. The pipe and clamp systems shall be designed to support the superimposed working platform loads for the respective configurations

4. Braces

Bay braces or tube and clamp diagonal braces must be installed at the same vertical increments as the ledgers.
The braces shall be designed to support lateral wind and earthquake loads in accordance with Design Loads specified.
The braces shall be installed in both orthogonal directions at each level and at bay intervals designed to support respective loads.

5. Bases

Screw jacks
Hollow core tubular adjustable screw jacks shall be used at base of standards.
Base screw jacks to be designed to accommodate vertical reaction of standard.
The screw jacks shall have a maximum extension of 360mm (14") or based on manufacturers design recommendations

Swivel jack bases shall be used on sloped bearing surfaces. The swivel jack based must be braced for the lateral shear force component using a 4:1 safety factor
Transfer beams

Bearing pads

Wood built up bearing pads shall be designed to transfer loads from the screw jack base to the finished grade.
The wood bearing pads shall bear on a compacted non frost susceptible granular bed specified by the geotechnical engineer.
Geotechnical engineer shall determine the SLS and ULS bearing capacity of the bearing strata.
The bearing pad shall be sized to suit the specified bearing capacity

6. Cladding

The cladding of the entire outside perimeter of the scaffold system shall be a weather tight tension enclosure system .
The tarp shall be 10 mils high strength reinforced polyethylene and resist tears or punctures from wind loading.
Material shall be flame retardant and UV treated.
The tarp shall be tensioned and connected to each standard along the height and at intervals to uniformly distribute wind loads to scaffold system.
The system shall have interlocking modular panels with internal connections at the standards to maintain a continuous weather seam. The material must be impermeable. The tarps shall be white and allow 30% minimum light transmission.

7. Working platforms

Working platforms shall be either pre-manufactured scaffold deck units or laminated veneer wood planks, or a combination there of.
The working platforms shall be installed at levels specified on drawings, installed up to 150 mm (6")away from the existing façade.
The platforms shall be installed to ensure continuous access between areas of works.
Platform installation shall ensure there are no tripping hazards between joints.
A 235mm (9 ½") toe board shall be provide at the outside edge of the scaffold enclosure.

Maximum allowable platform load must be determined form either platform material strength and deflection criteria or load capacity of ledger whichever is less.

8. Roof Platform

Roof platforms shall be either pre-manufactured scaffold deck units or laminated veneer wood planks, or a combination there of. The roof shall be sloped to accommodate drainage. Roofing materials shall be applied to roof structure as specified by project architect.

9. Transfer Beams

Structural steel transfer beams shall be provided to span over areas specified on drawings, such as the West Pavilion entrance vestibule. The Beams shall be designed to strength shear and torsion loads of the superimposed scaffold point load reactions with a maximum total load deflection of l/240.
Structural steel support columns shall be designed to support transfer beams down to foundation pads sized to the specified SLS and ULS bearing

10. Side brackets

Side brackets with 880mm (2'-11") or 650 mm (2'-2") may be used, cantilevered from rosette of standards to access up to façade where appropriate.
Side brackets shall be designed to support superimposed platform dead and live loads

11. Push pull ties

The scaffold system shall be laterally supported on to the building with pipe and clamp to support compressive loads and with wire of an appropriate gauge tied to scaffold standards and anchored to mortar joints of building.
The push pull ties shall be designed to accommodate lateral reaction from wind and seismic loads in accordance with design loads specified.
Appropriate care must be taken to not damage stone work. Patching of hole once ties removed shall match mortar to the approval of the project architect.
If a tie has to be removed to accommodate work on the existing façade, provide additional ties in adjacent areas to accommodate superimposed lateral loads.
Note that lateral ledger beams may be required to span across work areas. The concentrated load at ends of these legers may require more multiple push pull ties to accommodate respective reaction.

SCAFFOLD LEGEND

1. Ledger:
5' = 5'-2" (1.57m) length
7' = 7'-0" (1.83m) length
10' = 10'-0" (3.05m) length
Design ledgers for superimposed specified design loads & self weight.
Double ledger for bearing platforms for 7' & 10' bays.

2. (in elevation) (In plan)
Standards: length to suit
Pipe & rosettes @ 0.5m (1'-9")
Design standards to suit for accumulated platforms self weight, live load @ specified levels.

3. Pipe & Clamp: length to suit
Design pipe & clamp to support specified design loads & self weight.

4. Brace:
Lateral bracing to support reaction of superimposed wind & seismic load reactions in accordance with loads prescribed by The Ontario Building Code.

5. Screw Jack Base typical to all standards.
Sill Plates to accommodate reactions to suit LSL and ULS bearing capacity of soil.

6. Cladding material to scaffold system to support wind loads prescribed by The Ontario Building Code.

7. Extent of scaffold planking.
Working platform designed to support design loads specified.

8. Roof platform designed to support specified design loads including snow, wind uplift, roofing materials & mechanical equipment.

9. Transfer beams provided to span over areas specified. Designed to strength shear and torsion loads of the superimposed scaffold point load reactions with a maximum total load defection of 1/240.

10. Side brackets with 880mm (2'-11") or 650 mm (2'-2") may be used, cantilevered from rosette of standards to access up to façade where appropriate.
Side brackets shall be designed to support superimposed platform dead and live loads.

11. Push-Pull tie designed to laterally support the scaffold system. Location of ties to be located as to avoid any windows/building features which should not be compromised.
Provide at each standard horizontal & 4.5m (15'-0") maximum vertically.

SUPERIMPOSED DESIGN LOADING

All components of the scaffold system shall support self weight of the Roof, Tarp, Decking, Standards, Ledgers and Braces. As well as the following live loads.

Access Platforms

Workers + Materials: 2.4 kPa (50 psf) across access platform deck for a maximum of 3 vertically aligned levels.

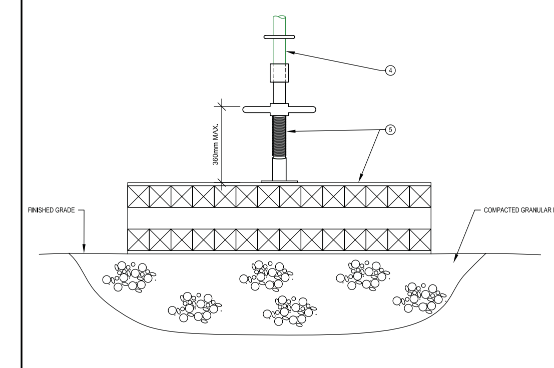
Roofs

Snow load: Snow/Rain load calculated in accordance with OBC 4.1.6.2. with appropriate snow drift
S = Is[Ss(Cb Cw Cs Ca) + Sr]

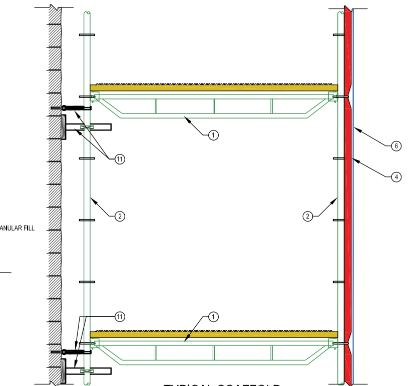
Lateral Loads

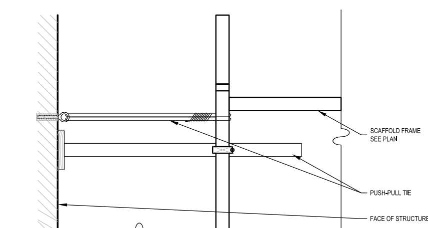
Wind: Wind calculated in accordance with OBC 4.1.7.
p = Iw q Ce Cg Cp

Seismic: Seismic calculated in accordance with OBC 4.1.8.11.
V = S(Ta) Mv Ie W/Rd Ro

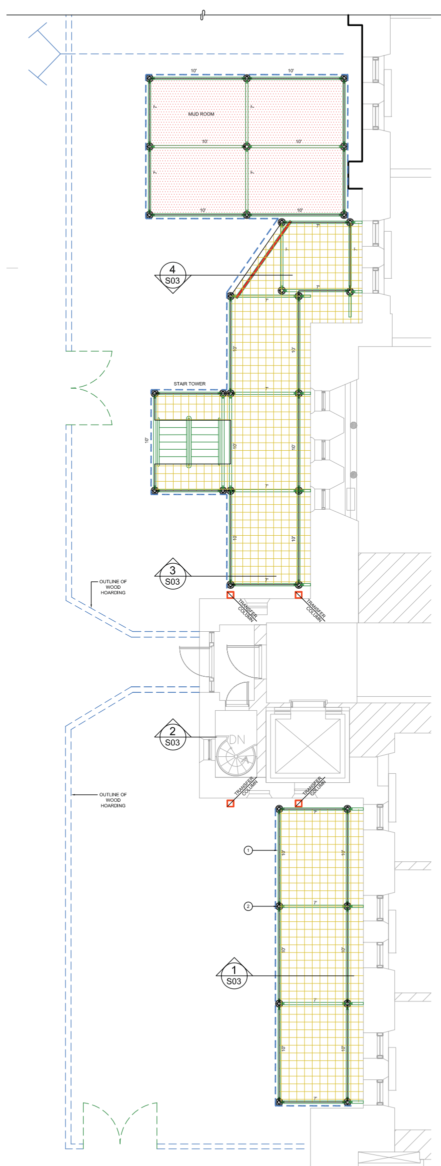


A SCAFFOLD BASE DETAIL
1 : 10

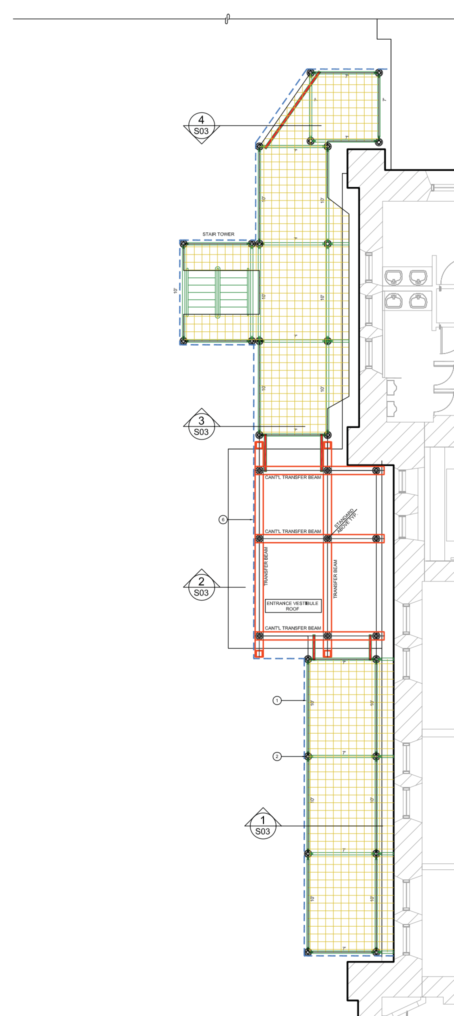

B TYPICAL SCAFFOLD SECTION
1 : 10



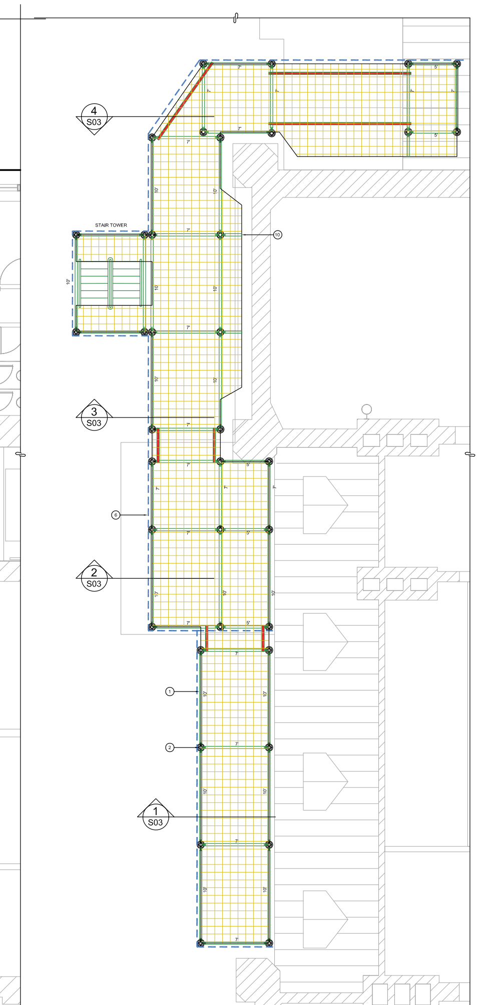
C TYPICAL TIE-BACK DETAIL SECTION
N.T.S.



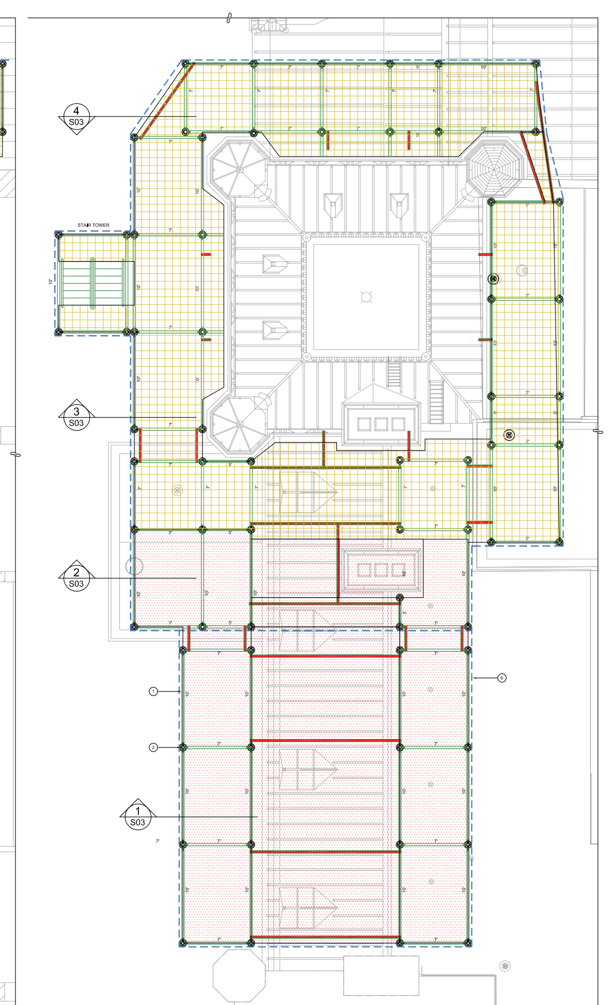
1 S01 WEST PAVILLION 1st to 3rd. PLAN
1 : 75



2 S01 WEST PAVILLION 4th PLAN
1 : 75



3 S01 WEST PAVILLION 5th to 12th PLAN
1 : 75



4 S03 WEST PAVILLION 13th to 17th PLAN
1 : 75

5 S01 WEST PAVILLION 18th PLAN
1 : 75

SCAFFOLD SPECIFICATION

General

The scaffold system is based on aluminum hollow tubular modular system scaffold components comprised of vertical standards ; ledgers to support working platforms and braces to support lateral loads. Components are connected with captive wedge lock pins

The scaffold supplier / installer shall produce shop drawings of the complete system bearing certification of a Professional Engineer of Ontario.
The scaffold component systems shall be designed to support superimposed specifed loads with a 4:1 safety factor as
The shop drawings shall provide detail appropriate to the proprietary system being used
The system shall be designed using superimposed loads shown on drawings and shall be reviewed by project consultants.

1. Ledgers:

Ledgers shall be connected on to rosettes of the standards by means of captive wedge pins
Truss ledgers must be used (not single ledgers) for 2.1m and 3.05 m effective width platforms when supporting a fully planked platform.
Other ledgers not supporting work platforms may be single ledgers
The ledgers shall be designed to flexural, shear and deflection criteria of the system with a 4:1 safety factor as specified be the specific system manufacturer

2. Standards

Vertical standards shall be comprised of aluminum tubes with rossete rings at 500mm c/c (1'-8") to accept ledger and brace connections

Standards shall be designed to accommodate:
Self weight of system, superimposed dead load of cladding system , working platforms ,etc. as well as live load for working platforms in use as specified in the Design Loads. The maximum allowable compressive capacity of the system shall have a 4:1 safety factor as prescribed by manufacturer.
Standard coupling pin connections components shall be provided to resist tensile loads such as those created by uplift and overturning loads

3. Pipe and clamp

Where modular components are not dimensionally possible to use, Pipe and clamp assemblies are to be constructed using aluminum or steel pipe secured at each junction to a standard, ledger or another pipe. The pipe and clamp systems shall be designed to support the superimposed working platform loads for the respective configurations

4. Braces

Bay braces or tube and clamp diagonal braces must be installed at the same vertical increments as the ledgers.
The braces shall be designed to support lateral wind and earthquake loads in accordance with Design Loads specified.
The braces shall be installed in both orthogonal directions at each level and at bay intervals designed to support respective loads.

5. Bases

Screw jacks
Hollow core tubular adjustable screw jacks shall be used at base of standards.
Base screw jacks to be designed to accommodate vertical reaction of standard.
The screw jacks shall have a maximum extension of 360mm (14") or based on manufacturers design recommendations

Swivel jack bases shall be used on sloped bearing surfaces. The swivel jack based must be braced for the lateral shear force component using a 4:1 safety factor
Transfer beams

Bearing pads

Wood built up bearing pads shall be designed to transfer loads from the screw jack base to the finished grade.
The wood bearing pads shall bear on a compacted non frost susceptible granular bed specified by the geotechnical engineer.
Geotechnical engineer shall determine the SLS and ULS bearing capacity of the bearing strata.
The bearing pad shall be sized to suit the specified bearing capacity

6. Cladding

The cladding of the entire outside perimeter of the scaffold system shall be a weather tight tension enclosure system .
The tarp shall be 10 mils high strength reinforced polyethylene and resist tears or punctures from wind loading.
Material shall be flame retardant and UV treated.
The tarp shall be tensioned and connected to each standard along the height and at intervals to uniformly distribute wind loads to scaffold system.
The system shall have interlocking modular panels with internal connections at the standards to maintain a continuous weather seam. The material must be impermeable. The tarps shall be white and allow 30% minimum light transmission.

7. Working platforms

Working platforms shall be either pre-manufactured scaffold deck units or laminated veneer wood planks, or a combination there of.
The working platforms shall be installed at levels specified on drawings, installed up to 150 mm (6")away from the existing façade.
The platforms shall be installed to ensure continuous access between areas of works.
Platform installation shall ensure there are no tripping hazards between joints.
A 235mm (9 ½") toe board shall be provide at the outside edge of the scaffold enclosure.

Maximum allowable platform load must be determined form either platform material strength and deflection criteria or load capacity of ledger whichever is less.

8. Roof Platform

Roof platforms shall be either pre-manufactured scaffold deck units or laminated veneer wood planks, or a combination there of. The roof shall be sloped to accommodate drainage. Roofing materials shall be applied to roof structure as specified by project architect.

9. Transfer Beams

Structural steel transfer beams shall be provided to span over areas specified on drawings, such as the West Pavilion entrance vestibule. The Beams shall be designed to strength shear and torsion loads of the superimposed scaffold point load reactions with a maximum total load deflection of l/240.
Structural steel support columns shall be designed to support transfer beams down to foundation pads sized to the specified SLS and ULS bearing

10. Side brackets

Side brackets with 880mm (2'-11") or 650 mm (2'-2") may be used, cantilevered from rosette of standards to access up to façade where appropriate.
Side brackets shall be designed to support superimposed platform dead and live loads

11. Push pull ties

The scaffold system shall be laterally supported on to the building with pipe and clamp to support compressive loads and with wire of an appropriate gauge tied to scaffold standards and anchored to mortar joints of building.
The push pull ties shall be designed to accommodate lateral reaction from wind and seismic loads in accordance with design loads specified.
Appropriate care must be taken to not damage stone work. Patching of hole once ties removed shall match mortar to the approval of the project architect.
If a tie has to be removed to accommodate work on the existing façade, provide additional ties in adjacent areas to accommodate superimposed lateral loads.
Note that lateral ledger beams may be required to span across work areas. The concentrated load at ends of these legers may require more multiple push pull ties to accommodate respective reaction.

SCAFFOLD LEGEND

1. Ledger: 5' = 5'-2" (1.57m) length, 7' = 7'-0" (1.83m) length, 10' = 10'-2" (3.05m) length. Design ledgers for superimposed specified design loads & self weight. Double ledger for bearing platforms for 7' & 10' bays.
2. Standards: length to suit. Pipe & rosettes @ 0.5m (1'-8"). Design standards to suit for accumulated platforms self weight, live load @ specified levels. (in plan) (in elevation)
3. Pipe & Clamp: length to suit. Design pipe & clamp to support specified design loads & self weight.
4. Brace: Lateral bracing to support reaction of superimposed wind & seismic load reactions in accordance with loads prescribed by The Ontario Building Code.
5. Screw Jack Base typical to all standards. Sill Plates to accommodate reactions to suit USL and ULS bearing capacity of soil.
6. Cladding material to scaffold system to support wind loads prescribed by The Ontario Building Code.
7. Extent of scaffold planking. Working platform designed to support design loads specified.
8. Roof platform designed to support specified design loads including snow, wind uplift, roofing materials & mechanical equipment.
9. Transfer beams provided to span over areas specified. Designed to strength shear and torsion loads of the superimposed scaffold point load reactions with a maximum total load deflection of 1/240.
10. Side brackets with 880mm (2'-11") or 650 mm (2'-2") may be used, cantilevered from rosette of standards to access up to façade where appropriate. Side brackets shall be designed to support superimposed platform dead and live loads.
11. Push-Pull tie designed to laterally support the scaffold system. Location of ties to be located as to avoid any windows/building features which should not be compromised. Provide at each standard horizontal & 4.5m (15'-0") maximum vertically.

SUPERIMPOSED DESIGN LOADING

All components of the scaffold system shall support self weight of the Roof, Tarp, Decking, Standards, Ledgers and Braces. As well as the following live loads.

Access Platforms

Workers + Materials: 2.4 kPa (50 psf) across access platform deck for a maximum of 3 vertically aligned levels.

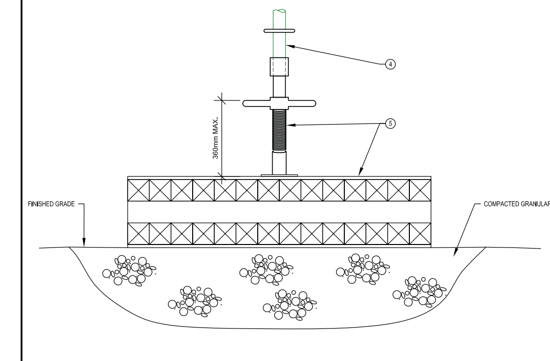
Roofs

Snow load: Snow/Rain load calculated in accordance with OBC 4.1.6.2. with appropriate snow drift
$S = Is[Ss(Cb\ Cw\ Cs\ Ca) + Sr]$

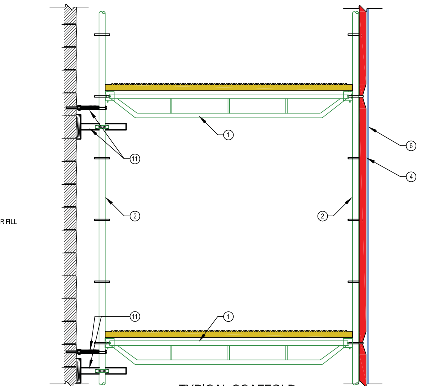
Lateral Loads

Wind: Wind calculated in accordance with OBC 4.1.7.
$p = Iw\ q\ Ce\ Cg\ Cp$

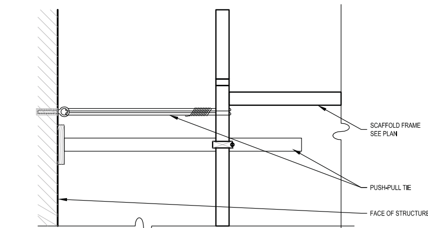
Seismic: Seismic calculated in accordance with OBC 4.1.8.11.
$V = S(Ta)\ Mv\ Ie\ W/Rd\ Ro$



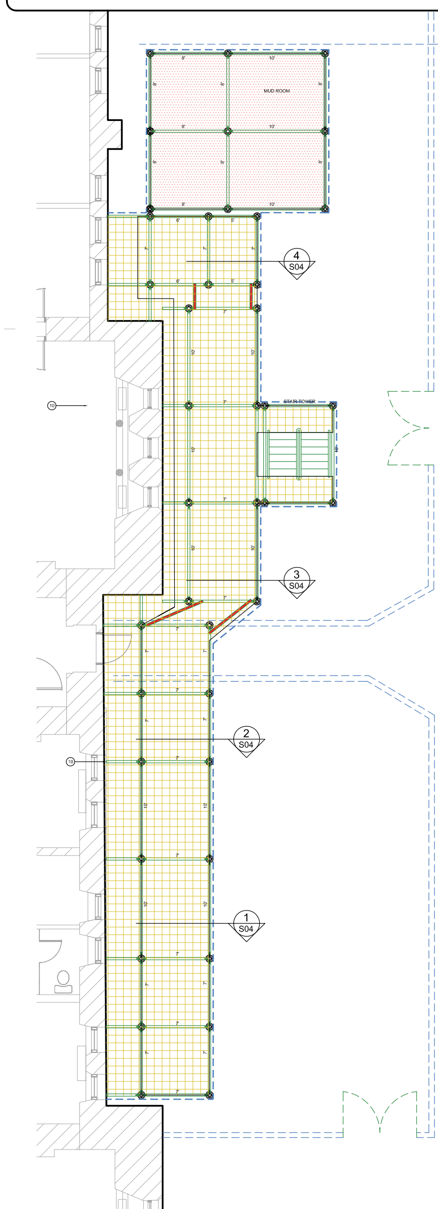
A SCAFFOLD BASE DETAIL
1 : 10



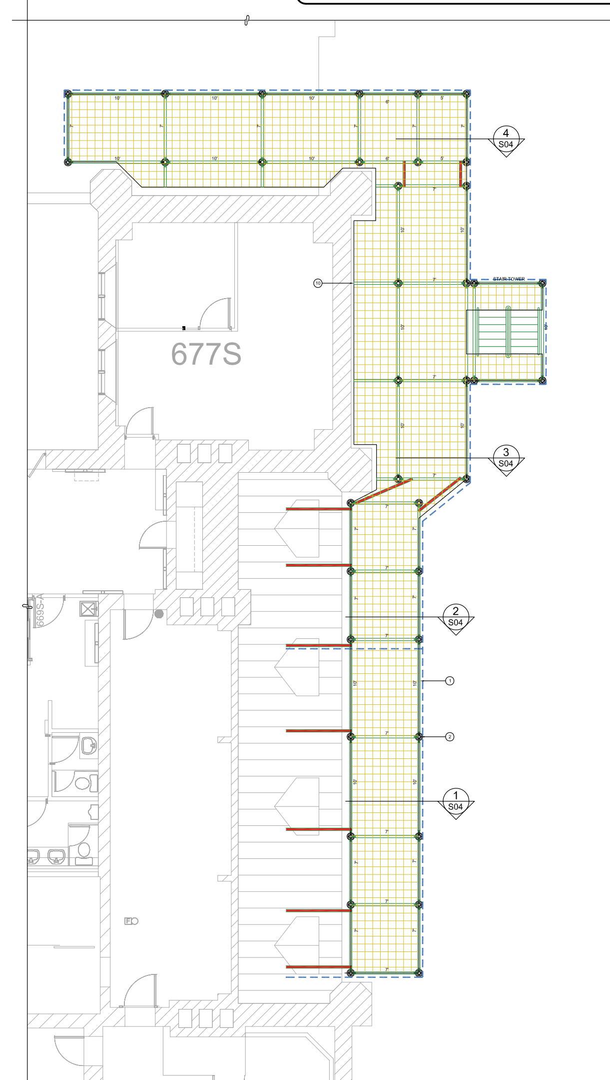
B TYPICAL SCAFFOLD SECTION
1 : 10



C TYPICAL TIE-BACK DETAIL
N.T.S.



1 S02 EAST PAVILLION 1st to 6th PLAN
1 : 75



2 S02 EAST PAVILLION 7th to 12th PLAN
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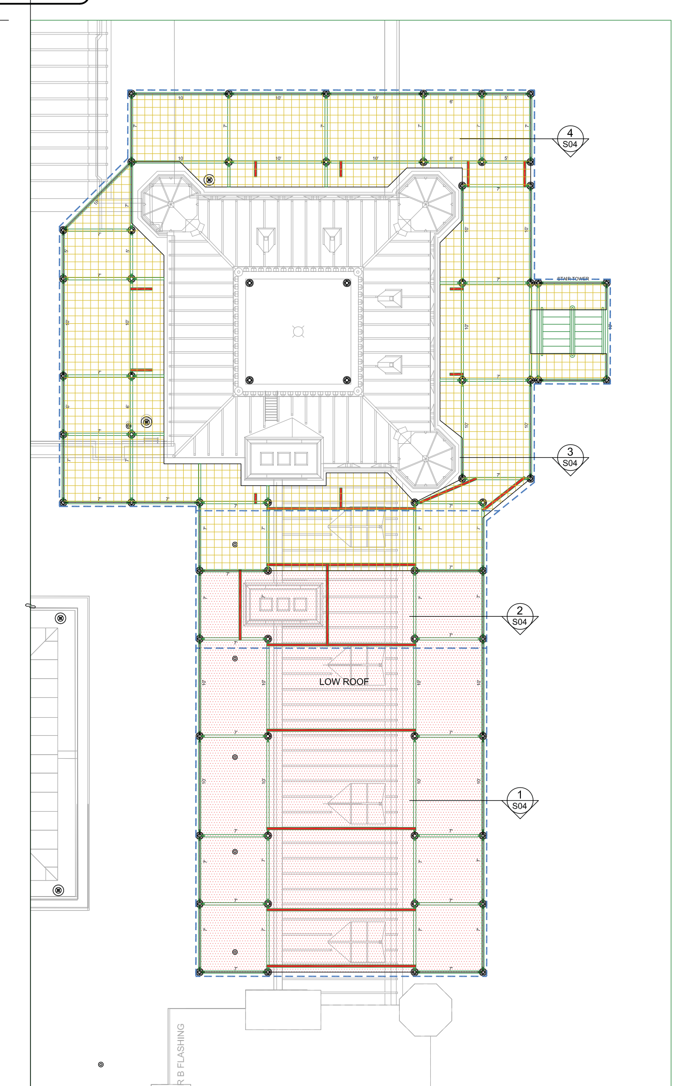

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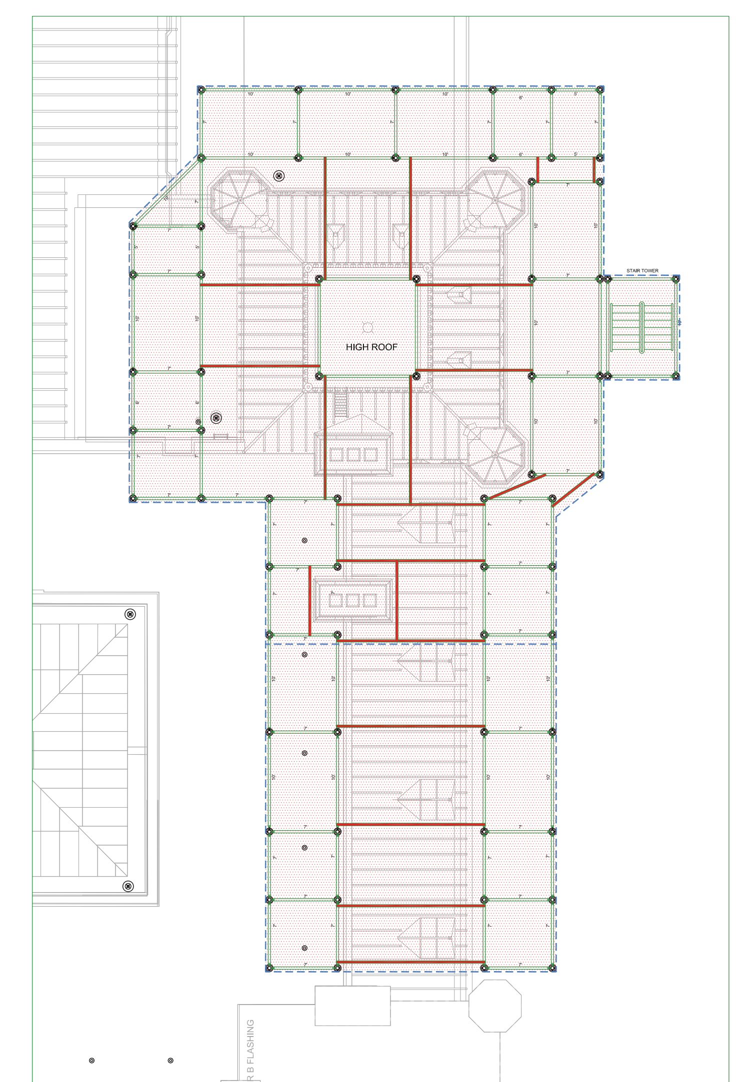

4 S02 EAST PAVILLION 18th PLAN
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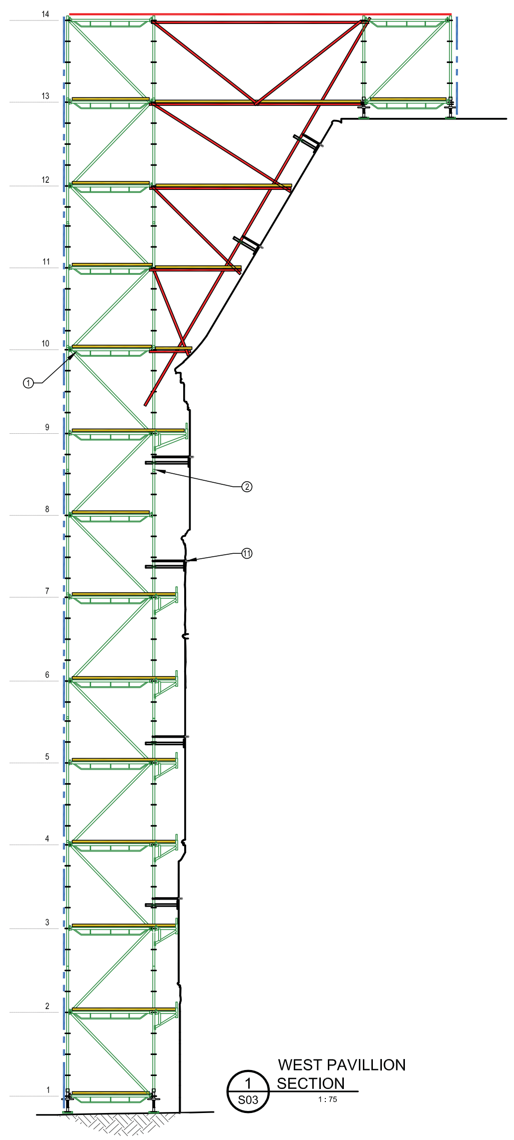

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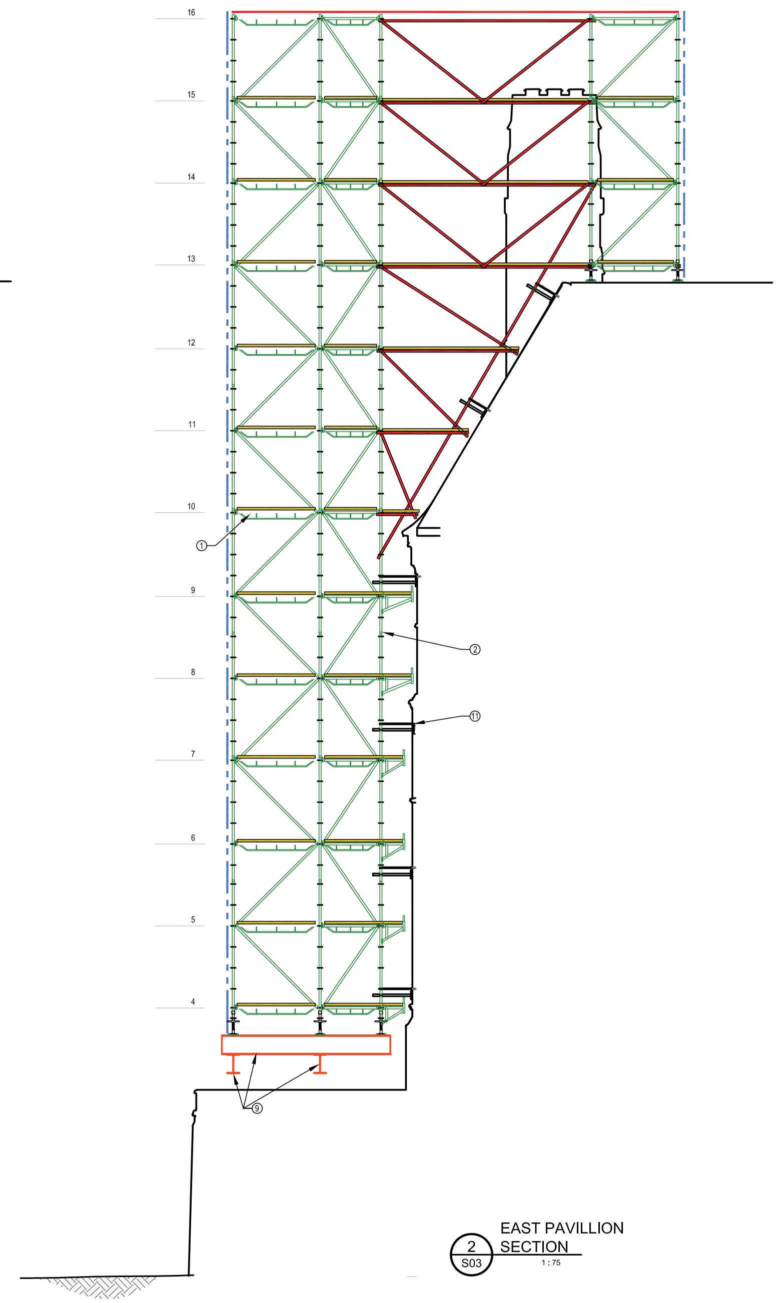

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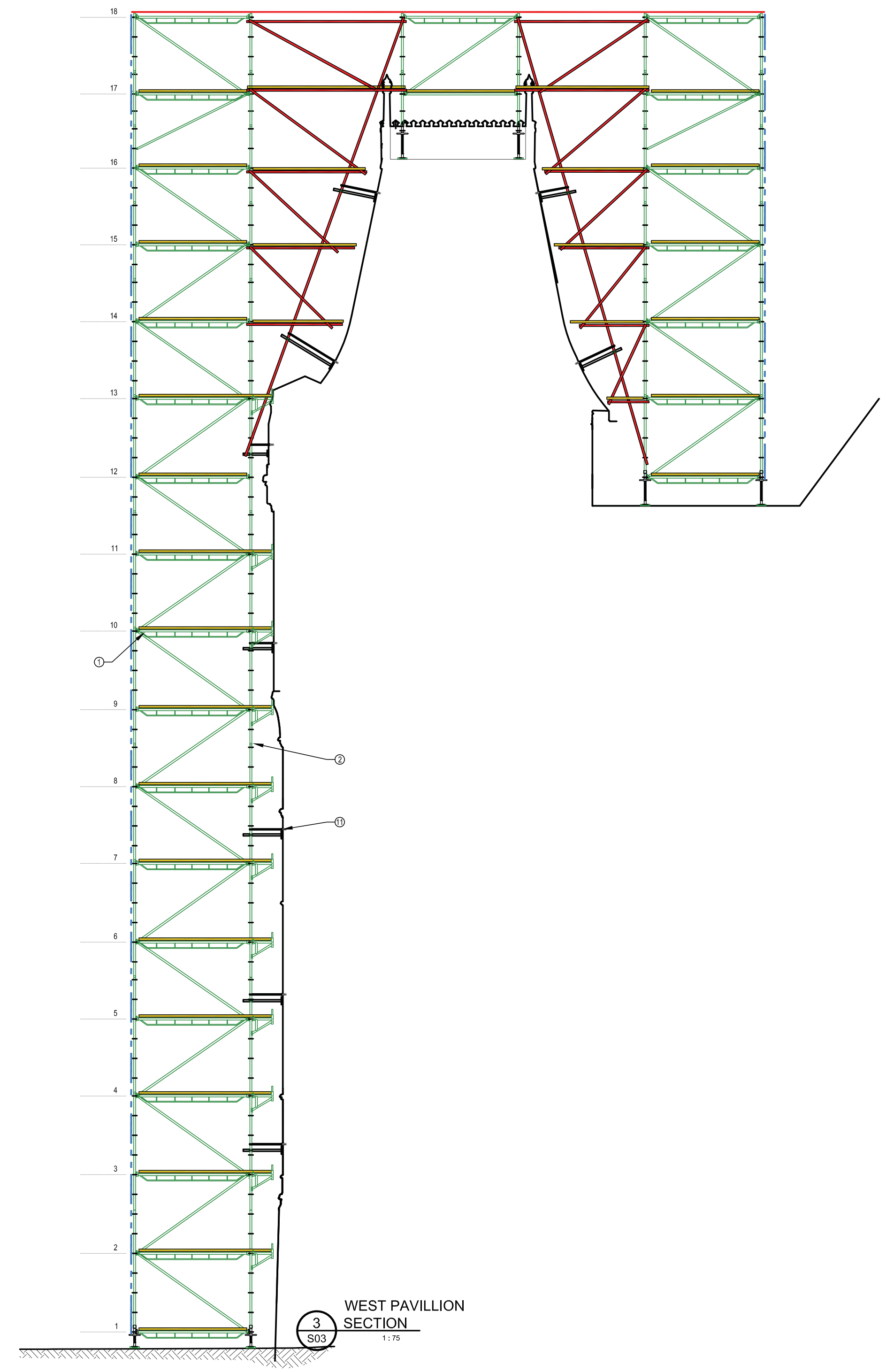

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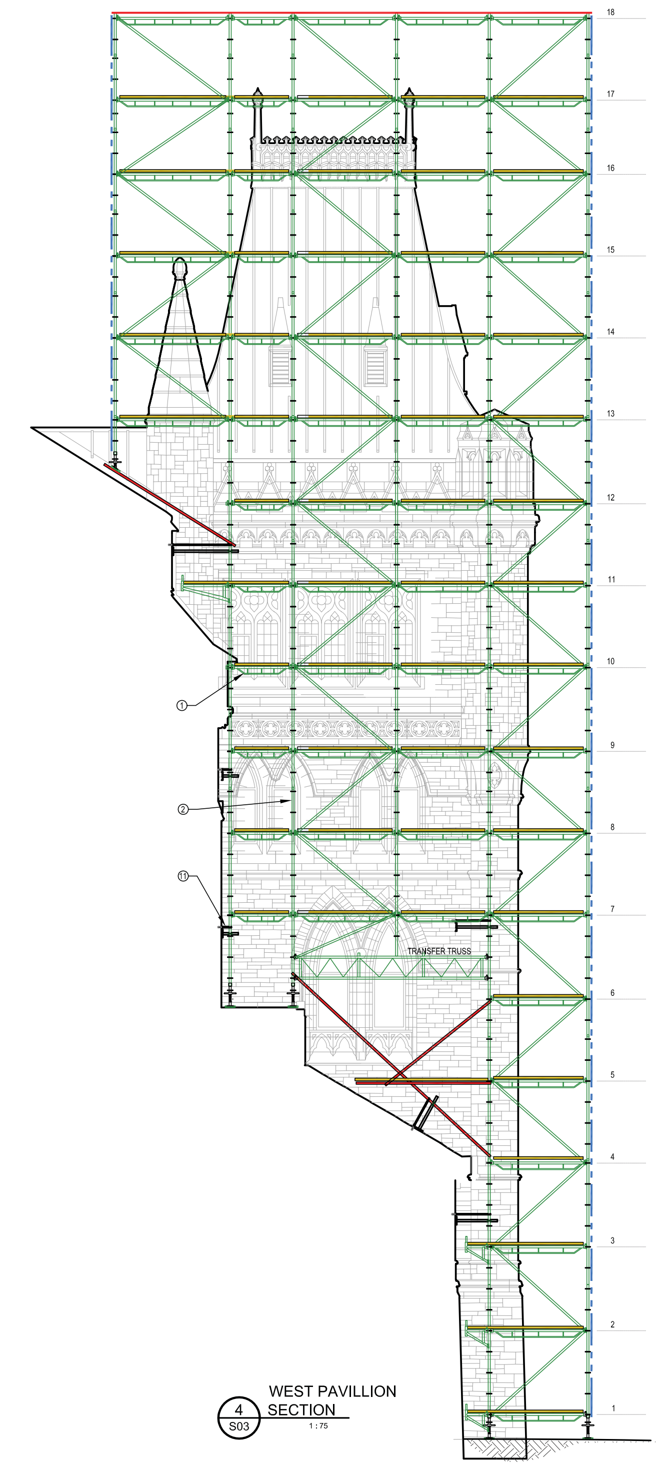

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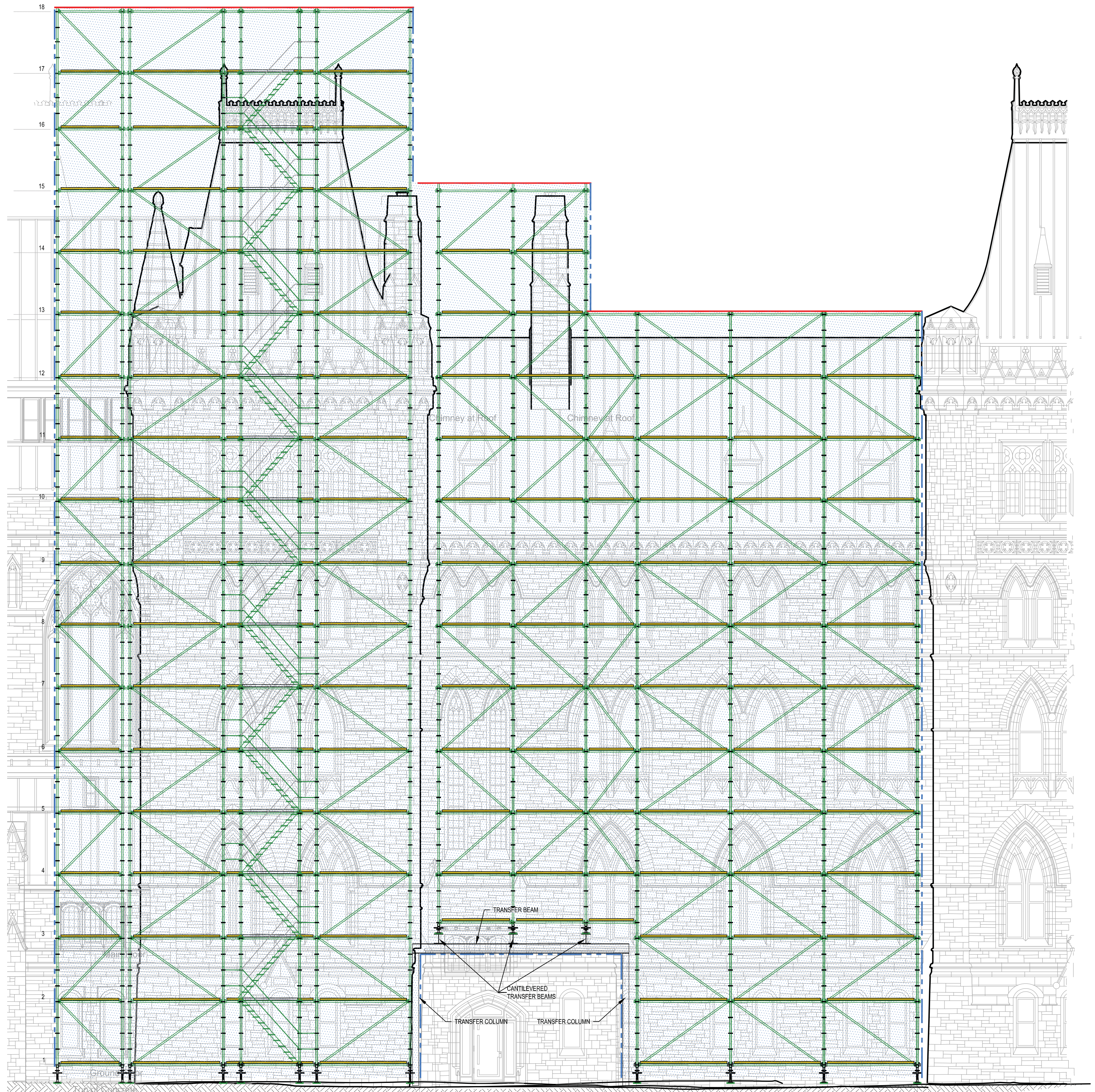

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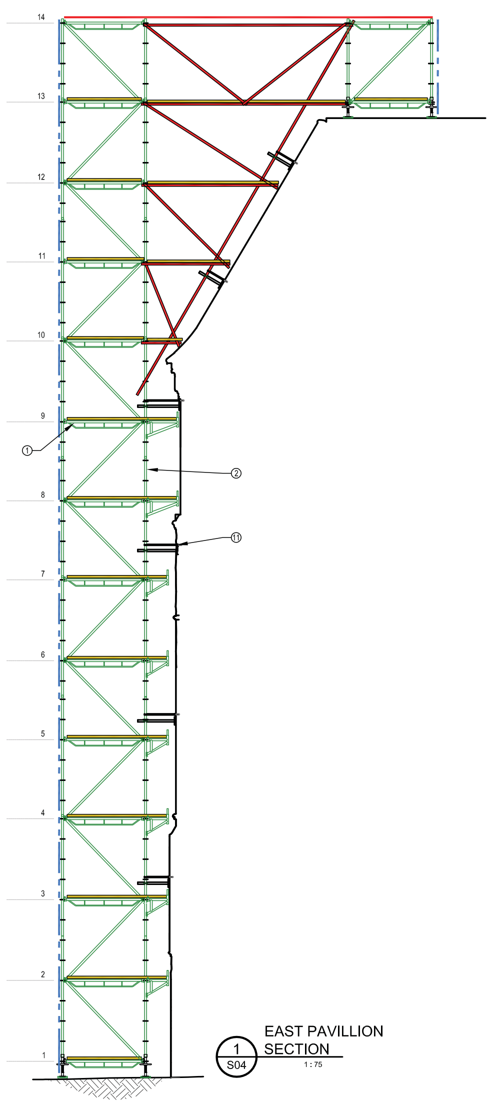
S03A
WEST PAVILLION SCAFFOLD ELEVATION
1 : 75



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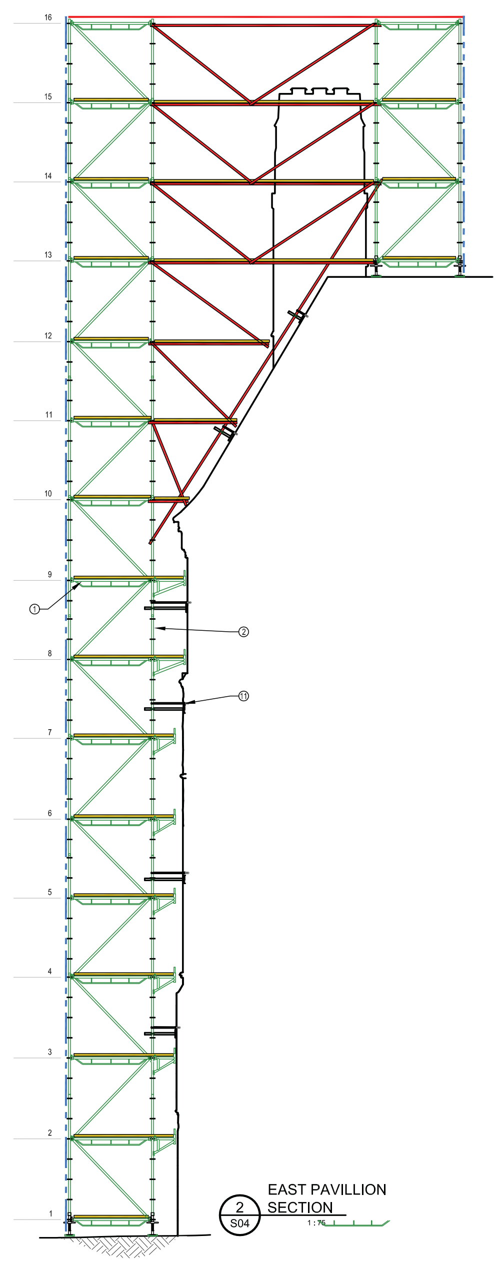

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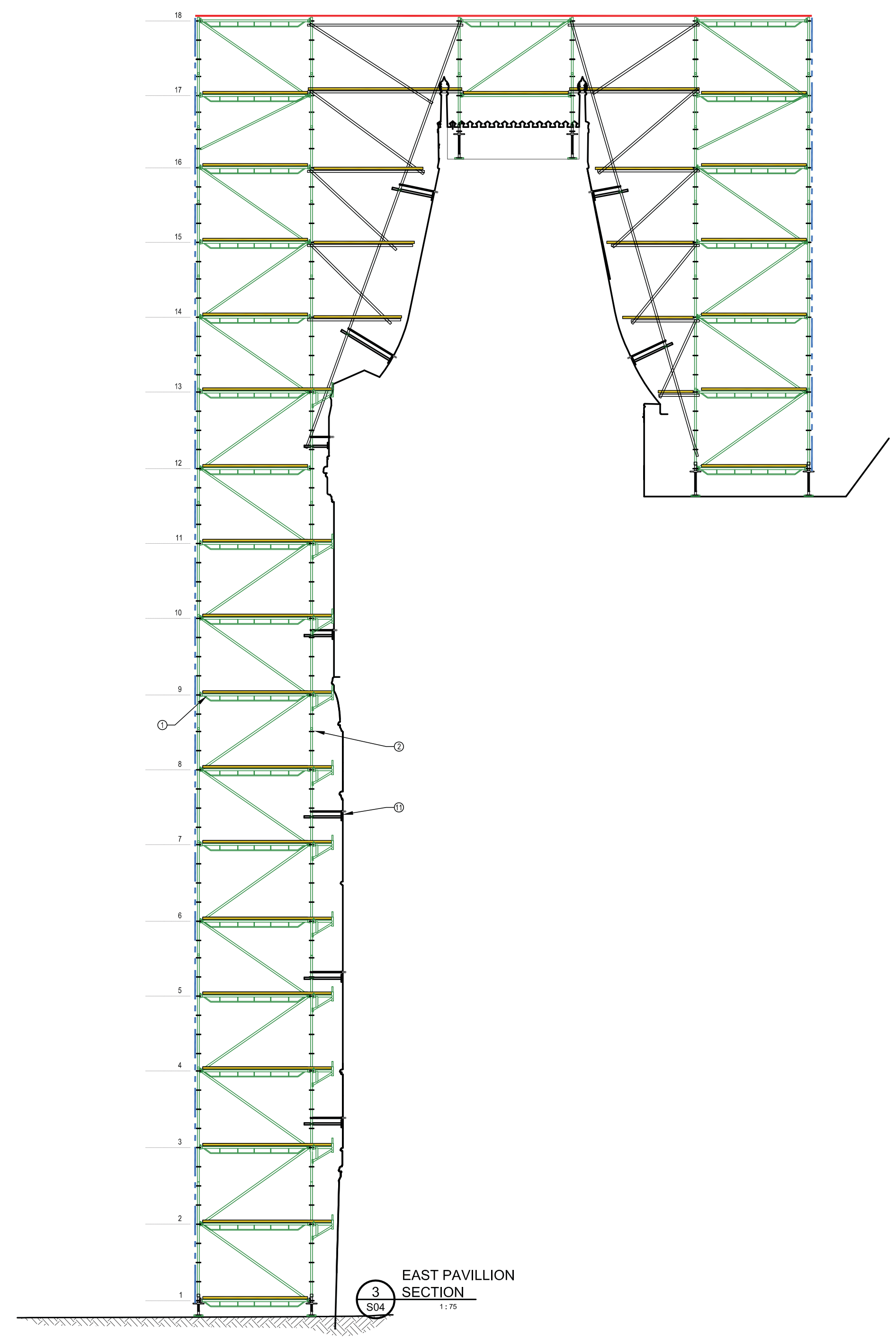

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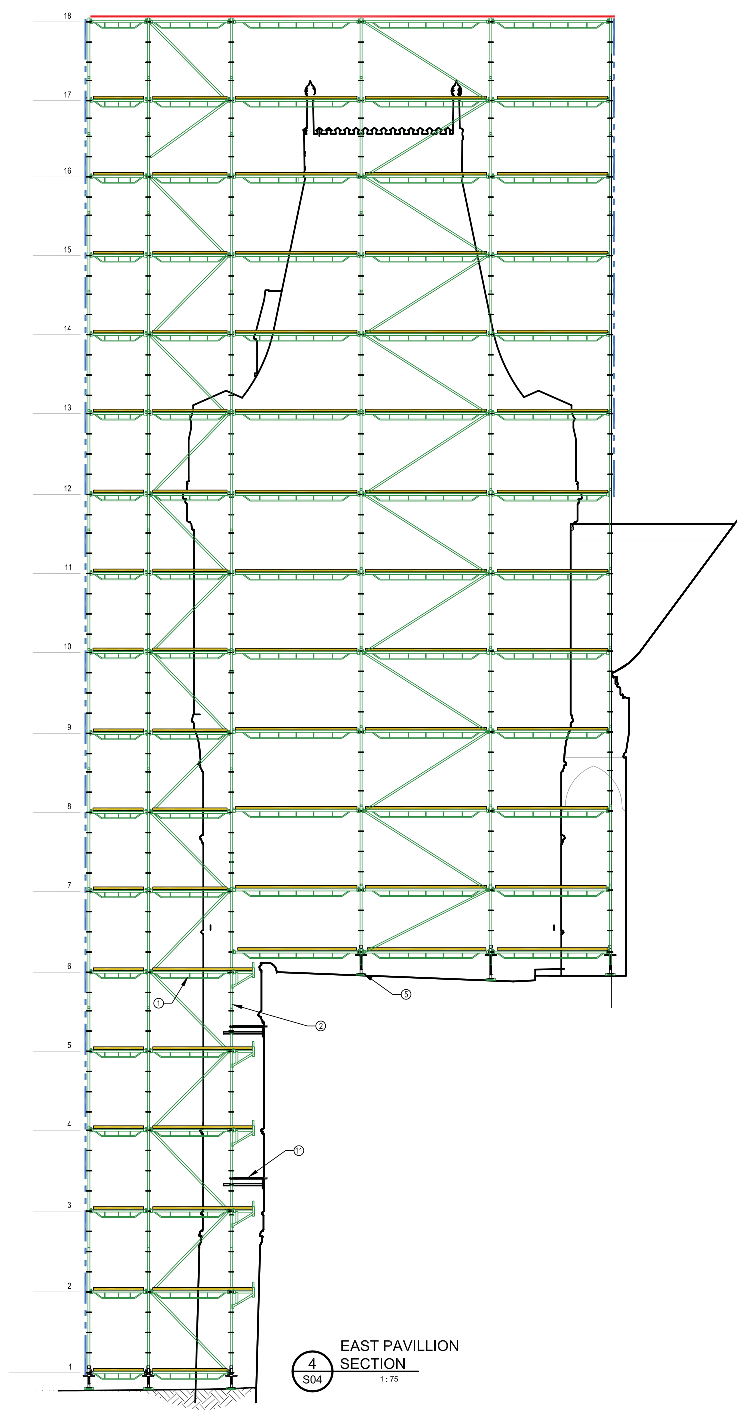

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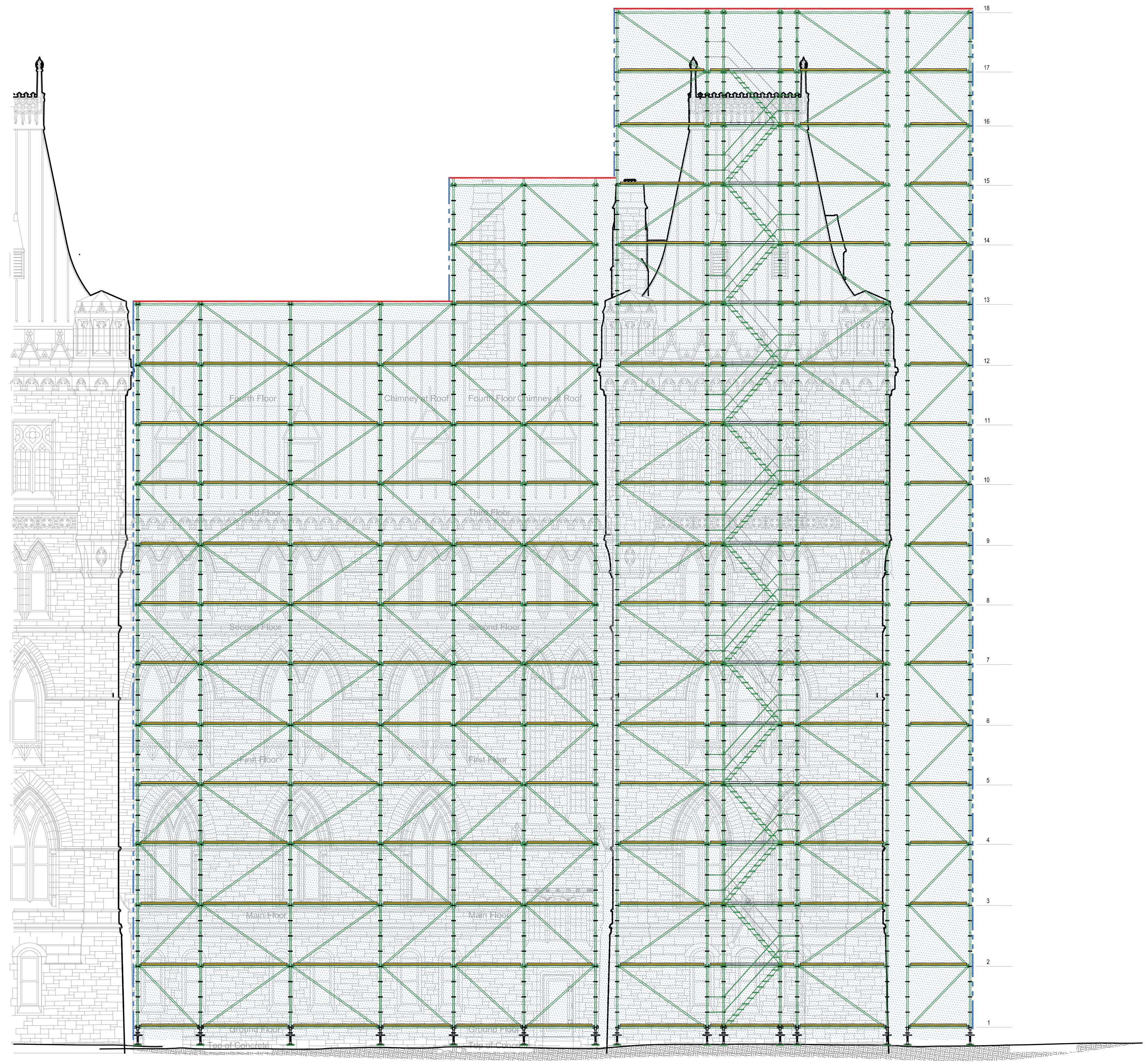

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WEST PAVILLION SCAFFOLD ELEVATION
1 : 75

APPENDIX VII
CONSTRUCTION BUDGET ESTIMATE - CLASS B

CENTRE BLOCK
EAST & WEST PAVILION REHABILITATION
OTTAWA, ONTARIO

CLASS 'B' ESTIMATE

June 5, 2013

Hanscomb

CENTRE BLOCK
EAST & WEST PAVILION REHABILITATION
OTTAWA, ONTARIO

CLASS 'B' ESTIMATE

Prepared For:

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June 5, 2013

PROJECT NUMBER: Ott-4798

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Appendices

1. INTRODUCTION

1.1 Purpose: This Class 'B' Estimate is intended to provide a realistic allocation of direct and indirect construction costs for the Centre Block, East & West Pavilion Rehabilitation, located in Ottawa, Ontario, with exceptions of items listed in 1.5 below.

1.2 Description: This is the rehabilitation of the Centre Block East & West Pavilion includes the following work; conservation of the foundation, exterior masonry, roof, attic space, windows, structural integrity; limited seismic upgrade, adjustments to mechanical & electrical systems where the conservation work affects the mechanical & electrical systems and scaffolding to provide working platform to perform the required work. .

1.3 Methodology: From the documentation and information provided, quantities of all major elements were assessed or measured where possible and priced at rates considered competitive for a project of this type under a stipulated lump sum form of contract in Ottawa, Ontario.

Pricing shown reflects probable construction costs obtainable in the Ottawa, Ontario area on the effective date of this report. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the work.

1.4 Specifications: For building components and systems where specifications and design details are not available, quality standards have been established based on discussions with the design team.

1. INTRODUCTION

1.5 Exclusions: This Class 'B' Estimate does not provide for the following, if required:

- Legal fees and expenses
- Financing or fund raising costs
- Owner's staff and associated management
- Relocation of existing facilities, including furniture and equipment
- Professional fees and expenses
- Cost of contaminated material removal, if required
- Overtime working hours allowance
- Cash allowances
- Phased construction premiums
- Construction contingency
- Preventative maintenance contracts
- Building permit
- Harmonized Sales Tax

2. DOCUMENTATION

This Class 'B' Estimate has been prepared from the following documentation:

- Design Development report dated May 2013

All of the above documentation was received from FGMDA and was supplemented with information gathered in meeting(s) and telephone conversations with the design team, as applicable.

Design changes and/or additions made subsequent to this issuance of the documentation noted above have not been incorporated in this report.

3. COST CONSIDERATIONS

3.1 Cost Base:

All costs are estimated on the basis of competitive bids (a minimum of six (6) general contractor bids and at least four (4) sub-contractor bids for each trade) being received in June 2013 from general contractors and all major sub-contractors and suppliers based on a stipulated lump sum form of contract.

If the minimum contractor/sub-contractor conditions are not met, the bids received could exceed the estimate.

3.2 Escalation:

A contingency of 2.0% has been included for construction cost escalation that may occur between June 2013 and the anticipated bid date of January 2014 for the project. Escalation during the construction period is included in the unit rates used in the estimate.

3.3 Contingencies:

A contingency of 7.0% has been included to cover design and pricing unknowns. This contingency is not intended to cover any program space modifications but rather to provide some flexibility for the designers and cost planners during the remaining contract document stages.

No contingency has been included to cover construction (post contract) unknowns. It is recommended that a provision for this item be included in the overall program budget.

3.4 Unit Rates:

The unit rates in the preparation of this Class 'B' Estimate include labour and material, equipment, subcontractor's overheads and profits.

3.5 Taxes:

No provision has been made for the Harmonized Sales Tax. It is recommended that the owner make separate provision for HST in the project budget.

3.6 Statement of Probable Costs:

Hanscomb has no control over the cost of labour and materials, the contractor's method of determining prices, or competitive bidding and market conditions. This opinion of probable cost of construction is made on the basis of experience, qualifications and best judgment of the professional consultant familiar with the construction industry. Hanscomb cannot and does not guarantee that proposals, bids or actual construction costs will not vary from this or subsequent cost estimates.

Hanscomb has prepared this estimate in accordance with generally accepted principles and practices. Hanscomb's staff is available to discuss its contents with any interested party.

3.7 Ongoing Cost Control:

Hanscomb recommends that the Owner and design team carefully review this document, including line item description, unit prices, clarifications, exclusions, inclusions and assumptions, contingencies, escalation and mark-ups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the next design phase.

Requests for modifications of any apparent errors or omissions to this document must be made to Hanscomb within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

It is recommended that a final update estimate be produced by Hanscomb using Bid Documents to determine overall cost changes which may have occurred since the preparation of this estimate. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. Hanscomb cannot reconcile bid results to any estimate not produced from bid documents including all addenda.

4. AFFECTED CLADDING AREA

AFFECTED CLADDING AREA:

Description	m2
East Pavilion	791
West Pavilion	746
TOTAL	**1,537**

The above areas have been measured in accordance with the third edition of the Canadian Institute of Quantity Surveyors' "Measurement of Buildings by Area and Volume".

5. CONSTRUCTION COST ESTIMATE SUMMARY

COST SUMMARY:

-	New Construction	$4,642,700
-	Site Development	$400,000
-	Ancillary Work	$1,845,400
	Total- Including Site	**$6,888,100**
-	General Requirements & Fee	$1,239,900
-	Off Hours Premium	$812,800
	Total- Excluding Contingencies	**$8,940,800**
-	Design and Pricing Allowance	$625,900
-	Escalation Allowance	$191,300
-	Construction Allowance	$0
	Total- Including Contingencies	**$9,758,000**
-	Harmonized Sales Tax	$0
	Total Construction Estimate	**$9,758,000**

Appendix

A - Elemental Cost Comparison

Project : **Centre Block East & West Pavilions**
: **Restoration**
Location : **Ottawa, Ontario**
Owner : **PWGSC**
Client : **FGMDA**

COMPARISON COST SUMMARY

Report Date: **June 5, 2013**

Element	Class C Estimate Option 1 March 7, 2013 — Elemental Amount		Class B Estimate June 5, 2013 — Elemental Amount		Variance	
	Sub-total	Total	Sub-total	Total	Sub-total	Total
A SHELL		**2,895,500**		**3,546,800**		**651,300**
A1 SUBSTRUCTURE		**134,500**		**138,800**		**4,300**
A11 Foundations	134,500		138,800		4,300	
A12 Basement Excavations	0		0		0	
A13 Special Conditions	0		0		0	
A2 STRUCTURE		**0**		**0**		**0**
A21 Lowest Floor Construction	0		0		0	
A22 Upper Floor Construction	0		0		0	
A23 Roof Construction	0		0		0	
A3 EXTERIOR CLADDING		**2,761,000**		**3,408,000**		**647,000**
A31 Walls Below Grade	7,600		7,600		0	
A32 Walls Above Grade	1,815,000		2,206,000		391,000	
A33 Windows and Entrances	270,800		290,800		20,000	
A34 Roof Coverings	667,600		855,600		188,000	
A35 Projections	0		48,000		48,000	
B INTERIORS		**75,000**		**75,000**		**0**
B1 PARTITIONS & DOORS		**0**		**0**		**0**
B11 Partitions	0		0		0	
B12 Doors	0		0		0	
B2 FINISHES		**75,000**		**75,000**		**0**
B21 Floor Finishes	0		0		0	
B22 Ceiling Finishes	0		0		0	
B23 Wall finishes	75,000		75,000		0	
B3 FITTINGS & EQUIPMENT		**0**		**0**		**0**
B31 Fittings & Fixtures	0		0		0	
B32 Equipment	0		0		0	
B33 Elevators	0		0		0	
B34 Escalators	0		0		0	
C SERVICES		**325,000**		**1,020,900**		**695,900**
C1 MECHANICAL		**140,000**		**922,900**		**782,900**
C11 Plumbing & Drainage	0		135,400		135,400	
C12 Fire Protection	0		123,100		123,100	
C13 HVAC	140,000		664,400		524,400	
C14 Controls	0		0		0	
C2 ELECTRICAL		**185,000**		**98,000**		**-87,000**
C21 Service & Distribution	0		32,000		32,000	
C22 Lighting & Power	0		0		0	
C23 Systems & Ancillaries	185,000		66,000		-119,000	
NET BUILDING COST - EXCLUDING SITE		**$ 3,295,500**		**$ 4,642,700**		**$ 1,347,200**
D1 SITE WORK		**400,000**		**400,000**		**0**
D11 Site Development	400,000		400,000		0	
D12 Mechanical Site Services	0		0		0	
D13 Electrical Site Services	0		0		0	
D2 ANCILLARY WORK		**2,452,800**		**1,845,400**		**-607,400**
D21 Demolition	0		0		0	
D22 Temporary Enclosures	2,452,800		1,845,400		-607,400	
NET BUILDING COST - INCLUDING SITE		**$ 6,148,300**		**$ 6,888,100**		**$ 739,800**
Z1 GENERAL REQUIREMENTS & FEE		**1,832,200**		**2,052,700**		**220,500**
Z11 General Requirements & Fee	1,106,700		1,239,900		133,200	
Z12 Off Hours Premium	725,500		812,800		87,300	
TOTAL EXCLUDING CONTINGENCIES		**$ 7,980,500**		**$ 8,940,800**		**$ 960,300**
Z2 ALLOWANCES		**1,061,500**		**817,200**		**-244,300**
Z21 Design contingency	798,100		625,900		-172,200	
Z22 Escalation contingency	263,400		191,300		-72,100	
Z23 Construction contingency	0				0	
TOTAL INCLUDING CONTIGENCIES		**$ 9,042,000**		**$ 9,758,000**		**$ 716,000**
__ HARMONIZED SALES TAX EXCLUDED		**0**		**0**		**0**
__ Harmonized Sales Tax	0		0		0	
TOTAL CONSTRUCTION ESTIMATE		**$ 9,042,000**		**$ 9,758,000**		**$ 716,000**

Gross Floor Area	1,537 m2	1,537 m2	- m2
Rate Per m2	$ 5,882.89 m2	$ 6,348.73 m2	$ 465.84 m2

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Appendix

B - Detailed Elemental Cost Estimate

Project	: **Centre Block East & West Pavilions**		Report date : 5 Jun 2013
	: **Rehabiliation**		Page No. : 1
Location	: **Ottawa, Ontario**	**ELEMENTAL COST SUMMARY**	Bldg Type : 313
Owner	: **PWGSC**		C.T. Index : 0.0
Consultant	: **FGMDA**		GFA : 1,537 m2

Element	Ratio	Elemental Cost		Elemental Amount		Rate per m2		%
	to GFA	Quantity	Unit rate	Sub-Total	Total	Sub-Total	Total	
A SHELL		1,537 m2			3,546,800		2,307.61	39.7
A1 SUBSTRUCTURE					138,800		90.31	1.6
A11 Foundations	0.080	125 m2	1,110.00	138,800		90.31		
A12 Basement Excavation				0		0.00		
A13 Special Conditions				0		0.00		
A2 STRUCTURE					0		0.00	0.0
A21 Lowest Floor Construction				0		0.00		
A22 Upper Floor Construction				0		0.00		
A23 Roof Construction				0		0.00		
A3 EXTERIOR ENCLOSURE					3,408,000		2,217.31	38.1
A31 Walls Below Grade	0.010	19 m2	400.00	7,600		4.94		
A32 Walls Above Grade	0.870	1,340 m2	1,646.00	2,206,000		1,435.26		
A33 Windows & Entrances	0.130	197 m2	1,476.00	290,800		189.20		
A34 Roof Coverings	0.380	586 m2	1,460.00	855,600		556.67		
A35 Projections	0.000	1 Sum	48,000.00	48,000		31.23		
B INTERIORS		1,537 m2			75,000		48.80	0.8
B1 PARTITIONS & DOORS					0		0.00	0.0
B11 Partitions				0		0.00		
B12 Doors				0		0.00		
B2 FINISHES					75,000		48.80	0.8
B21 Floor Finishes				0		0.00		
B22 Ceiling Finishes				0		0.00		
B23 Wall Finishes	0.000	1 Sum	75,000.00	75,000		48.80		
B3 FITTINGS & EQUIPMENT					0		0.00	0.0
B31 Fittings & Fixtures				0		0.00		
B32 Equipment				0		0.00		
B33 Elevators				0		0.00		
B34 Escalators				0		0.00		
C SERVICES		1,537 m2			1,020,900		664.22	11.4
C1 MECHANICAL					922,900		600.46	10.3
C11 Plumbing & Drainage	0.000	1 Sum	135,400.00	135,400		88.09		
C12 Fire Protection	0.000	1 Sum	123,100.00	123,100		80.09		
C13 HVAC	0.000	1 Sum	664,400.00	664,400		432.27		
C14 Controls				0		0.00		
C2 ELECTRICAL					98,000		63.76	1.1
C21 Service & Distribution	0.000	1 Sum	32,000.00	32,000		20.82		
C22 Lighting, Devices & Heating				0		0.00		
C23 Systems & Ancillaries	0.000	1 Sum	66,000.00	66,000		42.94		
NET BUILDING COST - EXCLUDING SITE				**$**	**4,642,700**		3,020.62	51.9
D SITE & ANCILLARY WORK		1,537 m2			2,245,400		1,460.90	25.1
D1 SITE WORK					400,000		260.25	4.5
D11 Site Development	0.000	1 Sum	400,000.00	400,000		260.25		
D12 Mechanical Site Services				0		0.00		
D13 Electrical Site Services				0		0.00		
D2 ANCILLARY WORK					1,845,400		1,200.65	20.6
D21 Demolitions				0		0.00		
D22 Temporary Enclosures	1.000	1,537 m2	1,201.00	1,845,400		1,200.65		
NET BUILDING COST - INCLUDING SITE				**$**	**6,888,100**		4,481.52	77.0
Z1 GENERAL REQUIREMENTS & FEE					2,052,700		1,335.52	23.0
Z11 General Requirements & Fee		18.0 %		1,239,900		806.70		
Z12 Off Hours		10.0 %		812,800		528.82		
TOTAL CONSTRUCTION ESTIMATE - EXCLUDING ALLOWANCES				**$**	**8,940,800**		5,817.05	100.0
Z2 ALLOWANCES					817,200		531.69	
Z21 Design & Pricing Allowance		7.0 %		625,900		407.22		
Z22 Escalation Allowance		2.0 %		191,300		124.46		
Z23 Construction Allowance		0.0 %		0		0.00		
TOTAL CONSTRUCTION ESTIMATE - INCLUDING ALLOWANCES				**$**	**9,758,000**		6,348.73	
_ **VALUE ADDED TAX (GST/HST)**					0		0.00	
__ Value Added Tax (GST/HST)		0.0 %		0		0.00		
TOTAL CONSTRUCTION ESTIMATE				**$**	**9,758,000**	**$**	**6,348.73**	

CLASS 'B' ESTIMATE

Hanscomb

A1 SUBSTRUCTURE		Quantity	Unit rate	Amount	Trade
A11 Foundations					
1	Repairs to existing concrete foundations	125 m2	250.00	31,250	
2	Patch & fill cracks in the concrete wall	12 m2	361.00	4,330	
3	Damp proofing to concrete walls c/w parging and drainage board	125 m2	115.00	14,380	
4	Perimeter drainage c/w granular cover	50 m	75.00	3,750	
5	Excavation to provide access to foundations c/w premium for working next to existing building	315 m3	175.00	55,130	
6	Backfill with free draining material	315 m3	95.00	29,930	
A11 Foundations	**TOTAL : $**	125 m2	1,110.40	138,800	

A3 EXTERIOR ENCLOSURE	Quantity	Unit rate	Amount	Trade
A31 Walls Below Grade				
1 Rake existing joints, finish pointing and backpointing	19 m2	400.00	7,600	
A31 Walls Below Grade **TOTAL : $**	19 m2	400.00	7,600	

A3 EXTERIOR ENCLOSURE		Quantity	Unit rate	Amount	Trade
A32 Walls Above Grade					
1	Rake existing joints, finish pointing and backpointing	1,340 m2	400.00	536,000	
2	Dismantle and rebuild exterior wall	289 m2	1,200.00	346,800	
3	Localize repairs of exterior wall	202 m2	350.00	70,700	
4	Temporary stabilization of masonry window jambs including consolidation, surface repairs and poulticing	106 no.	350.00	37,100	
5	Corner reinforcements in turrets and pinnacle	75 no.	650.00	48,750	
6	Dismantle and rebuild chimney and tops of turrets & pinnacle c/w replacement of concrete brick back wall with stone	10 no.	45,000.00	450,000	
7	Structural reinforcement in top of turrets and pinnacle	6 no.	2,000.00	12,000	
8	Allowance for protective flashing over selected protruding band courses	1 sum	50,000.00	50,000	
9	Masonry cleaning of heavy efflorescence	21 m2	130.00	2,730	
10	Masonry cleaning of heavy ferric staining	5 m2	174.00	870	
11	Masonry cleaning of heavy copper staining	4 m2	174.00	700	
12	Masonry cleaning of heavy organic growth	4 m2	50.00	200	
13	Masonry cleaning of heavy mortar staining	4 m2	130.00	520	
14	Allowance for stabilization of exterior load bearing walls	1,340 m2	150.00	201,000	
15	Allowance for repairs to carved and sculptural elements	1 sum	150,000.00	150,000	
			Carried Forward :	1,907,370	

A3 EXTERIOR ENCLOSURE	Quantity	Unit rate	Amount	Trade
A32 Walls Above Grade (Continued)		**Brought Forward :**	1,907,370	
16 Allowance for a contractor's conservator	1 sum	150,000.00	150,000	
17 Allowance for supply of replacement stone c/w shipping, customs, taxes and brokerage	76 m3	1,954.10	148,510	
- Berea stone	71 m3	1,905.00	135,255	
- Nepean stone	5 m3	2,650.00	13,250	
A32 Walls Above Grade **TOTAL : $**	1,340 m2	1,646.19	2,205,900	

A3 EXTERIOR ENCLOSURE	Quantity	Unit rate	Amount	Trade
A33 Windows & Entrances				
1 Repairs to existing aluminum windows in-situ	128 m2	850.00	108,800	
2 Repairs to existing steel and leaded windows in-situ	59 m2	1,750.00	103,250	
3 Repairs to existing steel windows in-situ	2 m2	850.00	1,700	
4 Remove existing windows and replace with steel windows	8 m2	2,500.00	20,000	
5 Replacement of office window panes with new temporary panes with sealed collars for ventilation and reinstall at end of project	57 no.	1,000.00	57,000	
A33 Windows & Entrances **TOTAL : $**	197 m2	1,476.14	290,800	

A3 EXTERIOR ENCLOSURE		Quantity	Unit rate	Amount	Trade
A34 Roof Coverings					
1	Remove and replace copper roofing and flashing	445 m2	1,750.00	778,750	
2	38mm insulation to last	445 m2	45.00	20,030	
3	Remove and replace existing flat roofing c/w flashing	62 m2	240.00	14,880	
4	Repairs to existing flat roofing along top of copper roofing	79 m2	150.00	11,850	
5	Allowance for localized repairs to roof slab	1 sum	30,000.00	30,000	
A34 Roof Coverings	**TOTAL : $**	586 m2	1,459.90	855,500	

A3 EXTERIOR ENCLOSURE	Quantity	Unit rate	Amount	Trade
A35 Projections				
1 Allowance for ornamental cresting	32 m	1,500.00	48,000	
A35 Projections **TOTAL : $**	1 Sum	48,000.00	48,000	

B2 FINISHES	Quantity	Unit rate	Amount	Trade
B23 Wall Finishes				
1 Allowance for work within the Attic space c/w cleaning & painting of corroded steel, and repairs to damaged/missing fire proofing	1 sum	75,000.00	75,000	
B23 Wall Finishes **TOTAL : $**	1 Sum	75,000.00	75,000	

C1 MECHANICAL		Quantity	Unit rate	Amount	Trade
C11	Plumbing & Drainage				
1	Domestic cold water	1 sum	27,800.00	27,800	
	- 25mm DCW piping	50 m	110.00	5,500	
	- Pipe insulation	1 sum	1,800.00	1,800	
	- Connection to existing DCW piping	1 sum	500.00	500	
	- Distribution piping on scaffolding, allow	1 sum	10,000.00	10,000	
	- Hose bibs, allow	25 no.	400.00	10,000	
2	Domestic hot water	1 sum	16,000.00	16,000	
	- DHW heater for tool washing etc., allow	2 no.	3,000.00	6,000	
	- Allow for piping, connection etc.	1 sum	10,000.00	10,000	
3	Sanitary drainage	1 sum	21,550.00	21,550	
	- 32mm dia sanitary drainage	10 m	135.00	1,350	
	- 75mm dia sanitary drainage	45 m	140.00	6,300	
	- 50mm sanitary vent piping	30 m	200.00	6,000	
	- Extend existing 50mm PRV vent piping	15 m	200.00	3,000	
	- Connection to existing sanitary piping	2 no.	500.00	1,000	
	- Cleanouts	2 no.	200.00	400	
	- Temporary SAN pump station, 151l/s @ 15.3m head, on housekeeping pad	1 no	3,500.00	3,500	
4	Natural gas supply	1 sum	16,000.00	16,000	
	- Relocate gas meter to outside temporary structure	1 sum	1,000.00	1,000	
	- Connection to existing piping	1 sum	2,000.00	2,000	
	- Gas piping	120 m	100.00	12,000	
	- Connection to MUA unit	2 no.	500.00	1,000	
5	Compressed air to scaffolding, allowance	1 sum	50,000.00	50,000	
6	Plumbing & drainage miscellaneous including mobilization, start-up, cleaning, drawings, manuals, tagging, identification, testing & verification	1 sum	4,000.00	4,000	
C11 Plumbing & Drainage	TOTAL : $	1 Sum	135,400.00	135,400	

C1 MECHANICAL		Quantity	Unit rate	Amount	Trade
C12 Fire Protection					
1	Fire department connection	1 sum	18,700.00	18,700	
	- Piping to fire department connection	65 m	220.00	14,300	
	- Relocate fire department simesse head	4 no.	600.00	2,400	
	- Connection to existing piping	4 no.	500.00	2,000	
2	Stand pipe system	1 sum	56,000.00	56,000	
	- 100mm dia stand piping supply to temporary structure	250 m	220.00	55,000	
	- Connection to existing stand pipe	2 no.	500.00	1,000	
3	Modification to wet pipe system	1 sum	15,960.00	15,960	
	- Pendent sprinkler head c/w branch piping, tie into existing etc.	57 no.	280.00	15,960	
4	Dry pipe sprinkler system	1 sum	8,400.00	8,400	
	- Dry valve assemble c/w alarm, valves drain etc.	1 sum	2,000.00	2,000	
	- 50mm dia dry sprinkler piping	40 m	160.00	6,400	
5	Fire extinguishers	30 no.	400.00	12,000	
	- EX c/w hanger, on scaffolding	30 no.	400.00	12,000	
6	Limit smoke movement limiter & provide outdoor vent		alow	5,000	
7	Fire protection miscellaneous including mobilization, start-up, cleaning, drawings, manuals, tagging, identification, testing & verification	1 sum	7,000.00	7,000	
C12 Fire Protection	**TOTAL : $**	1 Sum	123,100.00	123,100	

C1 MECHANICAL		Quantity	Unit rate	Amount	Trade
C13 HVAC					
1	Heat generation & transfer	1 sum	470,000.00	470,000	
	- Gas fired boiler on temporary structure	2 no.	40,000.00	80,000	
	- Glycol transfer loop c/w insulation (east & west)	2 no.	180,000.00	360,000	
	- Force flow heaters (east & west), allow	1 sum	20,000.00	20,000	
	- Allow for miscellaneous valves	1 sum	10,000.00	10,000	
2	Cooling ganeration & transfer	1 sum	34,200.00	34,200	
	- Pinguino type AC unit c/w individual temperature control	57 no.	600.00	34,200	
3	Air distribution	1 sum	147,200.00	147,200	
	- Temporary rooftop MUA unit, MUA-1 & MUA-2 1000cfm max, model RT-65	2 no.	8,000.00	16,000	
	- OA ductwork rectangular, allow	2,250 kg	20.00	45,000	
	- OA/EA ductwork rectangular, allow	1 sum	5,000.00	5,000	
	- Thermal insulation	1 sum	12,800.00	12,800	
	- Typical setup c/w plywood, flex duct, diffuser etc., allow	57 no.	1,200.00	68,400	
4	Seismic restraints	1 sum	5,000.00	5,000	
5	HVAC miscellaneous including mobilization, startup, cleaning, drawings, manuals, tagging, identification, testing & verification	1 sum	8,000.00	8,000	
C13 HVAC	TOTAL : $	1 Sum	664,400.00	664,400	

C2 ELECTRICAL	Quantity	Unit rate	Amount	Trade
C21 Service & Distribution				
1 Service & distribution	1 sum	22,000.00	22,000	
- 50kVA transformer, 120/208V	2 no.	3,500.00	7,000	
- Disconnect, 600V	2 no.	500.00	1,000	
- Panel, 120/208V	2 no.	2,000.00	4,000	
- Feeder, 3#3 awg teck cable	160 m	50.00	8,000	
- Grounding	1 sum	2,000.00	2,000	
2 Service & distribution - miscellaneous	1 sum	10,000.00	10,000	
- Drawings, manuals etc	1 sum	1,000.00	1,000	
- Permits, fees & inspection	1 sum	2,000.00	2,000	
- Testing etc	1 sum	2,000.00	2,000	
- Mobilization	1 sum	5,000.00	5,000	
C21 Service & Distribution **TOTAL : $**	1 Sum	32,000.00	32,000	

C2 ELECTRICAL	Quantity	Unit rate	Amount	Trade
C23 Systems & Ancillaries				
1 Fire alarm system	1 sum	11,000.00	11,000	
- Pull station	2 no.	250.00	500	
- Smoke detector	2 no.	250.00	500	
- Horn/strobe	2 no.	250.00	500	
- Conduit & wiring	1 sum	2,000.00	2,000	
- New fire alarm panel	2 no.	2,000.00	4,000	
- Connection to existing system	1 sum	2,000.00	2,000	
- Testing & verification	1 sum	1,500.00	1,500	
2 Modification/replacement of existing lightning protection and connection existing as required	1 sum	40,000.00	40,000	
3 Protection/relocation/reinstallation of exterior electrical system affected	1 sum	15,000.00	15,000	
- Connection to make-up air unit #1	1 no.	1,000.00	1,000	
- Connection to make-up air unit #2	1 no.	2,000.00	2,000	
- Disconnect, remove & reinstall camera during and after construction	5 no.	1,000.00	5,000	
- Disconnect, remove & reinstall projector during and after construction	1 sum	4,000.00	4,000	
- Other miscellaneous work		allow	3,000	
C23 Systems & Ancillaries **TOTAL : $**	1 Sum	66,000.00	66,000	

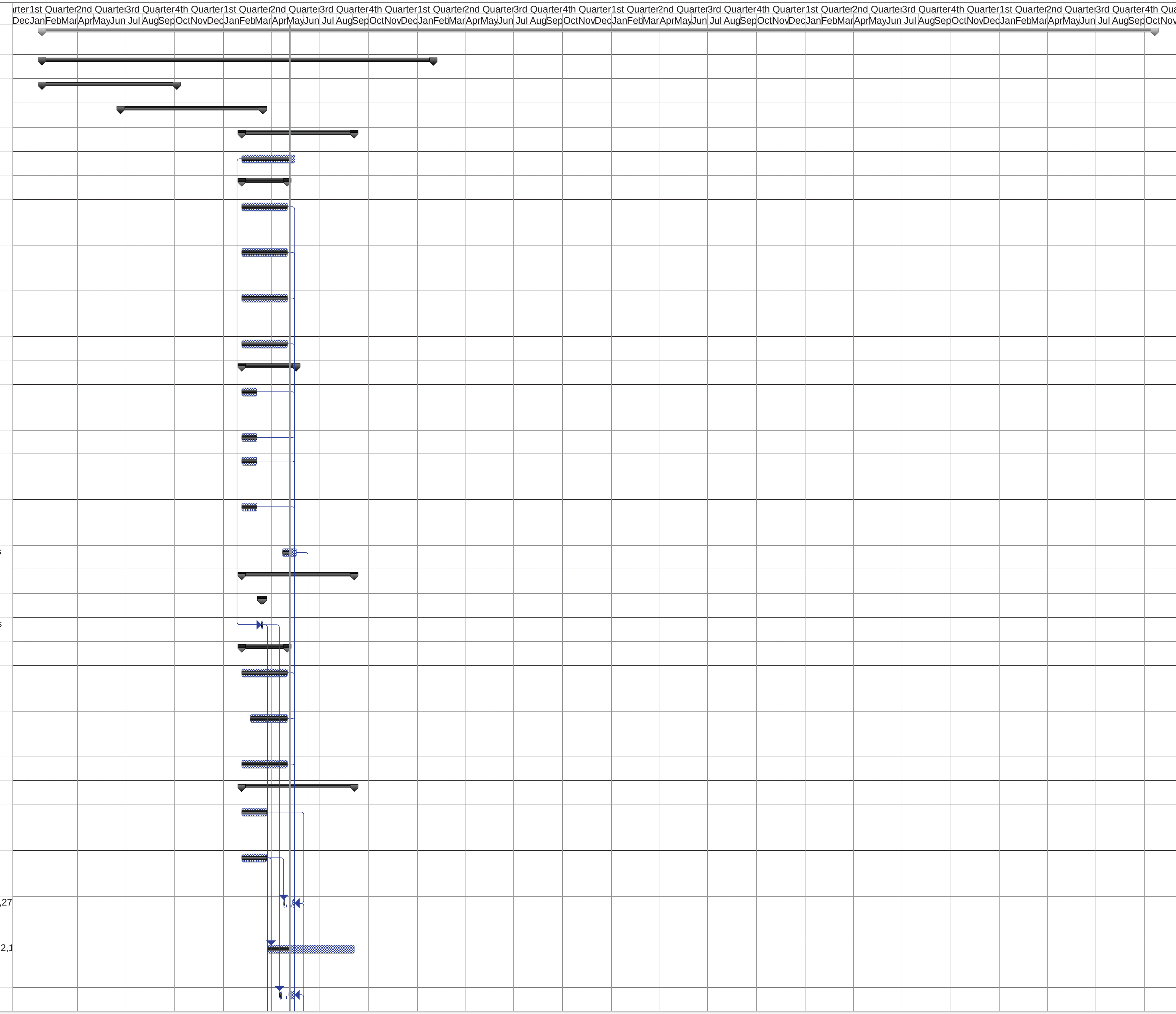
D1 SITE WORK	Quantity	Unit rate	Amount	Trade
D11 Site Development				
1 Allowance for restoration of site landscaping	1 sum	400,000.00	400,000	
D11 Site Development **TOTAL : $**	1 Sum	400,000.00	400,000	

D2 ANCILLARY WORK	Quantity	Unit rate	Amount	Trade
D22 Temporary Enclosures				
1 Scaffolding to the east and west pavilions c/w tarping - standard scaffolding	1,537 m2	550.00	845,350	
2 Allowance for winter heating for masonry	1 sum	1,000,000.00	1,000,000	
D22 Temporary Enclosures **TOTAL : $**	1,537 m2	1,200.65	1,845,400	

APPENDIX VIII
PROPOSED PROJECT SCHEDULE

CENTRE BLOCK EAST AND WEST PAVILIONS
DETAILED SCHEDULE

ID	Task Name	Duration	% Complete	Start	Finish	Predecessors
0	**Centre Block East and West Pavilions**	**1438 days**	**70%**	**Wed 1/25/12**	**Thu 10/19/17**	
1	**PROJECT KICKOFF AND ONGOING PROJECT MEETINGS**	**503 days**	**63%**	**Wed 1/25/12**	**Thu 1/30/14**	
108	**RS 2. PRE-DESIGN SERVICES**	**175 days**	**100%**	**Wed 1/25/12**	**Fri 10/5/12**	
170	**RS 3. SCHEMATIC (Concept) DESIGN**	**183 days**	**100%**	**Thu 6/21/12**	**Fri 3/15/13**	
234	**RS 4. DESIGN DEVELOPMENT**	**145 days**	**78%**	**Mon 2/4/13**	**Tue 9/3/13**	
235	Project Administration	69 days	90%	Mon 2/4/13	Tue 5/14/13	227
236	**Heritage Conservation**	**59 days**	**100%**	**Mon 2/4/13**	**Tue 4/30/13**	
237	Prepare opportunities & strategies that limit impact to the heritage fabric	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
238	Prepare strategy for balancing conservation objectives with other project objectives & economic constraints	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
239	Draft analysis & conservation treatment report for all conservation materials outlining techniques & processes	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
240	Prepare final conservation approach & methodology	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
241	**Review of Regulatory Requirements**	**72 days**	**90%**	**Mon 2/4/13**	**Fri 5/17/13**	
242	Refine, develop & prepare detailed building code analysis	20 days	100%	Mon 2/4/13	Mon 3/4/13	227
243	Refine, develop & prepare detailed standard analysis	20 days	100%	Mon 2/4/13	Mon 3/4/13	227
244	Refine, develop & prepare detailed fire & life safety strategy	20 days	100%	Mon 2/4/13	Mon 3/4/13	227
245	Refine, develop & prepare detailed summary of meetings with Authorities Having Jurisdiction	20 days	100%	Mon 2/4/13	Mon 3/4/13	227
246	Integration of HRSDC comments	20 days	50%	Mon 4/22/13	Fri 5/17/13	227FS+52 days
247	**Complete Design Development Documentation**	**145 days**	**76%**	**Mon 2/4/13**	**Tue 9/3/13**	
248	**Investigations**	**3 days**	**100%**	**Wed 3/13/13**	**Fri 3/15/13**	
249	Investigations in attic	3 days	100%	Wed 3/13/13	Fri 3/15/13	235SS+26 days
250	**Site/Civil**	**59 days**	**100%**	**Mon 2/4/13**	**Tue 4/30/13**	
251	Refine & develop design for site features & restrictions	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
252	Refine & develop design for infrastructure, subsurface & above grade services	48 days	100%	Wed 2/20/13	Tue 4/30/13	227
253	Refine and develop construction yard	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
254	**Architectural/Building Envelope**	**145 days**	**71%**	**Mon 2/4/13**	**Tue 9/3/13**	
255	Assess mechanical, physical & chemical properties of units, assembly and in-situ stresses	34 days	100%	Mon 2/4/13	Fri 3/22/13	227,192,194
256	Assess effectiveness & suitability of masonry cleaning options	34 days	100%	Mon 2/4/13	Fri 3/22/13	227,192,194
257	Assemble & analyze the results of the field investigation	5 days	50%	Wed 4/24/13	Wed 5/15/13	255FF,192,194,27
258	Assemble & Analyze the results of the Testing Program	111 days	25%	Mon 3/25/13	Tue 9/3/13	191,256,233,192,1
259	Complete all analysis work for field investigation	11 days	36%	Tue 4/16/13	Wed 5/15/13	227,249,273SF



Project: Centre Block East and West P
Date: Mon 5/6/13

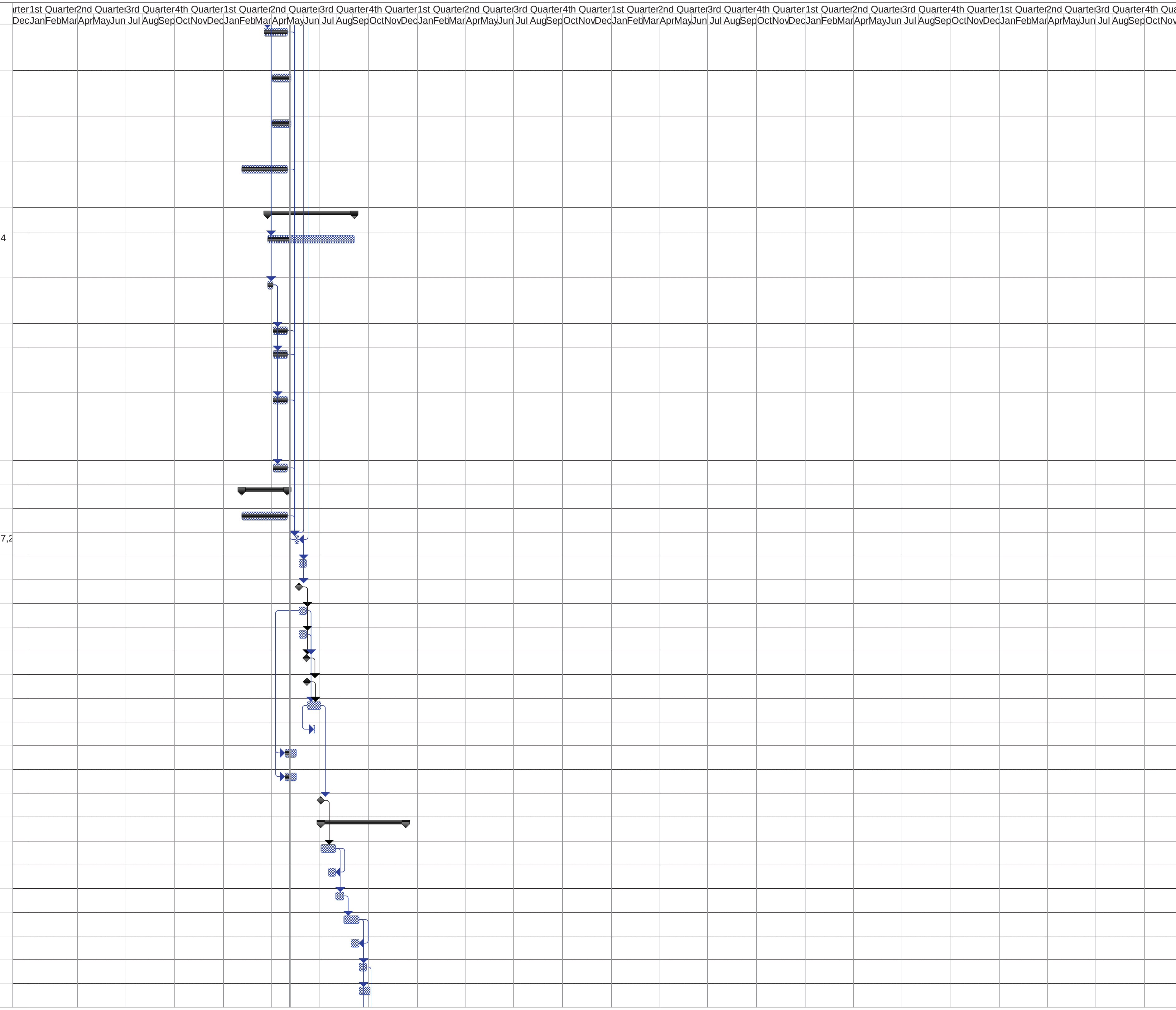
Task	Summary	Rolled Up Progress	Project Summary	Inactive Task	Manual Task	Manual Summary	
Progress	Rolled Up Task	Split	Group By Summary	Inactive Milestone	Duration-only	Start-only	
Milestone	Rolled Up Milestone	External Tasks	Deadline	Inactive Summary	Manual Summary Rollup	Finish-only	

Schedule Date: May 3, 2013
Baseline Date: May 9, 2012
Print Date: Mon 5/6/13, 7:55 AM

Fournier Gersovitz Moss Drolet et associes architectes
Hanscomb Limited

CENTRE BLOCK EAST AND WEST PAVILIONS
DETAILED SCHEDULE

ID	Task Name	Duration	% Complete	Start	Finish	Predecessors
260	Refine & develop detailed drawings for masonry walls, roofing, windows & doors	30 days	100%	Mon 3/18/13	Tue 4/30/13	227,249
261	Complete repair material selection & design and design of conservation treatments	26 days	92%	Tue 4/2/13	Tue 5/7/13	227
262	Confirm types of stone replacement c/w quantities and stone procurement	26 days	92%	Tue 4/2/13	Tue 5/7/13	227
263	Develop sustainable design opportunities & strategies	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
264	**Structural & Seismic**	**111 days**	**57%**	**Mon 3/25/13**	**Tue 9/3/13**	
265	Review & Analyze all new evidence provided by the testing program	111 days	25%	Mon 3/25/13	Tue 9/3/13	256,227,192,194
266	Complete all structural & limited seismic analysis work	6 days	100%	Mon 3/25/13	Wed 4/3/13	256
267	Refine, develop & prepare detailed drawings	19 days	100%	Thu 4/4/13	Tue 4/30/13	266
268	Complete repair material selection & desing and design of conservation treatments	19 days	100%	Thu 4/4/13	Tue 4/30/13	266
269	Refine concept design & performance requirements for scaffolding, enclosure system & temporary support requirements	19 days	100%	Thu 4/4/13	Tue 4/30/13	266
270	Identify sustainable design opportunities & strategies	19 days	100%	Thu 4/4/13	Tue 4/30/13	266
271	**Mechanical & Electrical**	**59 days**	**100%**	**Mon 2/4/13**	**Tue 4/30/13**	
272	Refine, develop & prepare detailed drawings	59 days	100%	Mon 2/4/13	Tue 4/30/13	227
273	Prepare Design Development Report	5 days	0%	Wed 5/15/13	Wed 5/22/13	251,252,253,267,2
274	Class B Estimate	10 days	0%	Thu 5/23/13	Wed 6/5/13	273
275	Submission of the Design Development Report	0 days	0%	Wed 5/22/13	Wed 5/22/13	273
276	PWGSC Review	10 days	0%	Thu 5/23/13	Wed 6/5/13	275
277	HoC Review/Senate Review	10 days	0%	Thu 5/23/13	Wed 6/5/13	275
278	PWGSC & HOC Issue Comments	0 days	0%	Wed 6/5/13	Wed 6/5/13	277,275
279	PWGSC Coordination Meeting	0 days	0%	Thu 6/6/13	Thu 6/6/13	278FS+1 day
280	Integrate Comments	17 days	0%	Fri 6/7/13	Tue 7/2/13	276,279
281	Round table discussion with Consultants	1 day	0%	Thu 6/20/13	Thu 6/20/13	280SS+9 days
282	FRBRO review of Schematic Design Report	16 days	38%	Fri 4/26/13	Fri 5/17/13	276SS-18 days
283	NCC review of Schematic Design Report	16 days	38%	Fri 4/26/13	Fri 5/17/13	276SS-18 days
284	Obtain PWGSC Approval	0 days	0%	Tue 7/2/13	Tue 7/2/13	280
285	**RS 5. CONSTRUCTION DOCUMENTS**	**110 days**	**0%**	**Wed 7/3/13**	**Mon 12/9/13**	
286	Submit 33% Documents	20 days	0%	Wed 7/3/13	Tue 7/30/13	284
287	33% Estimate (Class A Estimate)	10 days	0%	Wed 7/17/13	Tue 7/30/13	286FF
288	PWGSC Review	10 days	0%	Wed 7/31/13	Wed 8/14/13	286
289	Submit 66% Documents	20 days	0%	Thu 8/15/13	Thu 9/12/13	288
290	66% Estimate (Class A Estimate)	10 days	0%	Thu 8/29/13	Thu 9/12/13	289FF
291	PWGSC Review	10 days	0%	Fri 9/13/13	Thu 9/26/13	289
292	FHBRO Review	15 days	0%	Fri 9/13/13	Thu 10/3/13	289

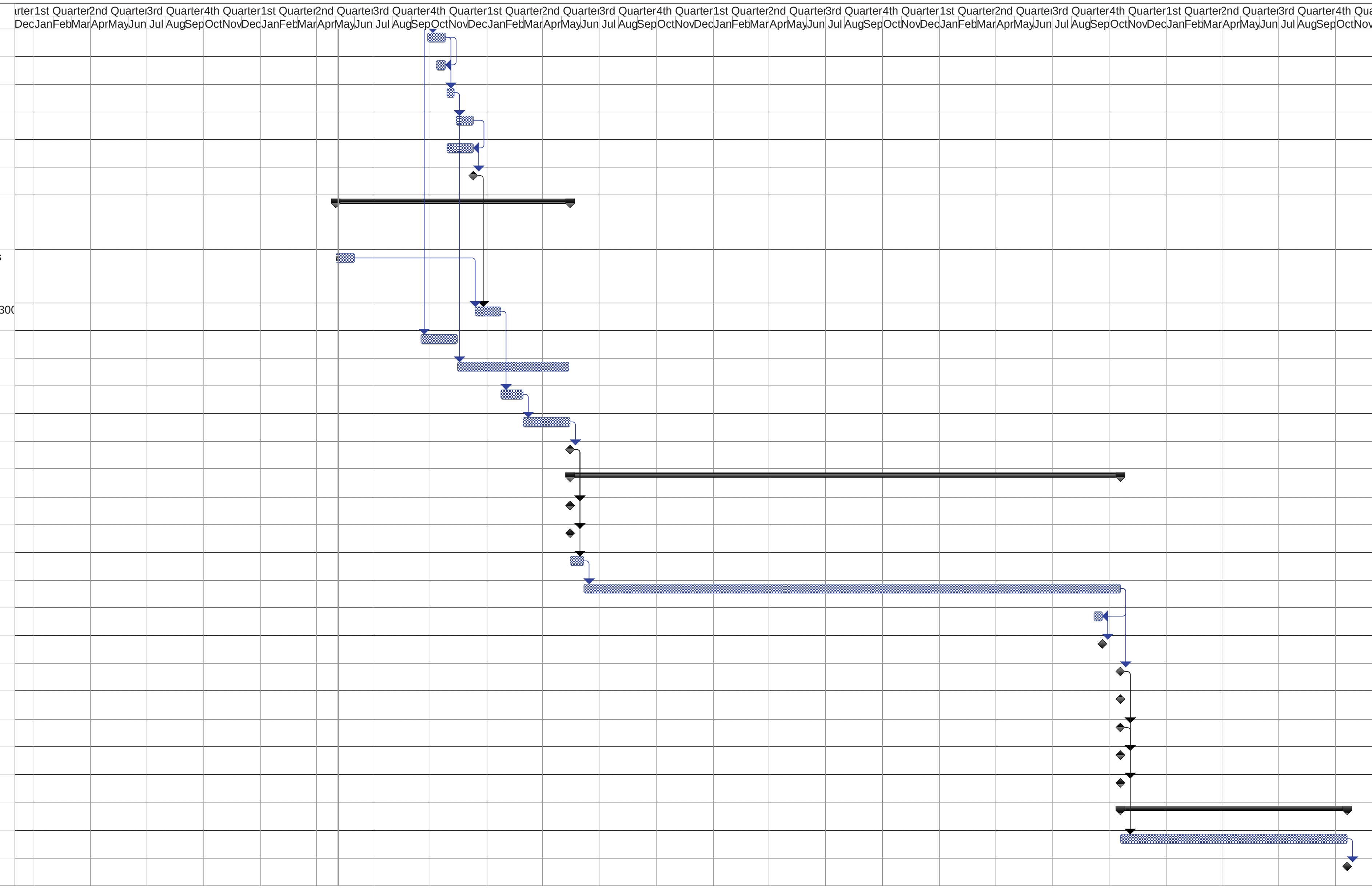


Project: Centre Block East and West P
Date: Mon 5/6/13

Task		Summary		Rolled Up Progress		Project Summary		Inactive Task		Manual Task		Manual Summary	
Progress		Rolled Up Task		Split		Group By Summary		Inactive Milestone		Duration-only		Start-only	
Milestone		Rolled Up Milestone		External Tasks		Deadline		Inactive Summary		Manual Summary Rollup		Finish-only	

CENTRE BLOCK EAST AND WEST PAVILIONS
DETAILED SCHEDULE

ID	Task Name	Duration	% Complete	Start	Finish	Predecessors
293	Submit 99% Documents	20 days	0%	Fri 9/27/13	Fri 10/25/13	291
294	99% Estimate (Class A Estimate)	10 days	0%	Fri 10/11/13	Fri 10/25/13	293FF
295	PWGSC Review	10 days	0%	Mon 10/28/13	Fri 11/8/13	293
296	Submit 100% Complete Documents	20 days	0%	Tue 11/12/13	Mon 12/9/13	295
297	Translation of 100% Complete Documents	30 days	0%	Mon 10/28/13	Mon 12/9/13	296FF
298	Obtain PWGSC Approval	0 days	0%	Mon 12/9/13	Mon 12/9/13	297
299	**RS 6. TENDER CALL, BID EVALUATION & CONSTR. CONTRACT AWARD**	**258 days**	**1%**	**Wed 5/1/13**	**Wed 5/14/14**	
300	Prequalification of Contractors and Specific Sub-Contractors	30 edays	7%	Wed 5/1/13	Fri 5/31/13	220FS+60 days
301	Tender Call	41 edays	0%	Thu 12/12/13	Wed 1/22/14	298FS+3 days,30(
302	Planning replacement materials	41 days	0%	Mon 9/16/13	Wed 11/13/13	290FS+1 day
303	Procurement of replacement materials	122 days	0%	Thu 11/14/13	Mon 5/12/14	295FS+2 days
304	Bid Analysis	25 days	0%	Thu 1/23/14	Thu 2/27/14	301
305	PWGSC Review	52 days	0%	Fri 2/28/14	Wed 5/14/14	304
306	Contract Award	0 days	0%	Wed 5/14/14	Wed 5/14/14	305
307	**RS 7. CONSTRUCTION AND CONTRACT ADMINISTRATION**	**605 days**	**0%**	**Wed 5/14/14**	**Tue 10/18/16**	
308	RPCD Approval for the procurement of replacement stone	0 days	0%	Wed 5/14/14	Wed 5/14/14	306
309	Procurement of replacement stone	0 days	0%	Wed 5/14/14	Wed 5/14/14	306
310	Mobilization and Mock-ups	15 days	0%	Thu 5/15/14	Thu 6/5/14	306
311	East and West Pavilions Rehabilitation	590 days	0%	Fri 6/6/14	Tue 10/18/16	310
312	Interim Inspection	10 days	0%	Tue 9/6/16	Mon 9/19/16	311FF-20 days
313	Certificate of Substatntial Performance	0 days	0%	Mon 9/19/16	Mon 9/19/16	312
314	Certificate of Completion	0 days	0%	Tue 10/18/16	Tue 10/18/16	311
315	**RS 8. Project Close-out**	**0 days**	**0%**	**Tue 10/18/16**	**Tue 10/18/16**	
316	Turn-over Approval	0 days	0%	Tue 10/18/16	Tue 10/18/16	314
317	Delivery Closeout	0 days	0%	Tue 10/18/16	Tue 10/18/16	314
318	Final Records Project Plan	0 days	0%	Tue 10/18/16	Tue 10/18/16	314
319	**RS 9. Warranty**	**259 days**	**0%**	**Wed 10/19/16**	**Thu 10/19/17**	
320	Post Contract Warranty review	259 days	0%	Wed 10/19/16	Thu 10/19/17	316
321	End of Contract Warranty Period	0 days	0%	Thu 10/19/17	Thu 10/19/17	320



Project: Centre Block East and West P
Date: Mon 5/6/13

Task, Progress, Milestone, Summary, Rolled Up Task, Rolled Up Milestone, Rolled Up Progress, Split, External Tasks, Project Summary, Group By Summary, Deadline, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only

APPENDIX IX
CONSERVATION STRATEGY

The Conservation Strategy

The relevant Parks Canada “Preservation and Rehabilitation Guidelines for Historic Places” are extracted from *The Standards and Guidelines* and are presented hereafter in conjunction with “Related Centre Block: East and West Pavilions Rehabilitation Project Guidelines”. Together, they compose the project’s Conservation Strategy, whose aim is to limit the impact of rehabilitation activities on the heritage character of the building in general, and on the preservation of its character-defining elements in particular.

The merging takes the form of a table for each building component (masonry, structure, architectural metals, etc), in which the national Guidelines are listed in the left-hand column and corresponding project-specific guidelines regrouped on the right. In this manner, the relationship between each reference guideline and details of its application in the case of the Centre Block Project will remain clear throughout the project.

It is important to note that this Conservation Strategy, as outlined in the tables provide a “snapshot” of:

- *The consensus reached to date on certain of the conservation approaches, or;*
- *The most recent position taken on those issues.*

The reader will note that a new column has been added to the tables, entitled “Design Development Phase” reflecting the developments since the Pre-Design and Schematic report. This corresponds to the understanding that the Conservation Strategy is a “living” document, in that it will be modified as new archival research and on-site findings inform our understanding, and the rehabilitation design develops.

CENTRE BLOCK REHABILITATION PROJECT - EAST AND WEST PAVILIONS:

CONSERVATION STRATEGY

EXTERIOR WALLS: PRESERVATION, REHABILITATION AND RESTORATION

Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*		Pre-Design Phase	Schematic Design Phase	Design Development Phase
1	Understanding the exterior walls and how they contribute to the heritage value of the historic building.	The HCS and Statement of Significance identify all elements of the exterior envelope as heritage character-defining elements; the masonry walls are therefore heritage character-defining elements.		
2	Understanding the properties and characteristics of the exterior walls as well as changes and previous maintenance practices.	The masonry walls have been surveyed to determine overall conditions and deteriorations. Discussions with the maintenance staff have been initiated and will continue.	Exploratory openings have been conducted to understand wall composition, conditions and causes of deteriorations. Meeting with the maintenance staff was held at the beginning of current stage.	
3	Documenting the composition, form, materials, details, dimensions and condition of exterior wall assemblies before undertaking an intervention. This includes geometry, scale, proportions, openings, form and supporting frames or structures.	The survey work has yielded a certain amount of information; the exploratory openings scheduled for the next phase will provide additional information.	Exploratory openings have provided a deeper understanding of exterior wall assemblies and shed light on certain previously unknown conditions to be investigated in next phases, including presence of metal ties in the attic walls and source of salts on the upper part of the towers.	Subsequent exploratory openings did not result in the presence of masonry anchors and demonstrated limited voiding and delamination. These findings are being taken under consideration for the finalization of the masonry interventions.
4	Assessing the condition of wall assemblies and their materials early in the planning process so that the scope of work is based on current conditions.			
5	Determining the cause of distress, damage or deterioration of exterior walls through investigation, monitoring and minimally invasive or non-destructive testing techniques.	The survey work has yielded a certain amount of information; the exploratory openings scheduled for the next phase will provide additional information, including spot checking of the embedded beam ends and the relieving steel arches.		
6	Protecting and maintaining exterior walls by cleaning and repairing damaged materials, and checking exterior wall assemblies for moisture penetration and insect infestation, taking corrective action, as necessary and as soon as possible.	Generalized cleaning and spot cleaning of heavily soiled areas are planned. Establishing the degree of clean will be done through a collaborative process with stakeholders from PWGSC, HCD and FHBRO. The degree of clean should harmonize with the South Façade. As for this matter, a benchmark has to be established. Also, the cleaning process has evolved since the South Façade Project. Analysis of the different opportunities will help define cleaning interventions for the East and West Pavilions Project.		
7	Retaining sound or deteriorated exterior wall assemblies that can be repaired.	A minimal intervention approach is favoured.	A minimal intervention approach is favoured. Replacement of stone is limited to poor quality material only, dismantling and rebuilding areas are limited to saturated areas that need to dry out and to elements that need seismic upgrade. Option 3: No interventions: this lack of action may result in cause further an acceleration of the deteriorations.	
8	Stabilizing deteriorated exterior walls by using structural reinforcement, weather protection, or correcting unsafe conditions, as required, until repair work is undertaken.	Certain replacement stones from recent repair campaigns have eroded; these may be replaced. The turrets were rebuilt in the 1980s, with an assembly of stone and concrete-block backing. They are showing signs of distress and need remediation.	A minimal intervention approach is favoured. Replacement of stone is limited to poor quality material only, dismantling and rebuilding areas are limited to saturated areas that need to dry out and to elements that need seismic upgrade. Option 3: No interventions: this lack of action may result in cause further an acceleration of the deteriorations.	
9	Repairing parts of exterior walls by patching, piecing-in, consolidating, or otherwise reinforcing, using recognized conservation methods. Repair may also include the limited replacement in kind, or with a compatible substitute material, of extensively deteriorated or missing parts of the exterior wall assembly. Repairs should match the existing work as closely as possible, both physically and visually.	The testing and exploratory opening work during the next phase should help define the scope of work.	Replacement of stone is limited to poor quality material only. Dismantling and rebuilding areas are limited to saturated areas that need to dry out and to elements that need seismic upgrade. In other areas showing signs of face deteriorations and cracking, repairs such as consolidation, patching, piecing-in will be specified using recognized conservation methods. Repairing only the exterior face of severely deteriorated window jambs will be a temporary action that will need to be addressed in the Major Rehabilitation Project. Option 3: No interventions may cause further deteriorations.	Replacement of stone is limited to poor quality material only. Dismantling and rebuilding areas are limited to saturated areas that need to dry out and to elements that need seismic upgrade. In other areas showing signs of face deteriorations and cracking, repairs such as consolidation, patching, piecing-in will be specified using recognized conservation methods. Repairing only the exterior face of severely deteriorated window jambs will be a temporary action that will need to be addressed in the Major Rehabilitation Project.

CONSERVATION STRATEGY

EXTERIOR WALLS: PRESERVATION, REHABILITATION AND RESTORATION

Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*		Pre-Design Phase	Schematic Design Phase	Design Development Phase
10	Protecting adjacent character-defining elements from accidental damage or exposure to damaging materials during maintenance or repair work.	These protective measures will be developed in the Contract Document phase.		
11	Replacing in kind extensively deteriorated or missing parts of exterior wall assemblies where there are surviving prototypes.	n/a		
12	Testing proposed interventions to establish appropriate replacement materials, quality of workmanship and methodology. This can include reviewing samples, testing products, methods or assemblies, or creating a mock-up. Testing should be carried out under the same conditions as the proposed intervention.	The testing/exploratory openings program will be initiated during the next phase. Mock-ups will be specified in the Contract Documents phase and followed during Contract Administration for Quality Control. The South Façade is being reviewed for its performance.	The exploratory openings have been initiated in the current phase and further investigations may be required are recommended. Material testing will continue unto the next phase. Mock-ups will be specified in the Contract Documents phase and followed during Contract Administration for Quality Control. The South Façade is being reviewed for its performance.	Materials testing is ongoing. Mock-ups will be specified in the Contract Documents phase and followed during Contract Administration for Quality Control.
13	Documenting all interventions that affect the exterior walls, and ensuring that the documentation is available to those responsible for future interventions.	As-built drawings will be prepared for PWGSC.		
14	Repairing an exterior wall assembly, including its functional and decorative elements, by using a minimal intervention approach. Such repairs might include the limited replacement in kind, or replacement using an appropriate substitute material of irreparable or missing elements, based on documentary or physical evidence. Repairs might also include dismantling and rebuilding a masonry or wood wall, if an evaluation of its overall condition determines that more than limited repair or replacement in kind is required.	Limited replacement in kind will be undertaken under this project scope.	A minimal intervention approach is favoured. Replacement of stone is limited to poor quality material only and damaged dismantled stones. Replacement stones' composition and physical properties will be studied to assure that these original characteristics are matched. Match the original requirements. Dismantling and rebuilding areas are limited to saturated areas that need to dry out and to elements that need seismic upgrade.	
15	Improving the drying ability of exterior wall assemblies through suitable heating and/or ventilation measures.	The Centre Block is under negative pressure; the implications of this are being studied.		
16	Accommodating the thermal expansion and contraction of masonry, concrete and curtain wall assemblies, by introducing expansion or control joints, and incorporating those joints into existing crack patterns, where feasible, to minimize impact on character-defining elements.	This issue is under study. The addition of thermal expansion joints is of dubious value: the South Façade, which is much longer, has none.		n/a
17	Replacing in kind an irreparable exterior wall assembly, based on documentary and physical evidence. If using the same kind of material is not environmentally sound, or technically or economically feasible, then a compatible substitute material may be considered.	Large scale replacement is outside the scope of this project.		
18	Replacing missing historic features by designing and constructing a new portion of the exterior wall assembly, based on physical and documentary evidence, or one that is compatible in size, scale, material, style and colour.	The Joanisse Study (1995) will be updated. The carvings are identified as heritage-character defining elements. A Meeting with the Dominion Sculptor is planned to review methodology and approach to carvings.	A review of each of the sculptural elements will be conducted and a list of deficiencies will be prepared. Historic research will be conducted to determine profiles of elements that are missing or severely deteriorated. If information isn't available, the context will be considered and interpreted in order to establish the profile of the original elements.	A complete survey of sculptural elements will be made and submitted to PWGSC. Recommendations will be limited to replacement of non-salvageable items, cleaning, and stabilization.
19	Modifying exterior walls to accommodate an expanded program, a new use, or applicable codes and regulations, in a manner that respects the building's heritage value.	n/a		
20	Designing a new addition in a manner that preserves the character-defining exterior walls of the historic building.	n/a		

	Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*	Pre-Design Phase	Schematic Design Phase	Design Development Phase
21	Complying with health, safety and security requirements in a manner that conserves the heritage value of the exterior wall assembly and minimizes impact on its character-defining elements.	Seismic interventions are limited to the turrets.	When dismantling and rebuilding is proposed for turrets, pinnacle (options 2 & 3) and chimneys (option 3), structural stabilization will be revised and added.	Temporary stabilization of turrets and pinnacle will be undertaken according to guidelines.
22	Working with code specialists to determine the most appropriate solution to health, safety and security requirements with the least impact on the character-defining elements and overall heritage value of the historic building.	n/a		
23	Removing or encapsulating toxic materials, using the least- invasive abatement methods possible, and only after thorough testing has been conducted.	Silica is present in the mortar and will be dealt with as a hazardous material.		
24	Protecting exterior walls against loss or damage by identifying and assessing specific risks, and by implementing an appropriate fire- protection and blast protection strategy that addresses those risks.	n/a		
25	Complying 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.	n/a		
26	Assessing the potential impacts of adding insulation to the building envelope, such as displacing the dew point and creating thermal bridges.	n/a		
27	Working 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.	n/a		

CENTRE BLOCK REHABILITATION PROJECT - EAST AND WEST PAVILIONS:

CONSERVATION STRATEGY

ROOFS: PRESERVATION, REHABILITATION AND RESTORATION

Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*		Pre-Design Phase	Schematic Design Phase	Design Development Phase
1	Understanding the roof and how it contributes to the heritage value of the historic building.	The HCS and Statement of Significance identify all elements of the exterior envelope as heritage character-defining elements; the copper roofs are therefore heritage character-defining elements.		
2	Understanding the properties and characteristics of the roof as well as changes and previous maintenance practices.	The copper roofs have been surveyed to determine overall conditions and deteriorations. Discussions with the maintenance staff have been initiated and will continue.	Exploratory openings have been conducted to understand roof composition, conditions and causes of deteriorations. Meeting with the maintenance staff was held at the beginning of current stage.	
3	Documenting the form, materials and condition of roof assemblies before undertaking an intervention, including the roof's pitch, shape, decorative and functional elements, and materials, and its size, colour and patterning.	The survey work has yielded a certain amount of information; the exploratory openings scheduled for the next phase will provide additional information. Original profiles exist and will be documented. The original finials and tower detailing have been removed. However, artifacts survive and will be documented.	Exploratory openings have been conducted to understand roof composition, conditions and causes of deteriorations. Original profiles have been documented. The original finials and tower detailing have been removed. However, artifacts survive and will be documented.	
4	Assessing the condition of the roof assembly and materials early in the planning process so that the scope of work is based on current conditions.	The copper roof has been determined to be at the end of its life-cycle. The flat roofs on the top of the pavilions, as well as on the west entrance porch will be replaced.		
5	Determining the cause of a roof's distress, damage or deterioration through investigation, monitoring and minimally invasive or non-destructive testing techniques.	The copper roof is at the end of its life-cycle. This is the primary cause of deterioration.		
6	Protecting and maintaining a roof by cleaning and maintaining the gutters, downspouts and flat roof drains, and replacing deteriorated flashing in kind. Roof sheathing should also be checked for proper venting to prevent moisture condensation and water penetration, and to ensure that materials are free from insect infestation.	A water-shedding strategy for the pavilions will be developed in the next phase of the project. It will be based in large measure on the strategy that was implemented for the South Façade. The strategy will need to be validated by PWGSC, for conformity to the larger strategy for the Centre Block, to be implemented under the Major Rehabilitation Project.	Option 1: punctual interventions. no Long-term strategy deferred to until the Major Rehabilitation Project. Option 2: a commissioning and maintenance strategy will be is being developed. Option 3: water-shedding strategy will be developed using is based on the strategy that was implemented for the South Façade as a reference. A commissioning and maintenance strategy is being will be developed.	A water-shedding strategy will be developed using is based on the strategy that was implemented for the South Façade as a reference. A commissioning and maintenance strategy is being will be developed.
7	Retaining sound or deteriorated roof assemblies that can be repaired.		n/a	
8	Stabilizing deteriorated roofs by structural reinforcement, weather protection or correcting unsafe conditions, as required, until repair work is undertaken.	The roof structure of the pavilions is steel with a cementitious "Flex-or-Crete" deck. It will be stabilized locally, as required, but is considered to be in good condition.		
9	Repairing parts of roofs by patching, piecing-in, consolidating, or otherwise reinforcing, using recognized conservation methods. Repair may also include the limited replacement in kind, or with a compatible substitute material, of extensively deteriorated or missing parts of the roof. Repairs should match the existing work as closely as possible, both physically and visually.	n/a, full replacement of the roof is planned		
10	Protecting adjacent character-defining elements from accidental damage or exposure to damaging materials during maintenance or repair work.	Provisions will be included in the specifications, during the Contract Document phase.		
11	Replacing in kind extensively deteriorated or missing parts of roof assemblies where there are surviving prototypes.	The exploratory openings and the documentation of the existing finials and ridge cresting will provide guidance.	The existing finials and ridge cresting found on the South Façade Towers will serve as prototypes to replace in kind missing finials and ridge cresting on the East and West Towers.	
12	Testing proposed interventions to establish appropriate replacement materials, quality of workmanship and methodology. This can include reviewing samples, testing products, methods or assemblies, or creating a mock-up. Testing should be carried out under the same conditions as the proposed intervention.	These quality assurance tools will be specified during the Contract Document phase and implemented during the Contract Administration phase.		

	Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*	Pre-Design Phase	Schematic Design Phase	Design Development Phase
13	Documenting all interventions that affect the building's roof, and ensuring that the documentation is available to those responsible for future interventions.	As-built drawings will be submitted to PWGSC.		
14	Repairing a roof assembly, including its functional and decorative elements, by using a minimal intervention approach. Such repairs might include the limited replacement in kind, or replacement with an appropriate substitute material, of irreparable or missing elements, based on documentary or physical evidence.		n/a	
15	Improving the detailing of roof elements, following recognized conservation methods, to correct faulty details. For example, adjusting the slope of a cornice to prevent ponding, or introducing a new drip edge at the eave to better direct water runoff away from a masonry wall. Such improvements should be physically and visually compatible.	The water-shedding conditions and drip-edge will be studied, to determine if inherent vices can be corrected, without impact on the aesthetic appearance of the pavilions. This work will also need to be coordinated by PWGSC for its integration with the rest of the Centre Block.	Option 1: improvements deferred to the Major Rehabilitation Project. Option 2: improvements will be developed to be compatible with the original profile. Option 3: Solutions from the South Façade Project will serve as a reference in order to respect the 1990s profile and assure visual continuity.	Solutions from the South Façade Project will serve as a reference in order to respect the 1990s profile and assure visual continuity.
16	Replacing in kind an entire element of the roof that is too deteriorated to repair — if the overall form and detailing are still evident — using the physical evidence as a model to reproduce the element. This can include a large section of roofing, a dormer, or a chimney. If using the same kind of material is not technically or economically feasible, then a compatible substitute material may be considered.	Replacement will be in kind.	Option 1: no replacement until the Major Rehabilitation Project. Option 2: replacement will be in kind. Option 3: since 38mm insulation is introduced in roof composition, profiles are slightly enlarged. This intervention will refer to the one implemented in the South Façade Project.	The addition of insulation will slightly alter the profile of the roof. These modifications will be completed so they reflect similar changes made on the South Facade.
17	Replacing missing historic features by designing and constructing a new roof feature, based on physical and documentary evidence, or one that is compatible in size, scale, material, style or colour.	The decorative ridge cresting will be replaced, based on physical evidence.		
18	Modifying or replacing a roof or roof element, to accommodate an expanded program, a new use, or applicable codes and regulations, in a manner that respects the building's heritage value.	Insulation is required, and different scenarios and potential impacts will be developed in the next project phase.	Option 1: no modifications until Major Rehabilitation Project. Option 2: no modifications to roof composition Option 3: since 38mm insulation is introduced in roof composition, profiles are slightly enlarged. This intervention follows exactly will refer to the one implemented in the South Façade Project.	The addition of insulation will slightly alter the profile of the roof. These modifications will be completed so they reflect similar changes made on the South Facade.
19	Selecting appropriate rooftop mechanical and service equipment and associated piping and cabling, such as air-conditioning components, transformers or solar collectors, and installing the equipment as inconspicuously as possible, while respecting the building's heritage value and character-defining elements.	n/a: all roof-top equipment is temporary and related only to supplying air to the upper floor offices during the construction period.		
20	Designing and constructing additions to roofs, such as access stairs, elevator or mechanical equipment housing, decks and terraces, and dormers and skylights that are inconspicuous from the public right of way and do not damage or obscure character- defining elements.	n/a: any access ladders etc. are hidden from view, on the interior faces of the mansards.		
21	Complying with health and safety requirements, by providing lightning protection, or snow and ice guards, or roof anchors in a manner that conserves the roof's heritage value and minimizes impact on its character-defining elements.	Lightning protection exists and will be reinstated. There are no snow guards considered in the program. However, heating cables will be studied in the next phase of the project.		
22	Working with code specialists to determine the most appropriate solution to health, safety and security requirements with the least impact on the character-defining elements and overall heritage value of the historic building.	In progress	The sprayed coating applied on the steel structure has to meet a 1 hour fire resistance.	

	Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*	Pre-Design Phase	Schematic Design Phase	Design Development Phase
23	Removing or encapsulating hazardous materials, such as asbestos insulation, using the least-invasive abatement methods possible, and only after thorough testing has been conducted.	Asbestos is limited to spray-on cementitious coatings. It will be abated as needed.		Asbestos and lead are present in the roof assembly and appropriate precautions will be taken for the abatement or installation of these materials.
24	Protecting roofs against loss or damage by identifying and assessing the specific fire risks, and by implementing an appropriate fire-protection strategy that addresses those risks.		n/a	
25	Complying with energy efficiency objectives in upgrades to the roof assembly 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.	Scenarios for the addition of insulation will be developed in the next phase, to a conceptual level.	Option 1: no modifications until Major Rehabilitation Project. Option 2: no modifications to roof composition Option 3: 38mm insulation is introduced in roof composition, slightly enlarging roof profiles. This intervention will refer to the one implemented in the South Façade Project.	Recommended option: installation of rigid insulation in the roof.
26	Working with energy efficiency and sustainability specialists to determine the most appropriate solution to energy efficiency and sustainability requirements with the least impact on the character-defining elements and overall heritage value of the historic building.			
27	Exercising caution and foreseeing the potential effects of insulating the roof on the building envelope to avoid damaging changes, such as displacing the dew point and creating thermal bridges, or increasing the snow load.			
28	Installing thermal insulation in non-character-defining roof spaces, such as attics, without adversely affecting the building envelope.	Scenarios for the addition of insulation will be developed in the next phase, to a conceptual level.	The installation of thermal insulation in the attic space will require minor alterations to the character defining elements of the roof and is currently under discussion.	
29	Ensuring that structural, drainage and access requirements to improve the roof's energy efficiency can be met without damaging character-defining elements.		n/a	
30	Assessing the addition of vegetated roof systems (green roofs) or storm water cisterns to flat-roof assemblies, and their impact on the building's heritage value and structural integrity, before work begins.		n/a	
31	Repairing a roof assembly from the restoration period by reinforcing its materials.		n/a	
32	Replacing in kind an entire roof feature from the restoration period that is too deteriorated to repair, using the physical evidence as a model to reproduce the feature. The new work should be well documented and unobtrusively dated to guide future research and treatment.		n/a	
33	Removing or altering a non character-defining roof or roof element, such as a later dormer or asphalt roofing, dating from a period other than the restoration period.		n/a	
34	Retaining alterations to roof assemblies that address problems with the original design if those alterations do not have a negative impact on the building's heritage value.		n/a	
35	Recreating a missing roof element that existed during the restoration period, based on physical or documentary evidence; for example, reinstating a dormer or cupola.	As noted above, the finials and ridge cresting will be recreated, based on existing physical models.		

CENTRE BLOCK REHABILITATION PROJECT - EAST AND WEST PAVILIONS:

CONSERVATION STRATEGY

WINDOWS, DOORS, AND STOREFRONTS: PRESERVATION, REHABILITATION AND RESTORATION

	Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*	Pre-Design Phase	Schematic Design Phase	Design Development Phase
1	Understanding windows, doors and storefronts and how they contribute to the heritage value of the historic building.	The HCS and Statement of Significance identify all elements of the exterior envelope as heritage character-defining elements; the original steel windows are therefore heritage character-defining elements.		
2	Understanding the properties, operation and characteristics of the windows, doors and storefronts as well as changes and previous maintenance practices.	The windows have been surveyed to determine overall conditions and deteriorations. Discussions with the maintenance staff have been initiated and will continue.	Exploratory openings have been conducted to understand steel window conditions and causes of deteriorations. Meeting with the maintenance staff was held at the beginning of current stage.	
3	Documenting the form, materials and condition of windows, doors and storefronts, and their elements, before undertaking an intervention. This includes the configuration, style, method of operation and materials.	The initial survey has documented the steel windows, which are scheduled for full restoration under the Major Rehabilitation Project. The aluminum replacement windows, dating from the 1980s will be maintained, but only until the Major Rehabilitation Project starts.	An original steel window has been surveyed, removed, crated and stored. A temporary replica has been installed. Frame anchoring and interface between jambs and frame have been observed.	
4	Assessing the condition of windows, doors and storefronts, including hardware, early in the planning process so that the scope of work is based on current conditions.	Exploratory openings are scheduled for the next project phase to confirm frame anchoring and to allow better understanding of the interface between the jambs and the frames. These openings will also inform a repair strategy for stone repairs surrounding the windows.		In-situ maintenance and stabilization will be completed until the Major Rehabilitation Project takes place.
5	Determining the cause of distress, damage, or deterioration of windows, doors and storefronts through investigation, monitoring, and minimally invasive or non-destructive testing techniques.	The exploratory openings to determine causes of distress/damage/deterioration will take place during the next project phase. The intent of this advance project is to stabilize the windows until the Major Rehabilitation Project, when they will be restored/ reinstated.		
6	Protecting and maintaining windows, doors and storefronts by using appropriate surface treatments, such as cleaning, rust removal, limited paint removal, and reapplying protective coating systems in kind.	The steel and lead came windows will be stabilized and maintained. A single window, judged to be in the worst condition of deterioration, will be taken out and restored, as a pilot project. This work will also help to inform the major rehabilitation project scope of work. The aluminum windows will be stabilized and maintained, until the major rehabilitation project starts. An original steel window has been surveyed, removed, crated and stored. A temporary replica has been installed.		
7	Making windows, doors and storefronts weather tight and energy efficient by re-puttying and replacing or installing weather-stripping, adjusting hardware, and sealing openings and joints.	This work will be done, within the limits of the stabilization program. The pilot project window will be weather stripped and tested for energy efficiency.		
8	Retaining sound and repairable windows, doors and storefronts, including their functional and decorative elements, such as hardware, signs and awnings.	This guideline summarizes the project intent.		
9	Stabilizing deteriorated windows, doors and storefronts by using structural reinforcement, and weather protection, or correcting unsafe conditions, as required, until repair work is undertaken.	This guideline summarizes the project intent.		
10	Repairing parts of windows, doors, or storefronts, by patching, piecing-in, consolidating, or otherwise reinforcing, using recognized conservation methods. Repair may also include the limited replacement in kind, or with a compatible substitute material, of those extensively deteriorated or missing parts of windows, doors and storefronts. Repairs should match the existing work as closely as possible, both physically and visually.	The repair strategy for the steel windows will follow from the pilot project.	The project intent is to stabilize original windows using recognized conservation methods until full restoration in the Major Rehabilitation Works.	
11	Protecting adjacent character-defining elements from accidental damage, or exposure to damaging materials during maintenance or repair work.	These protective measures will be developed in the Contract Document phase.		
12	Replacing in kind extensively deteriorated or missing parts of windows, doors and storefronts, where there are surviving prototypes.	Although replacement-in-kind for the steel and lead came windows may occur, this work is not the intention of the project. The aluminum windows would not be replaced-in-kind.		

CENTRE BLOCK REHABILITATION PROJECT - EAST AND WEST PAVILIONS:

CONSERVATION STRATEGY

WINDOWS, DOORS, AND STOREFRONTS: PRESERVATION, REHABILITATION AND RESTORATION

Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*		Pre-Design Phase	Schematic Design Phase	Design Development Phase
13	Testing proposed interventions to establish appropriate replacement materials, quality of workmanship and methodology. This can include reviewing samples, testing products, methods or assemblies, or creating a mock-up. Testing should be carried out under the same conditions as the proposed intervention.	This work will be specified in the Contract Documents and followed during Contract Administration, for Quality Assurance.		
14	Documenting all interventions that affect the building's windows, doors and storefronts, and ensuring that the documentation is available to those responsible for future interventions.	As-built drawings will be provided to PWGSC.		
15	Repairing windows, doors and storefronts by using a minimal intervention approach. Such repairs might include the limited replacement in kind, or replacement with an appropriate substitute material, of irreparable or missing elements, based on documentary or physical evidence.	Stabilization and minimal approach repairs is the main intent of the project.	Option 1 & 2: Only stabilization of original steel material is considered until full restoration in the Major Rehabilitation Project. Option 2: Roof modifications will ask for the replacement of dormers aluminum windows. Masonry repairs and/or roof modifications may result in the replacement of some aluminum windows. New windows should replicate original steel windows as for the South Façade Project. Option 3: No interventions will be undertaken; this strategy has an elevated risk in that it may allow acceleration of the deteriorations.no interventions may cause further deteriorations.	Recommended option: Roof modifications will ask for the replacement of dormers aluminum windows. Masonry repairs and/or roof modifications may result in the replacement of some aluminum windows. New windows should replicate original steel windows as for the South Façade Project.
16	Replacing in kind irreparable windows, doors or storefronts based on physical and documentary evidence. If using the same materials and design details is not technically or economically feasible, then compatible substitute materials or details may be considered.	General replacement is not within the project scope.		
17	Replacing missing historic features by designing and installing new windows, doors and storefronts based on physical and documentary evidence, or one that is compatible in size, scale, material, style and colour.	n/a. All original windows are existent; some have been replaced with aluminum frames, and these will probably be replaced with steel frames that replicate the original windows, but only at the time of the major rehabilitation project.	Option 1 & 2: Only stabilization of original steel material is considered until full restoration in the Major Rehabilitation Project. Option 3: Roof modifications will ask for the replacement of dormers aluminum windows. New windows should replicate original steel windows as for the South Façade Project.	Recommended roof modifications will require the replacement of dormer windows which should replicate the original steel windows.
18	Designing and constructing a new window, door or storefront when it is completely missing, with a new design that is compatible with the style, era and character of the historic place, or a replica based on documentary evidence.	n/a		
19	Using signs, awnings, canopies or marquees of a scale and design that is compatible with the historic building.	n/a		
20	Providing a setback in the design of drop ceilings, when required, to allow for full height window openings.	n/a		

Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*		Pre-Design Phase	Schematic Design Phase	Design Development Phase
21	Complying with health, safety and security requirements in a manner that conserves the heritage value of the windows, doors and storefronts and minimizes impact on its character-defining elements.		n/a	
22	Working with code specialists to determine the most appropriate solution to health, safety and security requirements with the least impact on the character-defining elements and overall heritage value of the historic building.		n/a	
23	Removing or encapsulating hazardous materials, such as lead-based paint, using the least-invasive abatement methods possible, and only after thorough testing has been conducted.	Given the age of the building, it is probable that the steel windows have lead-based paint. The paint removal is not contemplated under the present project scope. Testing will be done on the paint as part of the next phase.		All toxic substances located within the limits of any remedial work being done on the windows will be removed according to regulations.
24	Protecting windows, doors or storefronts against loss or damage by identifying and assessing specific risks, and by implementing an appropriate fire protection strategy that addresses those risks. For example, replacing a character-defining wood door with a compatible fire-rated door, only after carefully considering other options.		n/a	
25	Complying with accessibility requirements in a manner that conserves, where possible, character-defining doors and storefronts, including their decorative and operating hardware. This can include using an automatic door opener instead of providing the required maneuvering space for wheelchairs at doors.		n/a	
26	Working with accessibility and conservation specialists and users to determine the most appropriate solution to accessibility issues with the least impact on the character-defining elements and overall heritage value of the historic building.		n/a	
27	Complying with energy efficiency objectives in upgrades to character-defining doors, windows and storefronts by installing weather-stripping, storm windows, interior shades and, if historically appropriate, blinds and awnings. The energy efficiency of the building envelope and systems as a whole should be considered.	The intention under the present project is to address specific user complaints, with respect to draughts. No large-scale remedial work is planned under this project for energy efficiency needs.		
28	Working with 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.		n/a	
29	Maintaining the building's inherent energy-conserving features in good operating condition, such as operable windows or louvered blinds for natural ventilation.		n/a	
30	Installing interior storm windows where original windows are character-defining and exterior storms are inappropriate.		n/a	

CENTRE BLOCK REHABILITATION PROJECT - EAST AND WEST PAVILIONS:

CONSERVATION STRATEGY

WINDOWS, DOORS, AND STOREFRONTS: PRESERVATION, REHABILITATION AND RESTORATION

	Guidelines from *The Standards and Guidelines for the Conservation of Historic Places in Canada – 2010*	Pre-Design Phase	Schematic Design Phase	Design Development Phase
31	Repairing windows, doors and storefronts from the restoration period, using a minimal intervention approach, such as patching, splicing, consolidating, or otherwise reinforcing their materials and improving weather protection.	The project goal is to stabilize the windows, using a minimal intervention approach.	The intent is to stabilize original steel windows until full restoration in the Major Rehabilitation project.	
32	Replacing in kind an entire window, door or storefront from the restoration period that is too deteriorated to repair, using the physical evidence as a model to reproduce the assembly. The new work should be well documented and unobtrusively dated to guide future research and treatment.	Some replacement-in-kind may be contemplated, but the number will be modest.	No replacement in kind of an entire window is being considered at this point.	
33	Removing or altering non character-defining windows, doors or storefronts, or their associated functional or decorative elements, from a period other than the restoration period.		n/a	
34	Retaining alterations to windows, doors or storefronts that address problems with the original design, if those alterations do not have a negative impact the building's heritage value.	n/a, although the aluminium windows will be stabilized to extend their life-cycle until the Major Rehabilitation Project.		
35	Recreating a missing window, door or storefront from the restoration period, based on physical or documentary evidence.		n/a	
36	Recreating missing signage, awnings or canopies where sufficient physical or documentary evidence exists, and the building's current use allows.		n/a	

APPENDIX X
REGULATORY ANALYSIS REPORT

MORRISON HERSHFIELD

APPLICATION OF THE NATIONAL BUILDING CODE

Centre Block Exterior Upgrades

Ottawa, ON

Presented to:
Fournier, Gersovitz, Moss, Drolet et associés architectes

1435 Saint-Alexandre Street, Suite 1000
Montréal, QC H3A 2G4

Report No. 2123297.00 December 1, 2012

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1. INTRODUCTION

1.1 Background

Morrison Hershfield Limited (MH) has been retained by Fournier, Gersovitz, Moss, Drolet et associés architectes to investigate the application of the applicable Codes to the Centre Block Exterior upgrades project in Ottawa.

This report is provided to the project team for use during design.

1.2 Scope of Report

This report is a presentation of Code requirements applicable to the rehabilitation of the cladding for the east and west pavilions. The scope of this report is limited to the major fire, life safety and occupancy elements as applicable to this exterior rehabilitation project.

1.3 Limitations

Reviewed material, furnished by others, is expected to be free of latent deficiencies or inaccuracies. Design calculations were not performed.

Comments and conclusions within this report represent our opinion, which has been based on an examination of the documents provided and our past experience.

In issuing this report, Morrison Hershfield does not assume any of the duties or liabilities of the designers, builders, owner or operators of the subject property. Persons who use or rely on the contents of this report do so with the understanding as to the limitations of the documents examined. Such persons understand that Morrison Hershfield cannot be held liable for damages they may suffer in respect to the design, construction, purchase, ownership, use or operation of the subject property.

2. FIRE PROTECTION APPLICABLE CODES

2.1 Introduction

The applicable Codes and Standards referenced in this section are with respect to fire and life safety and do not include structural Codes and Standards that will be applied to this project. Requirements for structural design will be identified by the structural engineer.

2.2 Codes Applicable at the Time of Construction

At the time of building construction, requirements that would have applied to the building construction are not comparable to the current Codes in terms of expected performance level. As such, analysis of building practice that was applicable at the time of construction has not been considered and is not relevant per the applicable Codes for fire and life safety. It is noted that the first National Building Code (NBC) of Canada was published in 1941. Also, refer to the Legislative Requirements below which indicates the application of the applicable Codes.

2.3 Codes Applicable at the Time of Renovations

As indicated previously, the first NBC was published in 1941. It is expected that renovations that occurred prior to 1941 would have been conducted in accordance with the best practices at that time. Since 1941, it is expected that renovations would have been undertaken in accordance with the provisions of the NBC applicable at the time of construction.

2.4 Legislative Requirements

The Centre Block is subject to the Canada Labour Code (CLC) and the Canada Occupational Health and Safety Regulations (COHS Regulations).

Renovations of the building are required to conform to the COHS Regulations, based on Subsections 2.2.(3) and (4) that are indicated below. Renovation activities and alterations are not specifically defined in the COHS Regulations but are generally interpreted to mean any material modification to an existing building.

> *COHS Regulations Subsections 2.2(3) and (4)*
>
> *2.2 (3) The renovation of any building shall, to the extent reasonably practicable, meet the requirements of the National Building Code.*
>
> *2.2 (4) When it is not reasonably practicable for an employer to comply with the requirements of subsection (3), the employer shall, before the proposed renovations start, notify the work place committee or the health and safety representative.*

It is noted that the COHS Regulations do not specifically permit a repair to reinstate materials or designs that would otherwise not conform to current Codes. There is expected to be significant construction difficulties resulting in impracticalities. The reinstatement of original materials (or similar) or designs must demonstrate that they match the performance level expected by the current NBC. This often requires the evaluation of other compensatory features.

Although the NBC is referenced by the COHS Regulations, it is applicable only *"...to the extent reasonably practicable..."* as per COHS Regulations Subsection 2.2(3). The qualification is entirely subjective and can consider many variables including construction complexity or difficulty and cost, in addition to life safety value of current Code provisions which differ from existing conditions or requirements that applied at the time of construction.

Furthermore, the NBC, as a model building code, is written with the intent to be applied to new construction, and in the event of major renovations or to correct a serious and imminent risk to life. The application of the NBC to existing buildings requires careful consideration of the relative value of Code provisions and the cost and implications on the building. This is as documented in the Appendix to the NBC.

At present, the COHS Regulations prescribe the 1995 edition of the NBC and National Fire Code (NFC). The extent to which an existing building is able to be modified to conform to the 1995 edition of the NBC is dependent on many factors including extent of intervention on the building, cost of implementation of upgrades, and other factors. It is noted that the 2010 editions of the model NBC and NFC have been issued as of November 2010. These Codes are not enforceable until referenced by legislation or policy. However, for the purposes of this project, the 2010 NBC and NFC will be used to define requirements.

2.5 Treasury Board Standards

The government policy that prescribes the NBC and/or NFC is the Treasury Board (TB) Fire Protection Standard. The objective of this policy is to "*...protect and minimize losses to federal real property and protect the lives of those who use these properties from fire-related risks.*" This policy requires that each government department establish a Departmental Fire Protection Coordinator who is responsible to establish cooperation with all parties to the policy. However, the policy establishes that the Department that has administrative responsibility for a building (i.e., Custodian Department) is accountable for the application of the NBC and NFC as defined by 6.1.2.

> *6.1.2 That real property in Canada administered by the department complies with the following:*
>
> *a. The fire protection requirements of the NFC, the NBC, and the NFBC[1] or of applicable local codes[2] when the following takes place:*
>
> - *There is a change in the use of the real property;*

[1] NFBC: National Fire Building Code.

[2] Applicable local codes are building and fire codes enacted in Canada by provinces, territories and municipalities and abroad by local jurisdiction that meet or exceed the requirement of the NBC, NFC and NFBC and are applied without contravening any federal statutes, laws or regulations and without prejudice to the Crown's legal and constitutional rights.

- *Real property is acquired (including lease renewal) or new structures are constructed; or*

- *Existing real property is altered and*

b. The NFC or applicable local fire codes throughout the life cycle of the property.

Based on the TB Standard, at the time of any alteration, the NBC is applicable. However, the NBC is applicable only in the context and to the extent of the proposed renovations. Otherwise, for existing elements, not within the scope of work or affected by the renovation, the NFC is applicable.

2.6 National Building Code

The NBC is applicable to this project via the COHS Regulations and the TB Fire Protection Standard Refer to Sections 2.4 and 2.5 of this report).

For the purposes of this project, the 2010 NBC and NFC will be used to define requirements.

2.7 Ontario Building Code

The Ontario Building Code (OBC) may be applied on a voluntary basis. It is appropriate to consider the requirements of the OBC if a building permit is to be obtained from the City of Ottawa. There is no obligation for Public Works and Government Services Canada (PWGSC) to obtain a building permit from the City. However, in order to retain a good relationship with the City as a "good neighbour", application for Building Permit is often made.

The 2006 edition of the OBC, with all amendments to date, is applicable under the Building Code Act at this time and will form the basis of design review by the City of Ottawa unless superseded by a subsequent Code. Part 11 of the OBC will apply for renovations to this existing building. However, extensive renovations will mandate the application of other Parts of the OBC. It is noted that in the event of a conflict between the OBC and the NBC, the National Code is the only Code that is enforceable under law.

The OBC is also tied to numerous applicable laws and conformance with the OBC is not intended to be in conflict with these other applicable laws. In order for a building permit to be issued, the applicant may be required to demonstrate conformance with all other applicable laws.

2.8 Referenced Standards

The National Building and Fire Codes as well as the OBC reference numerous Standards. These Standards apply to the extent that they are referenced and in context of functional statements and objectives that are tied to the provisions referencing these Standards.

When a referenced Standard contains conditions or provisions which are in conflict with the NBC or NFC, the provisions of the NBC or NFC shall govern.

2.9 Other Requirements

Other requirements will be applicable to this project includes the following:

- Requirements for construction safety
- Occupational health and safety
- Electrical Safety Authority requirements
- Technical Standards and Safety Authority requirements, etc.

2.10 Applicable Authority Having Jurisdiction

The following is noted with respect to the applicable Authority Having Jurisdiction:

- The Departmental Fire Protection Coordinator (i.e., A senior official designated by the Deputy Head for the purpose of overseeing the implementation of the TB Fire Protection Standard) is accountable for fire safety. The Departmental Fire Protection Coordinator is responsible for ensuring compliance with the Treasury Board Standard including compliance with the National Building and Fire Codes and all referenced Standards. The Departmental Fire Protection Coordinator may engage the services of Fire Protection Services of the Labour Program of Human Resources Skills Development Canada (HRSDC) to advise and guide the implementation of these Codes and Standards. HRSDC may provide technical fire protection services and is responsible for providing strategic advice on the Treasury Board Fire Protection Standard, guiding the real property community, etc.

- The COHS Regulations are enforced by Canada Safety Officers within Human Resources Skills Development Canada.

- The OBC, to the extent that it can be applied to this project, is subject to the City of Ottawa Building Department as the authority having jurisdiction.

3. DESCRIPTION OF THE PROJECT

This project consists of the rehabilitation of the cladding for the east and west pavilions at the Centre Block in Ottawa. Also, as part of this project, the spray-applied fire resistive material used to protect steel members supporting the roof assembly will be repaired.

For work to be completed on the cladding, scaffolding will be erected on the outside of the building. The scaffolding may be enclosed during the winter months so that work can continue during cold weather. If the scaffolding is enclosed, the enclosure is expected to be heated.

The building will continue to be occupied during the rehabilitation of the cladding and the other repairs.

4. APPLICATION OF THE CODES

The application of the National Building and Fire Codes to this project is complicated by the fact that the construction is exterior to the building but enclosed in a weather-protection shell for the safety of workers. Since the construction of the scaffolding is temporary, the following Code provisions will not be fully applicable when evaluated against the criteria of reasonableness and practicability. For the purpose of this report, the requirements are documented but not analyzed in detail.

4.1 Separation of Construction Site to Building

The building will be occupied during construction. As such, as per NFC Sentence 5.6.1.12.(1), occupied portions of the building are to be separated from the construction site by a fire separation with a 1 hour fire resistance rating.

It is noted that construction of a fire separation between the scaffolding and the building will conflict with objectives of the project and will occasionally interfere with the project performance. Please see additional recommendations under Section 4.5 below.

4.2 Fire Department Access

As per NFC Article 5.6.1.4., Fire Department access to the building is to be maintained. A means is to be provided so Firefighters have access to all levels of the building. The construction cannot obstruct fire hydrants, portable fire extinguishers and the Fire Department connections.

4.3 Means of Egress

The means of egress from the occupied building are to be maintained at all times. When the construction results in an exit that is temporarily unusable, provisions are to be taken to clearly identify other exits (NFC Article 5.6.1.16.).

4.4 Fire Alarm System

The building's fire alarm system is to be operational at all times, however, temporary shut-downs of the fire alarm system is permitted as per NFC Sentence 6.1.1.4.(1). If the fire alarm system is shut down, alternative measures are to be implemented. Alterative measures can include a fire watch and discussions should be undertaken with the Fire Department so that occupants of the building and the Fire Department are promptly notified of a fire condition in the building.

A means to alert site personnel of a fire is to be provided and is to be capable of being heard throughout the building as per NFC Sentence 5.6.1.17.(1). Notification of occupants working on the scaffolding that there is a fire in the building is recommended to be provided. Refer to Section 4.13 of this report.

Consideration for extending signaling zones to the scaffold areas is proposed as are the provision of manual stations to allow workers to initiate the fire alarm as needed.

4.5 Sprinkler System

The existing Centre Block is required to be sprinklered but is predominantly non-sprinklered until the major rehabilitation of the building.

As an addition to the building, the NBC would expect sprinkler protection, however, since the scaffold areas are not permanent additions and are unheated at times, an alternative approach is recommended.

In this case, in order to preserve window openings and avoid the construction of a 1 hour fire rated separation between eh exiting building and the scaffolding, the scaffolding could be sprinklered with a dry system designed to activate automatically if closed sprinklers are exposed to heat. Alternatively, a system of heat detectors in conjunction with open deluge sprinklers can be considered.

4.6 Standpipe System

The existing Centre Block is provided with a standpipe system. Under conventional construction projects, the standpipe system would be expected to serve the scaffolded areas.

In this case, it is recommended that no additional standpipe be provided but that protection is provided from the existing building by firefighters as needed.

4.7 Portable Fire Extinguishers

Portable fire extinguishers are to be provided in the construction area in accordance with NFC Article 5.6.1.5. and in accordance with NFPA 10, "Standard for Portable Fire Extinguishers."

Portable fire extinguishers are to be provided in unobstructed and easily accessible locations in the following key areas:

- Where hot work operations are carried out
- Where combustibles are stored
- Near or on any internal combustion engines
- Where flammable and combustible liquids or gases are stored or handled
- Where temporary fuel-fired equipment is used

Portable fire extinguishers are to have a minimum rating of 2-A:10-B:C on moveable equipment and 4-A:40-B:C in all other locations.

4.8 Exposure Conditions to Building

Fire hazards as a result of work being undertaken within the scaffolding can expose unprotected openings in the building. Openings in portions of the building that remain occupied or are re-occupied after construction can also exposure the scaffolding to a fire condition. Refer to Section 4.13 of this report for recommendations to address hazards.

Protection of adjacent buildings from the construction area is required as per NFC Sentence 5.6.1.2.(1). However, other buildings are remotely located from the Centre Block and the other buildings would not be exposed to fire hazards associated with the construction on the Centre Block.

4.9 Fire Watch

As per Article 5.6.1.14., a fire watch is to be undertaken at maximum intervals of 1 hour in the portion of the building that continues to be occupied but only in conditions when the existing building is not equipped with a functioning fire alarm. The Fire Watch is required to be undertaken only when the building is occupied during demolition and when construction operations are taking place and fire alarm is not operational.

4.10 Protection of the Public

The following key provisions are applicable for the protection of the public:

- A covered way to protect the public is required as per NBC Sentence 8.2.1.1.(1) if the scaffolding is located within 2 metres from a public way used by pedestrians. The covered way is to be constructed as per Sentence 8.2.1.2.(1).

- Fencing, boarding or barricades are to be provided in accordance with NBC Article 8.2.1.3. if the scaffolding is located within 2 metres from a public way used by pedestrians. Other occupational health and safety requirements are also applicable to fencing, boarding or barricades.

- Safe passage of pedestrian and vehicular traffic is to be provided past the site in accordance with NBC Article 8.2.3.1.

- Waste material is to be removed as quickly as possible by means of appropriate containers, an enclosed shaft or chute (closed if it is more than 45° to the horizontal) or a hoisting apparatus. Waste material that is cleared is to be deposited in an enclosure arranged to prevent the waste material from being projected beyond the enclosure and which is not accessible to the public. Refer to NBC Subsection 8.2.5.

4.11 Ignition Sources

In accordance with NFC Sentence 5.6.1.8.(1), combustibles are to be kept away from ignition sources that include but are not limited to devices capable of producing ignition, internal combustion engines, temporary heating equipment, etc.

If the scaffolding enclosure will be heated in the winter months, clearances between combustible material and temporary heating equipment, including flues are to be provided in accordance with Part 6 of the NBC or in accordance with the minimum clearances indicated on certified heating equipment (NFC Sentence 5.6.1.8.(2)).

If fabrics or films are used to temporary enclose the building (including the enclosure for the scaffolding), the fabrics or films are to be securely fastened to prevent them from being blown against heaters or other ignitions sources (NFC Sentence 5.6.1.19.(1)).

4.12 Fire Safety Plan

A fire safety plan is to be prepared prior to demolition or construction activities in accordance with NFC Article 5.6.1.3.

4.13 Roof Fire Resistance Rating

As part of the scope of the exterior upgrades, the spray-applied fire resistive material used to protect steel members supporting the roof assembly will be repaired. However, in order to determine what upgrades are to occur, the required fire resistance rating of the roof assembly is to be determined.

If of new construction, based on the building containing Group A, Division 2 and Group D major occupancies, the construction requirements of Article 3.2.2.24. and Article 3.2.2.54. would be applicable. Article 3.2.2.24. and Article 3.2.2.54. do not require the roof assembly to be provided with a fire resistance rating, however, the building would be required to be sprinklered.

The building is not sprinklered, as such, application of the requirements for new construction which would exempt the roof fire resistance rating are not considered to be applicable (i.e., the requirements of new construction do not provide a baseline for the building as the building is unsprinklered). To determine the expected performance of a roof assembly in a building that is unsprinklered, previous Code editions have been considered as the requirement to sprinkler buildings of this size and occupancy is a modern requirement of the Code.

Code changes were implemented in the 1995 NBC which required buildings of this size and occupancy to be sprinklered. Prior to the 1995 NBC (i.e., 1990 NBC), a building of this size and occupancy was not required to be sprinklered, however, the roof was required to be provided with a 1 hour fire resistance rating.

The current edition of the NBC does not have requirements that would require a roof to be provided with a fire resistance rating greater than 1 hour. In addition, if a building is sprinklered, a roof rating is not required to be provided. As such, a sprinkler system would exempt the roof rating in the building. This approach is consistent with other Codes which are based on the NBC (e.g., Ontario Building Code).

To meet the intent of the current requirement of the NBC, renovated and repaired roof elements are subject to a 1 hour fire resistance rating (i.e., repair the spray-applied fire resistive material so that a 1 hour fire resistance rating is provided).

4.14 Risk Analysis

As per NBC Sentence 8.1.2.2.(1), precautions are to be undertaken to mitigate the risk of a person being exposed to an undue hazard.

If the scaffolding is enclosed during the winter months and there is a fire in the building, smoke may be able to enter the scaffolding enclosure through openings and may travel to other levels of the building via the scaffolding enclosure. In addition, occupants of the scaffolding will be exposed to smoke from the fire which may lead to the incapacitation of the occupants.

To mitigate the risk of fire occurring in the building, the following features, as noted above are recommended:

- Extend the fire alarm signaling devices to the enclosed scaffolding so that a person in the scaffolding enclosure will be notified of a fire in the occupied building. This will reduce the notification time of occupants and evacuation time.

- Provide a smoke exhaust fan for the scaffolding enclosure. The addition of a smoke exhaust fan will help reduce smoke spread to other levels of the building via the scaffolding enclosure. It is recommended that the smoke exhaust fan be manually activated by trained personnel.

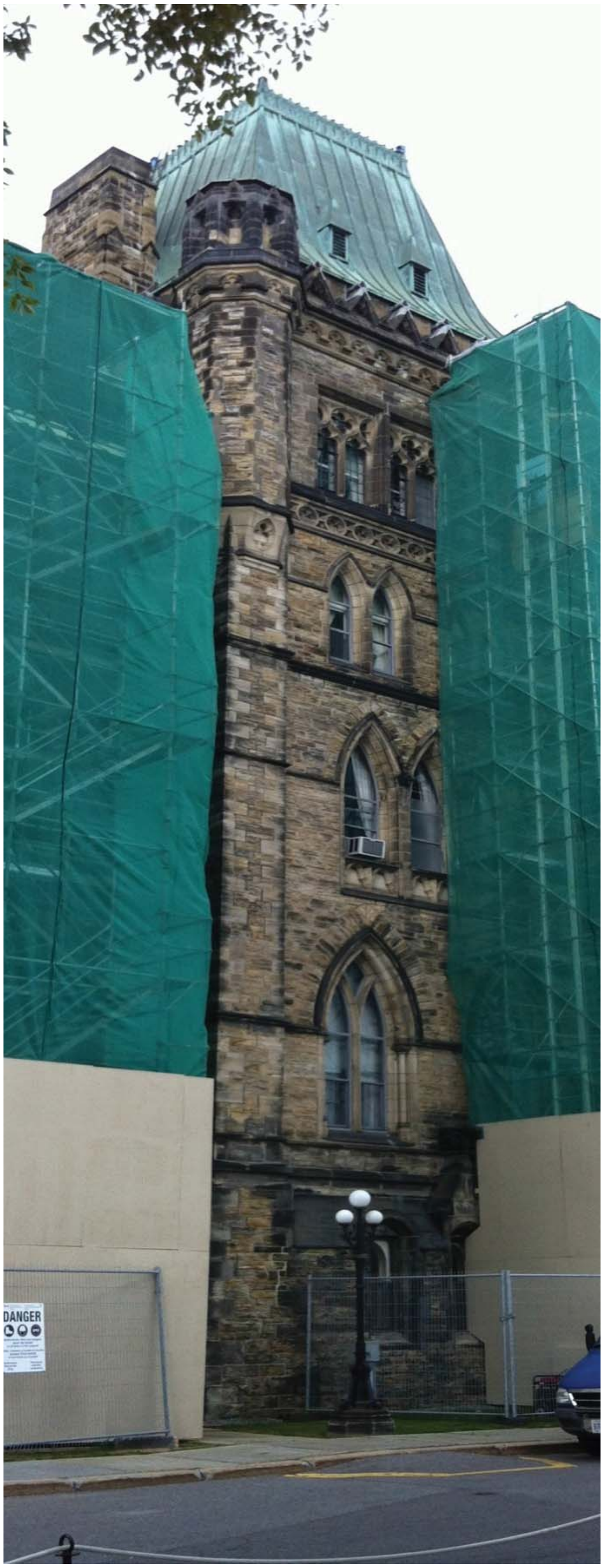
End of Report

Morrison Hershfield Limited

LICENSED PROFESSIONAL ENGINEER
J. W. JESKE
PROVINCE OF ONTARIO

Judy Jeske P.Eng. Principal
Senior Code Specialist
Director, Code and Life Safety Group

APPENDIX XI
BUILDING ENVELOPE ANALYSIS



**INSPECTION SOMMAIRE
DE L'ENVELOPPE VERTICALE
DES PAVILLONS *EST* ET *OUEST*
DU BLOC CENTRAL
RAPPORT D'EXPERTISES**

PARLEMENT D'OTTAWA
Colline du Parlement
Ottawa, Ontario

Soumis à:
Monsieur Matteo Cendamo
Architecte collaborateur
Fournier Gersovitz Moss Drolet et Associés Architectes

Dossier:
M-2751-A

Montréal, le 25 juin 2013

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PARTIE 1 - MANDAT

Patenaude-Trempe inc. (PT inc.) a été mandatée par Monsieur Matteo Cendamo, architecte collaborateur pour la firme Fournier Gersovitz Moss Drolet et Associés Architectes (FGMD) pour procéder à une évaluation de l'enveloppe verticale de même qu'à une analyse du comportement hygrothermique théorique des toitures des mansardes des pavillons *est* et *ouest* du bloc central du Parlement d'Ottawa situé sur la colline du Parlement.

L'expertise comprenait plus spécifiquement les étapes suivantes :

- Inspection sommaire des façades des pavillons *est* et *ouest* du bloc central ;
- Observations et commentaires sur les percées exploratoires effectuées par l'entrepreneur préalablement à nos visites;
- Simulations informatiques du comportement hygrothermique théorique des toitures des mansardes des pavillons *est* et *ouest*.

Ce rapport présente les résultats des différentes étapes de l'expertise ainsi que notre opinion technique sur les observations et les modifications proposées par FGMD de la composition des mansardes des pavillons *est* et *ouest* du bloc central (telles que l'ajout d'un isolant et d'un nouveau revêtement).

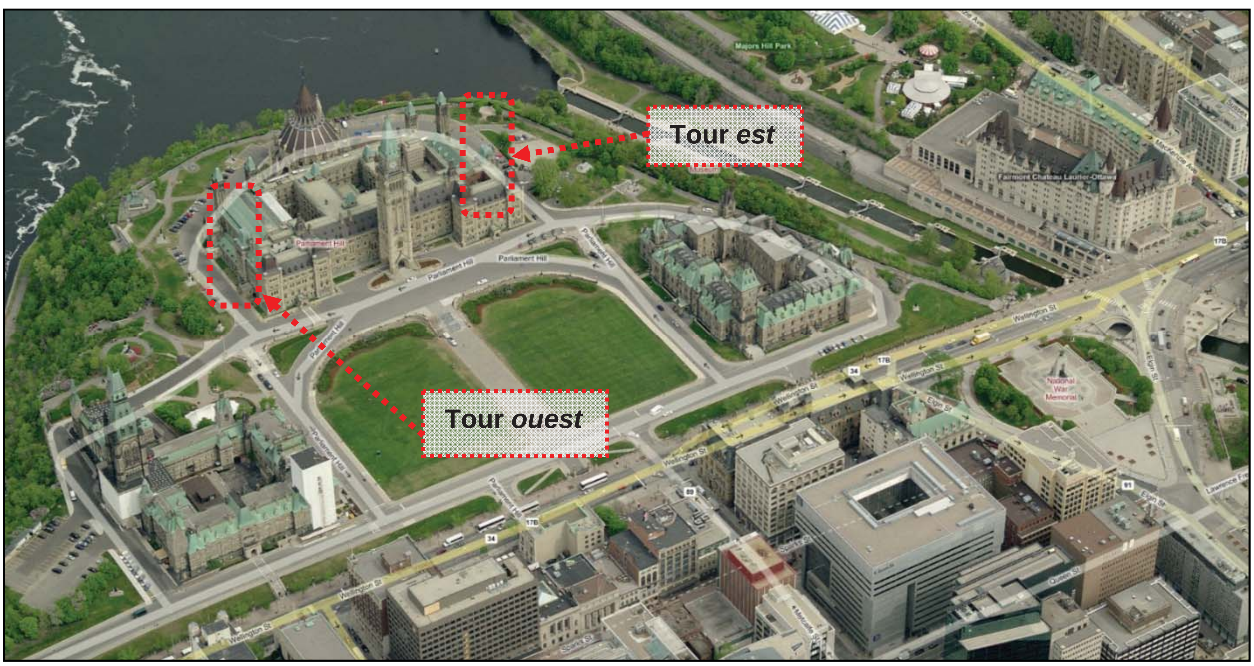


Figure nº 1: Localisation des pavillons au Parlement à Ottawa

Source: http://www.bing.com/maps

PARTIE 2 - GÉNÉRALITÉS

2.1 PORTÉE LIMITE DU DOCUMENT

Ce rapport résume les expertises et les analyses faites par Patenaude-Trempe en relation avec l'évaluation de l'enveloppe du Parlement d'Ottawa situé sur la colline du Parlement à Ottawa.

Il ne porte ni sur la conformité des ouvrages existants aux codes en vigueur ni sur l'identification de moisissures, d'amiante ou d'autres contaminants. Le document exclut aussi toute étude de nature structurale ou de mécanique du bâtiment.

Les opinions émises dans ce rapport se basent sur l'observation de percées exploratoires réalisées dans un temps donné, en période estivale, à des endroits ciblés. Elles sont valables dans la mesure où les conditions relevées lors de l'expertise sont représentatives des conditions générales que l'on retrouve dans les murs extérieurs.

Ce rapport se base sur des appréciations qualitatives des assemblages. En effet, aucun test normalisé d'étanchéité à l'air ou à l'eau n'a été réalisé dans le cadre de ce mandat sur les composantes en place.

Enfin, les recommandations formulées dans ce rapport ne constituent d'aucune façon des spécifications techniques pour fins de construction. Elles visent uniquement à informer notre mandant, Fournier Gersovitz Moss Drolet et Associés Architectes, ou ses professionnels mandatés sur l'état général des façades des pavillons du bloc central du Parlement et à l'orienter, le cas échéant, quant aux stratégies possibles d'interventions correctives ou d'entretien, au cours des prochaines années.

2.2 DATES ET MÉTHODOLOGIE D'EXPERTISES

Le tableau suivant présente les dates auxquelles les différentes étapes d'expertises ont été réalisées ainsi que les personnes qui y ont participé.

Tableau 1: Méthodologie d'expertise

Date	Objet	Intervenants	Conditions climatiques
28 août 2012	**Inspection des façades Observation des percées exploratoires**	• Patrick Masson, MOTPQ, LEED AP/CB+D, directeur division expertise Montréal (PT inc.) • Mélina Roy, T.P. (PT inc.) • John Diodati, architecte (FGMD) • Matteo Cendamo, architecte (FGMD)	Ensoleillé, 12 °C
13 septembre 2012	**Observation des percées exploratoires**	• Patrick Masson, MOTPQ, LEED AP/CB+D, directeur division expertise Montréal (PT inc.)	Ensoleillé, 23 °C

2.3 DESCRIPTION DU BÂTIMENT

Le bloc central du Parlement d'Ottawa, qui inclut les deux pavillons touchées par la présente étude, a été reconstruit après un incendie qui a emporté tous les bâtiments de la colline du Parlement, à l'exception de la bibliothèque. La reconstruction du bloc central s'est achevée vers 1920. Formellement, le bâtiment est très similaire à l'ancien. Cependant, il a été reconstruit selon les nouvelles méthodes de l'époque, c'est-à-dire qu'il possède une structure métallique. Le nouveau bâtiment, comme l'ancien, est recouvert de grès.

Photo nº 1: Vue générale du bloc central du Parlement d'Ottawa

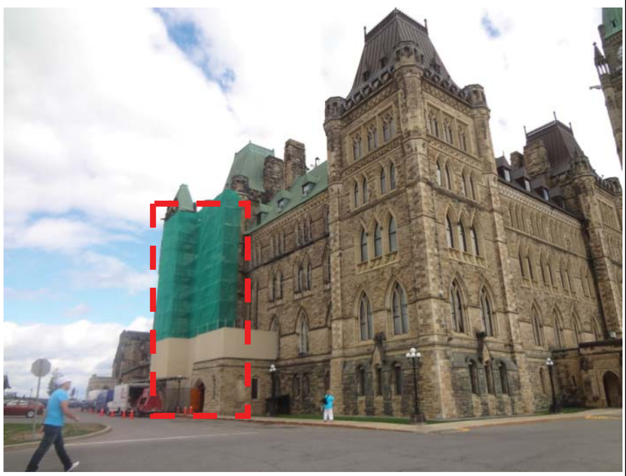


Photo nº 2: Zone inspectée – Pavillon *ouest*

Photo nº 3: Zone inspectée – Pavillon *est*

PARTIE 3 - OBSERVATION DES CONDITIONS EXISTANTES

Note : L'inspection effectuée dans le cadre de ce mandat est limitée à une appréciation générale non exhaustive des conditions apparentes de la maçonnerie. Aucun relevé détaillé n'est prévu dans les limites de l'étude qui avait été demandée.

Une inspection sommaire des façades des pavillons *est* et *ouest* a été réalisée dans le cadre de notre expertise.

L'inspection s'est faite à partir du sol et à l'aide des échafauds mis en place pour la réalisation des percées exploratoires.

Selon les informations fournies par FGMD, les façades sont composées de pierres de grès de trois formations géologiques différentes : Wallace, Borea et Nepean. La pierre de type Nepean est utilisée pour la partie courante tandis que les deux autres types sont utilisés pour le moulurage et les décorations.

La grande majorité de la surface est en bon état. Des déficiences mineures ont été observées :

- Dépôts atmosphériques sur les surfaces ;
- Joints évidés ou fissurés ;
- Pierre éclatée, brisée, érodée ou fissurée ;
- Déplacement des pierres d'ogive.

Des réparations antérieures effectuées à l'aide de crépi cimentaire ont été observées sur certaines pierres. Ces interventions ne sont plus solidaires, sont tombées ou sont fissurées. Cette méthode d'intervention a eu pour effet de provoquer une dégradation de la surface de la pierre par l'emprisonnement de l'humidité derrière le revêtement de crépi cimentaire.

Plusieurs types de mortier ont été observés, laissant deviner les différentes interventions faites au cours des années.

Pour les deux pavillonss, les tourelles montrent les signes de dégradation les plus importants. Nous avons observé des déplacements, de la fissuration des joints et des pierres, plusieurs interventions antérieures inappropriées, des pierres érodées et des joints ouverts.

	
Photo nº 4: Délamination de la réparation et pierre érodée sous la surface	Photo nº 5: Dépôt sur la pierre et surface érodée
	
Photo nº 6: Joints ouverts et produit de resurfaçage employé	Photo nº 7: Déplacement de l'ogive et des pierres adjacentes

PARTIE 4 - VÉRIFICATION DES ASSEMBLAGES

Trente-deux percées exploratoires ont été pratiquées sur les différentes façades à l'étude, soit les pavillons *est* et *ouest* du bloc central du Parlement. La plupart des ouvertures ont été faites avant notre arrivée sur le site. Les autres ont été complétées en notre présence, mais sous la direction de notre mandant. Le choix de la localisation des percées a été fait par notre mandant, FGMD. La localisation des ouvertures est indiquée sur les élévations à l'annexe 1 du présent rapport.

Pour chacune des percées, les pierres de parement ont été enlevées afin d'exposer le fond mural en maçonnerie de brique d'argile, de béton ou de terracotta. Dans certains cas, et ce à la demande de FGMD, un ou deux rangs de briques ont été retirés afin de déterminer la composition à l'arrière ainsi que l'état des composantes. Voici le résumé de nos observations.

4.1 PAREMENT

- La pierre de parement, en grès, est en bon état ; cependant, à certains endroits, la pierre est effritée en surface. La pierre de parement, de différentes épaisseurs, se retrouve encastrée dans le fond mural en brique d'argile ;
- Des dépôts noirâtres sont présents sur la surface de la pierre, correspondant probablement à des dépôts de pollution atmosphérique ;
- Le mortier du parement est très solide bien qu'à certains endroits, les joints soient effrités ou partiellement évidés, principalement aux étages supérieurs.

4.2 FOND MURAL

- Le fond mural en brique d'argile est très solide et ne comporte aucune fissure ou trace de dégradation. Dans la majorité des cas, la brique a dû être brisée pour permettre son enlèvement. Il a donc été impossible de récupérer des briques entières afin de les faire analyser en laboratoire ;
- Le mortier du fond mural est très solide, il s'effrite très légèrement dans des cas isolés ;
- Le fond mural était sec dans le cas de toutes les ouvertures exploratoires ;
- La dimension (profondeur) des pierres de parement varie de façon importante d'un rang à l'autre, permettant ainsi de créer un forme de liaison entre le parement et le fond mural ;
- La maçonnerie de brique est installée sans schéma précis. Les briques sont installées horizontalement ou verticalement. Certaines briques sont installées de façon à assurer une liaison entre le premier rang et le second ;
- Les blocs de terracotta sont dans un très bon état et ne montrent aucune trace de dégradation apparente ;

- Les éléments de structure d’acier sont en très bon état ; des traces de rouille mineure ont été observées. Dans l’ouverture ET04, des signes de corrosion plus importante ont été constatés sur la poutre d’acier ;
- En présence d’un élément d’acier ou de béton, un vide existe entre le parement et cet élément. Nous n’avons pas observé de liaisonnement entre le parement et les éléments de structure. La structure semble être encastrée dans la maçonnerie du fond mural ;
- Pour l’ouverture EP02, une mince pellicule noire non identifiée (elle ressemble à un enduit) est présente entre l’arrière de la pierre de parement et le béton du fond mural ;
- Pour l’ouverture EP04, un enduit noir non identifié est présent sur la face arrière de la pierre de parement. De plus, un vide existe entre le parement et l’élément structural en béton ;
- Différents types de mortier ont été observés dans le fond mural, notamment dans le cas de l’ouverture EP06 ;
- Dans les ouvertures sur les tourelles telles que ET06, il a été constaté que les joints de mortier ne sont plus solidaires à la pierre de parement sur toute la profondeur du joint.

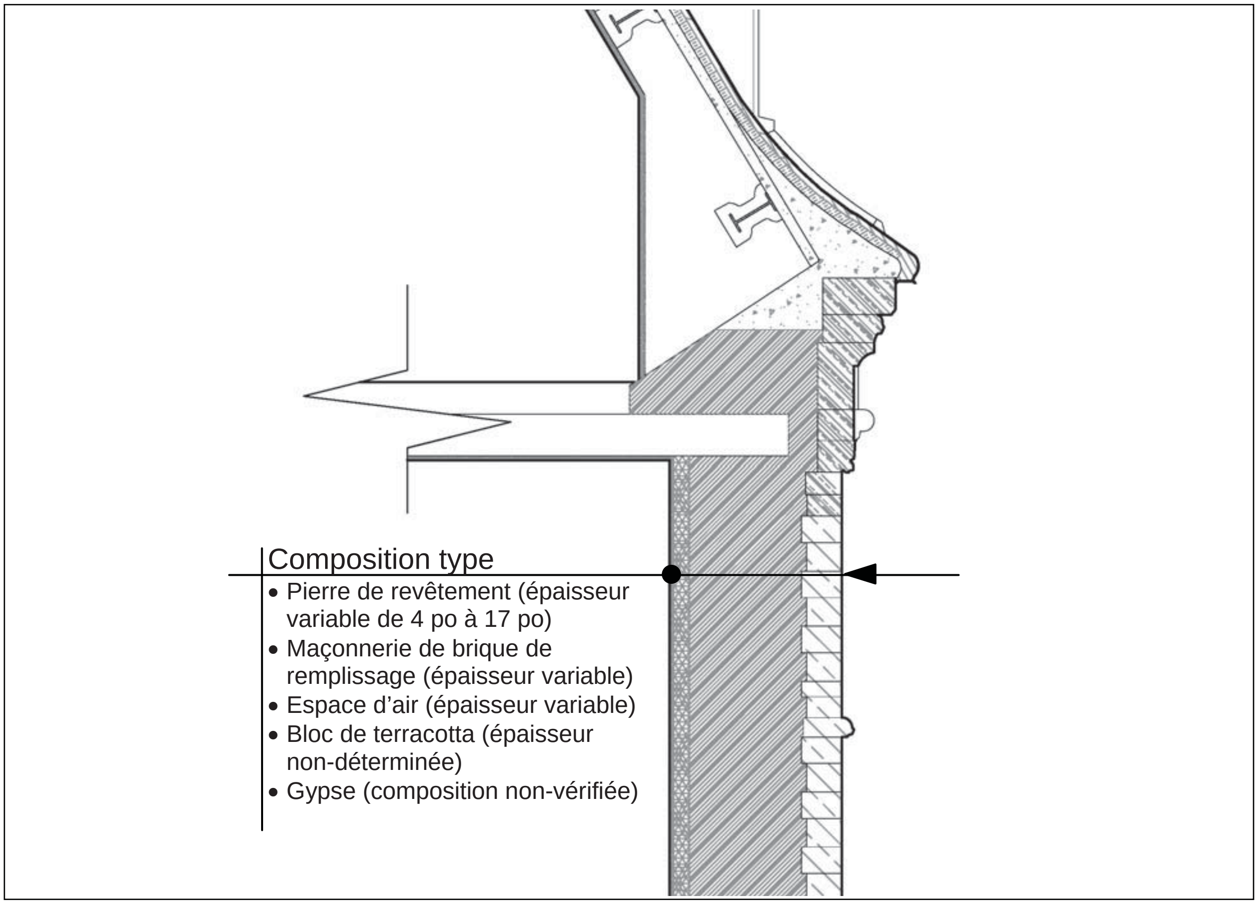
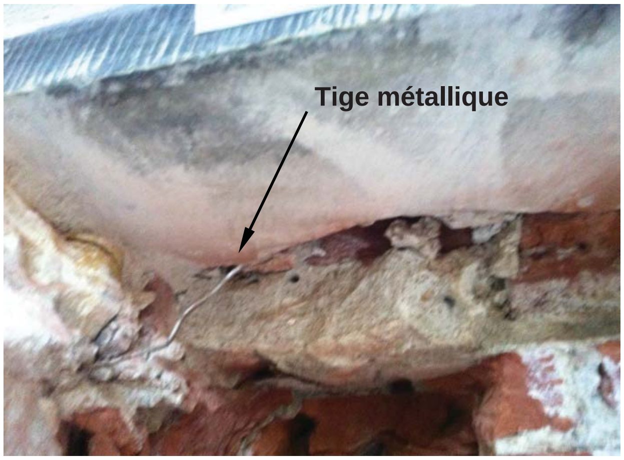


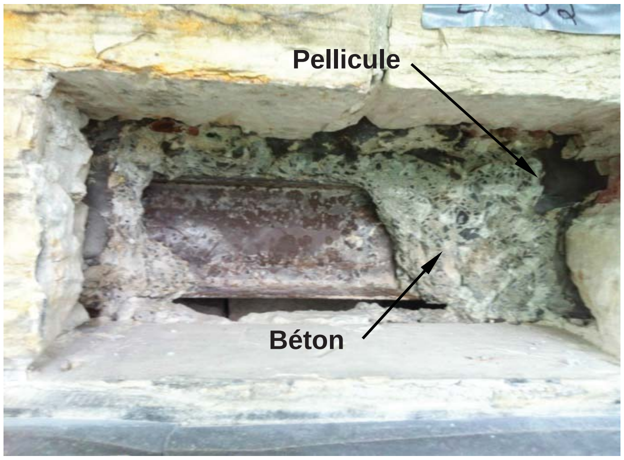
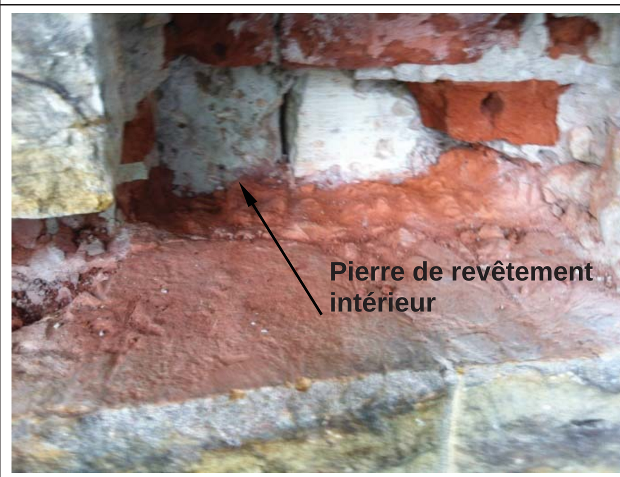
Figure nº 2: Composition type

Détail annoté par PT inc. fourni par Fournier Gersovitz Moss Drolet et Associés Architectes

Tableau 2: Tableau des percées exploratoires

Élévation ***est*** du **Parlement**	
Identification	**Description**
EP01, EP03 et EP06	Percées exploratoires dans la partie courante du mur à différents niveaux sur la façade.

<table>
<tr>
<td>
</td>
<td>
</td>
</tr>
<tr>
<td>EP01 : La pierre de parement a été retirée et deux rangs de briques ont été exposés.</td>
<td>EP03 : La pierre de parement a été retirée et deux rangs de briques ont été exposés.</td>
</tr>
<tr>
<td></td>
<td>
</td>
</tr>
<tr>
<td>EP06 : La pierre de parement a été retirée ainsi que deux rangs de briques; les blocs de terracotta ont été exposés. Un élément de structure d'acier est apparent derrière la brique.</td>
<td>EP06 : Présence de béton entre les éléments de maçonnerie.</td>
</tr>
</table>

Élévation *est* du Parlement	
Identification	**Description**
EP02, EP04 et EP07	Percées exploratoires dans l'enveloppe de l'escalier à différents niveaux.
	
EP02 : La pierre de parement a été retirée, exposant une poutre d'acier en partie recouverte de béton.	EP04 : La pierre de parement a été retirée ainsi que deux rangs de briques. Derrière, on retrouve un espace vide d'environ 4 po, et le dos du revêtement de pierre intérieure est exposé.
	
EP07 : La pierre de parement a été retirée ainsi qu'un rang de pierre, laissant le dos de la pierre de revêtement intérieur exposé.	EP07 : Endos de la pierre de revêtement intérieur de l'escalier.

Élévation *est* du pavillon *est*	
Identification	**Description**
ET03, ET05 et ET06	Percées exploratoires à différents niveaux de la section latérale du pavillon *est*, façade *est*.

	
ET03 : Ouverture inachevée au moment de l'inspection. La pierre de parement a été retirée, laissant la brique apparente.	ET05 : Ouverture inachevée au moment de l'inspection. La pierre de parement a été retirée, laissant la brique apparente.
	
ET06 : Ouverture dans la partie latérale de la façade; la pierre de parement a été retirée ainsi qu'un rang de pierre, laissant le dos de la pierre de revêtement intérieur exposée.	ET06 : Briques installées en boutisses, quelques vides de construction dans l'assemblage de maçonnerie de briques.

Élévation *est* du pavillon *est*	
Identification	**Description**
ET04 et ET08	Percées exploratoires à différents niveaux de la section centrale du pavillon *est*, façade *est*.

	
ET04 : La pierre de parement a été retirée, une poutre d'acier ainsi que des blocs de terracotta sont apparents.	ET04 : Ouverture inachevée au moment de l'inspection. La pierre de parement a été retirée, laissant la brique apparente.

Élévation *est* du pavillon *est*	
Identification	**Description**
ET04 et ET08	Percées exploratoires à différents niveaux de la section centrale du pavillon *est*, façade *est*.
	
ET08 : Ouverture sous la bordure de toiture, dans la partie centrale de la façade; la pierre de parement a été retirée ainsi la maçonnerie de brique, exposant une poutre d'acier.	ET08 : Poutre d'acier apparente.

Élévation *nord* du pavillon *est*	
Identification	**Description**
ETN02 et ETN08	Percées exploratoires sur la section centrale du pavillon *est*, façade *nord*.
	
ETN02 : La pierre de parement a été retirée; l’ouverture n’était pas achevée lors de notre passage.	ETN08 : Pierre de parement et maçonnerie de briques retirées, exposant une poutre d’acier.

<table>
<tr><th colspan="2">Élévation nord du pavillon est</th></tr>
<tr><th>Identification</th><th>Description</th></tr>
<tr><td>ETN01, ETN06, ETN08 et ETN09</td><td>Percées exploratoires à différents niveaux de la section latérale du pavillon est, façade nord.</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>ETN01 : La pierre de parement a été retirée; l’ouverture n’était pas achevée lors de notre passage.</td><td>ETN06 : La pierre de parement a été retirée, laissant la brique apparente. Briques installées en boutisses.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>ETN09 : Ouverture sous la bordure de toiture, dans la partie latérale de la façade; la pierre de parement a été retirée ainsi la maçonnerie de brique, exposant un remplissage de béton.</td><td>ETN09 : Présence de béton derrière la maçonnerie de brique.</td></tr>
</table>

Élévation *nord* du pavillon *ouest*	
Identification	**Description**
WTN01 et WTN03	Percées exploratoires à différents niveaux du pavillon *ouest*, façade *nord*.

WTN01 : La pierre de parement a été retirée; l'extrémité d'une poutre d'acier est apparente.

WTN03 : La pierre de parement a été retirée, laissant la brique apparente.

<table>
<tr><th colspan="2">Élévation ouest du pavillon ouest</th></tr>
<tr><th>Identification</th><th>Description</th></tr>
<tr><td>WT00, WT06 (non entamée), WT08, WT09 ET WT10</td><td>Percées exploratoires à différents niveaux des sections latérales du pavillon ouest, façade ouest.</td></tr>
<tr><td>
</td><td></td></tr>
<tr><td>WT00 : La pierre de parement a été retirée, laissant la maçonnerie de brique apparente.</td><td>WT08 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente.</td></tr>
<tr><td>
</td><td></td></tr>
<tr><td>WT09 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente.</td><td>WT10 : La pierre de parement ainsi que le premier rang de briques ont été retirés, laissant un deuxième rang de briques apparent.</td></tr>
</table>

<table>
<tr><th colspan="2">Élévation ouest du pavillon ouest</th></tr>
<tr><th>Identification</th><th>Description</th></tr>
<tr><td>WT01, WT02, WT03, WT04, WT05, WT07, WT11, WT12 et WT13</td><td>Percées exploratoires à différents niveaux des sections centrales du pavillon ouest, façade ouest.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>WT01 : La pierre de parement a été retirée, laissant la maçonnerie de brique apparente.</td><td>WT02 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente ainsi qu’une poutre d’acier. Présence de quelques vides de construction dans l’arrière-mur de maçonnerie.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>WT03 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente.</td><td>WT04 : La pierre de parement ainsi que la maçonnerie de briques ont été retirées, exposant une poutre d’acier.</td></tr>
</table>

<table>
<tr><th colspan="2">Élévation ouest du pavillon ouest</th></tr>
<tr><th>Identification</th><th>Description</th></tr>
<tr><td>WT01, WT02, WT03, WT04, WT05, WT07, WT11, WT12 et WT13</td><td>Percées exploratoires à différents niveaux des sections centrales du pavillon ouest, façade ouest.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>WT05 : La pierre de parement a été retirée, exposant des briques en boutisses ainsi qu’une poutre d’acier.</td><td>WT07 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>WT05 : La pierre de parement a été retirée, laissant la maçonnerie de briques apparente.</td><td>WT12 : La pierre de parement a été retirée ainsi que la maçonnerie de briques, exposant une poutre d’acier.</td></tr>
</table>

<table>
<tr><th colspan="2">Élévation ouest du pavillon ouest</th></tr>
<tr><th>Identification</th><th>Description</th></tr>
<tr><td>WT01, WT02, WT03, WT04, WT05, WT07, WT11, WT12 et WT13</td><td>Percées exploratoires à différents niveaux des sections centrales du pavillon ouest, façade ouest.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">WT13 : La pierre de parement a été retirée ainsi que la maçonnerie de briques, exposant une poutre d’acier.</td></tr>
</table>

PARTIE 5 - SIMULATIONS DES CONDITIONS EXISTANTES AU NIVEAU DES MANSARDES

Notre mandat initial comprenait des simulations 2D (WUFI) sur les assemblages muraux existants pour en évaluer les performances. Afin d'effectuer de telles simulations, la caractérisation en laboratoire des différents matériaux constituant les assemblages existants était requise. Devant l'impossibilité de récupérer la brique ou la pierre de parement, devant le fait que les compositions de mur et la fonction du bâtiment ne seraient pas modifiées, et en considérant que le mur est dans un très bon état général, il a été convenu avec notre mandant de ne pas procéder à ces simulations. Les résultats obtenus pourrait être erronés puisqu'ils sont basés sur le comportement hygrothermique de produits génériques et non le comportement des matériaux présents dans l'assemblage.

Des modifications aux mansardes sont par contre prévues. Afin de vérifier l'impact des modifications proposées par FGMD au niveau des mansardes des pavillons *est* et *ouest* du bloc central du Parlement, des simulations ont été effectuées sur la modélisation des compositions de ces mansardes. Il est à noter que l'inspection des mansardes et le relevé des conditions existantes ne faisant pas partie du présent mandat, les simulations sont donc basées sur les informations reçues de la part de notre mandant.

Des simulations informatiques à l'aide d'un logiciel 1D statique (tel que les logiciels HAM ou CONDENSE) ont donc été réalisées sur les modélisations des deux (2) assemblages typiques d'origine au niveau des mansardes. Les modifications proposées par FGMD ont par la suite été intégrées à chacun des modèles pour en évaluer l'influence.

Ces simulations ont été réalisées dans le but d'évaluer la performance thermique de la composition des mansardes et son comportement théorique en regard de la diffusion de la vapeur d'eau.

Pour évaluer les risques de condensation de la vapeur d'eau en diffusion dans les murs en conditions hivernales, les variables suivantes ont été utilisées pour chacune des simulations :

Conditions extérieures : température de - 25 °C avec une humidité relative de 90 %, conditions de design hivernales pour la ville d'Ottawa selon le *Code national du bâtiment* (2005).

Conditions intérieures : température de 20 °C avec une humidité relative de 30 % (conditions intérieures fournies par FGMD).

La méthode de calcul utilisée par le logiciel de simulation est la méthode du point de rosée (« *dew-point method* », « *2005 ASHRAE Handbook Fundamentals* », chapitre 23). Ce type d'analyse se fait en comparant la pression de vapeur à saturation avec la pression de vapeur en diffusion continue à tout point dans la composition de mur. Lorsque la pression de vapeur en diffusion continue calculée est égale ou plus élevée que la pression de vapeur à saturation, il y a risque de condensation.

1) **Pression de vapeur à saturation :** la pression de vapeur à saturation est directement proportionnelle à la température. À une température donnée, la pression de vapeur à saturation est atteinte lorsque l'humidité relative de l'air est de 100 %. Comme elle dépend de la température, la pression de vapeur à saturation variera dans la composition de toiture selon les températures de chaque côté de l'enveloppe du bâtiment et selon la performance thermique de chacune de ses composantes.
2) **Pression de vapeur en diffusion continue :** en conditions hivernales, les pressions de vapeur d'eau sont beaucoup plus faibles dans l'air froid extérieur que dans l'air chaud intérieur. Pour équilibrer le système, la vapeur d'eau migre par diffusion au travers de l'assemblage de l'intérieur (pression de vapeur forte) vers l'extérieur (pression de vapeur faible). La pression de vapeur en diffusion continue dans la composition de toiture est donc fonction des pressions de vapeur de chaque côté de l'enveloppe et de la résistance à la vapeur d'eau de chacune des composantes de l'assemblage.

5.1 MODÉLISATION DES ASSEMBLAGES D'ORIGINE

Les figures 3 et 4 suivantes illustrent la modélisation des deux assemblages typiques existant au niveau des mansardes.

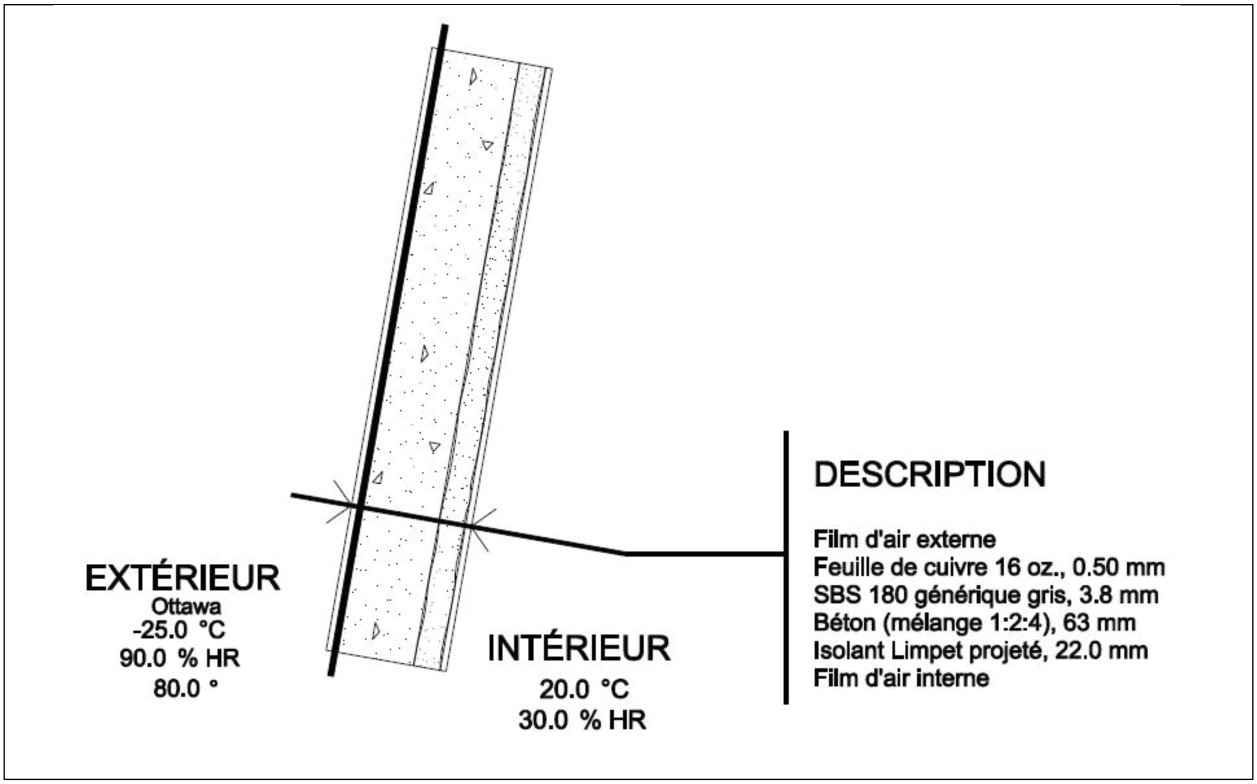


Figure nº 3: Modélisation de l'assemblage n°1

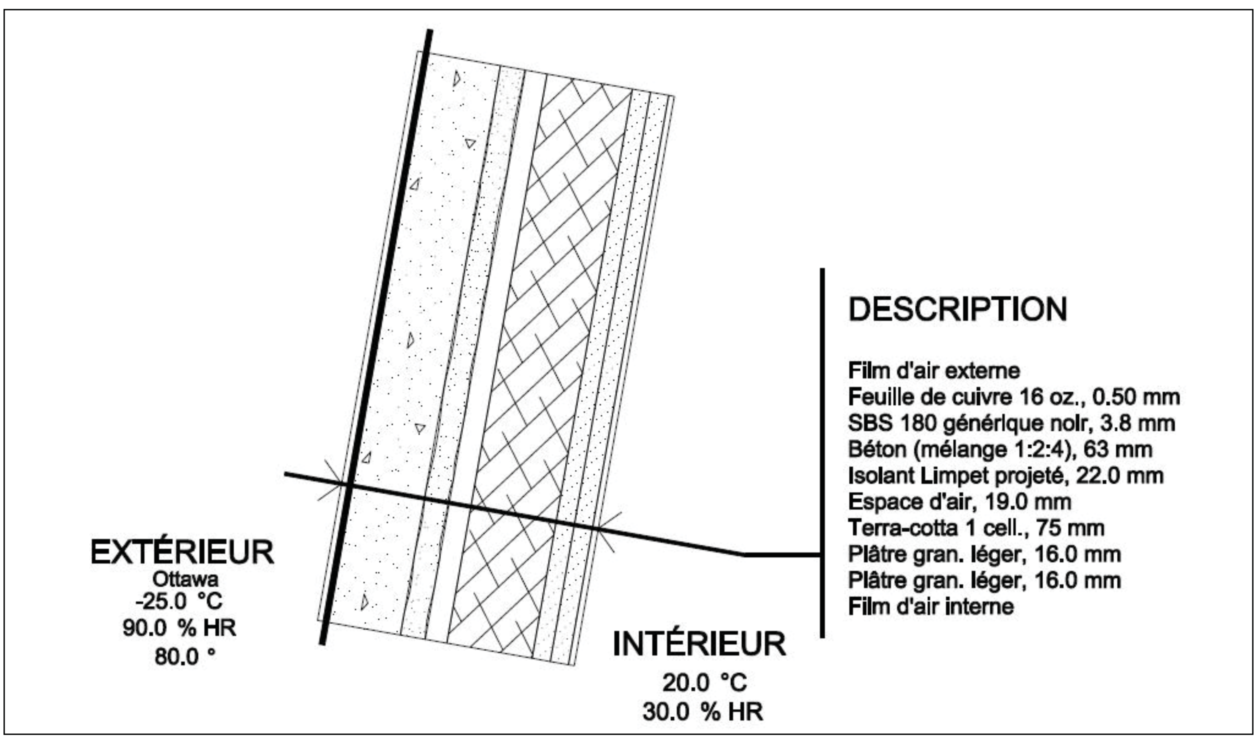


Figure nº 4: Modélisation de l'assemblage n°2

5.1.1 Résultats des simulations sur l'assemblage d'origine

La résistance thermique totale calculée pour chacun des deux assemblages est de :

- Pour l'assemblage n°1, la résistance thermique RSI est de 0,78 m^2 C/W;
- Pour l'assemblage n°2, la résistance thermique RSI est de 1,27 m^2 C/W.

Aux conditions fixées pour les simulations, un risque de condensation de la vapeur d'eau en diffusion est présent dans les deux assemblages.

En effet, dans les deux cas, les simulations indiquent que la condensation risque de se manifester en surface intérieure du béton, qui est maintenue à des températures très froides (jusqu'en dessous de - 20 °C). Les résultats des simulations sur les compositions d'origine sont disponibles à l'annexe 2 du présent document.

5.1.2 Commentaires relatifs aux simulations des assemblages d'origine

La résistance thermique des deux assemblages au niveau des mansardes est faible, la seule composante offrant une résistance thermique relativement élevée étant l'ignifuge appliqué sur le béton (RSI 0,51, soit 65 % de la résistance thermique de l'assemblage n°1 et 40 % de l'assemblage n°2).

Comme la chute de température dans les deux assemblages se retrouve donc principalement au niveau de l'ignifuge, c'est à cet endroit que la pression de vapeur à saturation est atteinte et qu'il y a risque de condensation. Cette condition peut occasionner l'apparition d'humidité du côté intérieur de l'enveloppe.

Cependant, les taux de condensation calculés sont très faibles (faible quantité d'eau produite par condensation). Par conséquent, selon les informations qui nous ont été données, il semblerait que cette condition n'a pas occasionné de problèmes notables au niveau des assemblages existants.

5.2 ANALYSE DES ASSEMBLAGES TYPIQUES MODIFIÉS

Les modifications proposées par FGMD ont comme objectif d'obtenir une enveloppe ayant un meilleur rendement thermique tout en évitant la formation de condensation dans les assemblages. La stratégie retenue pour les modifications est l'installation d'un isolant par l'extérieur combinée à l'installation d'un pare-air et d'un pare-vapeur continus et efficaces.

Plus spécifiquement, les modifications proposées par FGMD sont d'enlever la couverture de cuivre 16 oz existante et d'installer, par-dessus la membrane de sous-couche existante en surface extérieure du béton, une nouvelle composition de toiture sandwich incluant les éléments suivants :

- Une membrane pare-air de type Tyvek;
- Une épaisseur de 38 mm d'isolant de polystyrène extrudé;
- Un panneau de support de contreplaqué d'une épaisseur de 19 mm;
- Une membrane de sous-couche de bitume élastomère (SBS);
- Une nouvelle couverture en feuille de cuivre 20 oz.

Dans cette nouvelle composition, c'est la membrane de sous-couche en bitume élastomère (SBS) existante en surface extérieure du béton qui agit comme pare-vapeur.

5.2.1 Résultats des simulations sur l'assemblage n°1 modifié

Les résultats des simulations des modifications sur l'assemblage n°1 sont présentés à l'annexe 2 du présent document. La figure 5 ci-dessous illustre la modélisation de l'assemblage n°1 modifié.

Selon les simulations, l'ajout d'isolant du côté extérieur permet de maintenir le béton à des températures plus élevées (entre environ 6 et 8 °C) et d'éviter que de la condensation se forme sur sa surface intérieure.

Les résultats indiquent néanmoins un risque de condensation au niveau de l'isolant de polystyrène extrudé. La couverture de cuivre et la nouvelle membrane de sous-couche de bitume élastomère offrent une grande proportion de la résistance à la vapeur d'eau totale de l'assemblage. Par conséquent, la pression de vapeur en diffusion dans l'assemblage ne chute pas suffisamment au niveau de la membrane existante sur la surface extérieure du béton, qui agit comme pare-vapeur, pour que l'atteinte de la pression de vapeur à saturation soit totalement évitée. Par conséquent, ces résultats indiquent un risque de condensation sur la surface intérieure du panneau de support en contreplaqué.

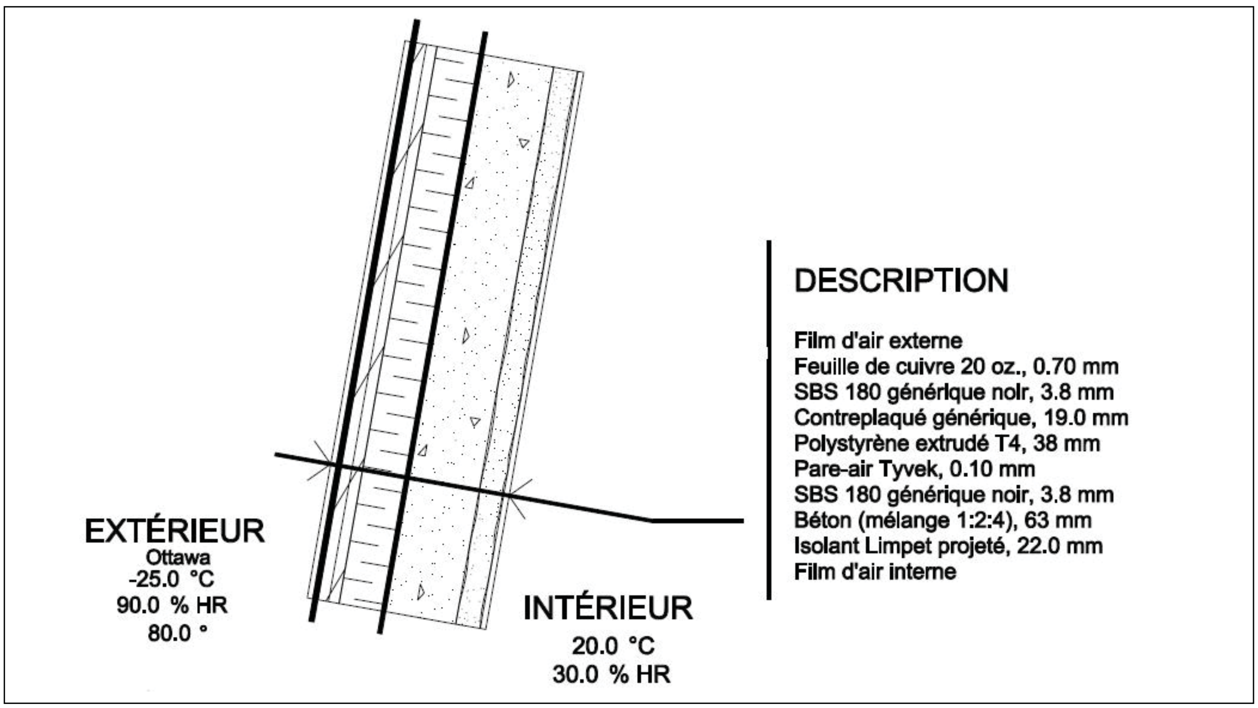


Figure nº 5: Modélisation de l'assemblage n°1 modifié

Il s'agit cependant de résultats théoriques qui, de plus, indiquent des taux de condensation très faibles. En pratique, si la membrane de sous-couche installée en surface extérieure du béton, qui agit comme pare-vapeur dans la composition modifiée, permet une totale continuité de l'étanchéité à la vapeur d'eau de l'enveloppe, les risques de condensation de la vapeur d'eau en diffusion sont, à notre avis, presque nuls. Nous croyons que le panneau de support devrait tout de même être composé d'un matériau imputrescible plutôt que d'un contreplaqué sensible à l'humidité.

Notons que la présence de l'ignifuge du côté intérieur, qui offre une résistance thermique non négligeable, limite le réchauffement direct du béton en le coupant de la chaleur ambiante à l'intérieur. Les performances hygrothermiques de l'assemblage seraient améliorées en enlevant cet ignifuge, car le béton serait maintenu à des températures plus élevées, évitant ainsi davantage les risques de condensation dans l'assemblage. Des vérifications relativement à la sécurité incendie devraient être faites avant d'intégrer cette intervention aux modifications apportées.

L'installation d'une membrane pare-air de type Tyvek, quant à elle, apparaît à notre avis inappropriée dans le cas présent. En effet, comme la membrane de bitume élastomère installée en surface extérieure du béton doit offrir une étanchéité à l'air et à la vapeur d'eau, la présence d'un deuxième plan d'étanchéité à l'air n'est pas requise.

Finalement, l'assemblage n°1 modifié offre une résistance thermique RSI de 2,33.

5.2.2 <u>Résultats des simulations sur l'assemblage n°2 modifié</u>

Les résultats de ces simulations sont disponibles à l'annexe 2. La figure 6 suivante illustre la modélisation de l'assemblage n°2 modifié.

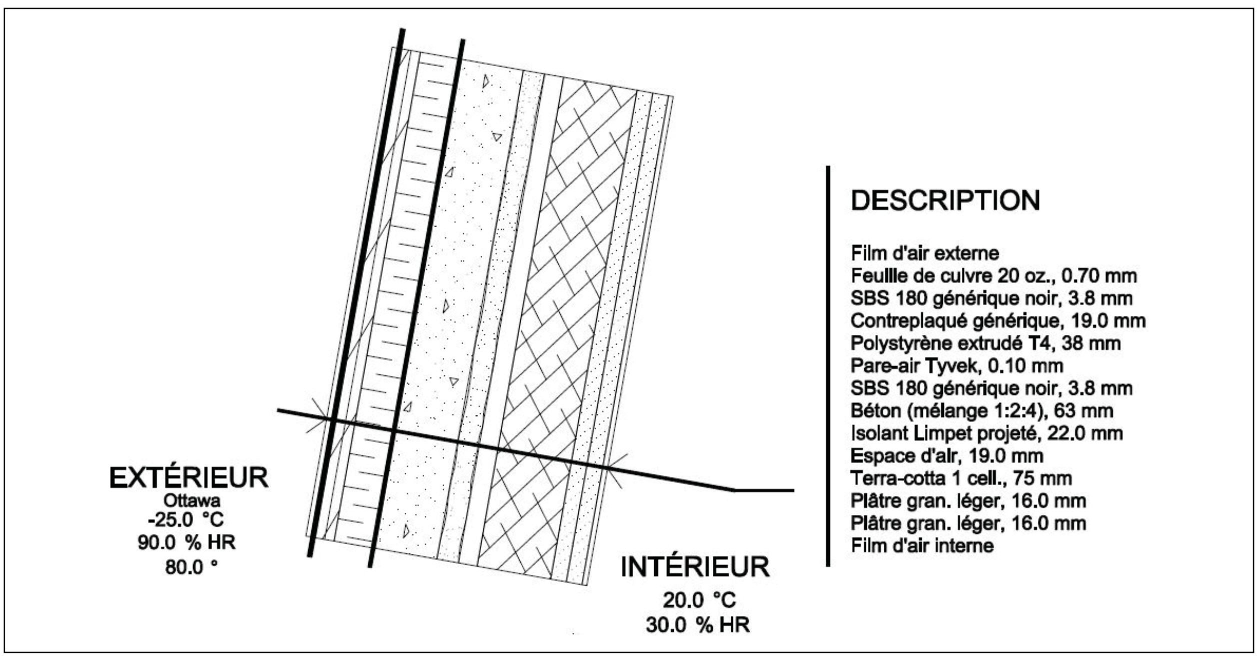


Figure n^o 6: Modélisation de l'assemblage n^{o}2 modifié

L'assemblage n°2 modifié offre une résistance thermique RSI théorique de 2,82.

Pour cet assemblage, l'ajout d'isolation du côté extérieur est insuffisant pour réchauffer suffisamment le béton et éviter les risques de condensation à ce niveau (selon les simulations, le béton se maintient entre 0 et 3°C). En effet, les simulations indiquent un risque de condensation dans le béton, ce qui pourra se traduire en pratique par l'apparition de condensation en surface intérieure du béton ou en surface intérieure de la membrane de bitume élastomère installée sur le béton. Dans les deux cas, il y a risque d'apparition d'humidité du côté intérieur du plan d'étanchéité à la vapeur d'eau de l'enveloppe.

Une plus grande épaisseur d'isolant du côté extérieur serait donc nécessaire pour permettre de réchauffer davantage les matériaux du côté chaud du système, donc le béton, diminuant ainsi les risques de condensation sur leur surface. D'après les simulations, une épaisseur d'au moins 50 mm de polystyrène serait requise pour éviter les risques de condensation du côté intérieur du plan d'étanchéité à la vapeur d'eau.

Encore ici, la membrane pare-air de type Tyvek n'est pas nécessaire dans cette composition, à condition que la membrane SBS installée en surface extérieure du béton offre une bonne continuité de l'étanchéité à l'air et à la vapeur d'eau de l'enveloppe.

5.3 COMPLÉMENT D'ANALYSE DES TOITURES MANSARDES

5.3.1 Analyse du rapport de Morrison Hershfield

La firme de consultant en ingénierie Morrison Hershfield Limited a été mandatée en 1994 par TPSGC pour effectuer une analyse sur les toitures mansardes en cuivre de l'élévation *sud* du bloc central du parlement d'Ottawa. Un rapport technique exposant les conclusions de son analyse et ses recommandations, intitulé « *Remedial Options for the South Copper Roof on the Center Block of Parliament Building* », a été émis par Morrison Hershfield en date du 9 septembre 1994. Ce rapport a été mis à notre disposition par FGMD en mai 2013.

Pour comparer nos résultats avec ceux de Morrison Hershfield, nous avons consulté son rapport de 1994. Il en ressort que nos recommandations concernant la quantité d'isolation nécessaire pour éviter les risques de condensation dans la composition des mansardes (voir la section 5,2 précédente) diffèrent des quantités d'isolant recommandées pour les même raisons dans le rapport de Morrison Hershfield (voir la section intitulée « *Requirement for Insulation* » à la page 16 du rapport).

La différence majeure entre notre étude et celle de Morrison Hershfield vient du fait que les compositions de toiture analysées ne sont pas exactement les mêmes dans les deux (2) études.

La composition décrite dans le rapport de Morrison Hersfield est la suivante (voir le tableau à la page 12 dudit rapport) :

- Film d'air externe;
- Revêtement de cuivre de 1 mm d'épaisseur ;

- Membrane de toiture (*tar paper)* :
- Béton de type Flex-o-crete de 63,5 mm d'épaisseur;
- Espace d'air de 152 mm;
- Finition de plâtre de 25 mm;
- Film d'air interne.

Il est entre autres constaté que, dans la composition analysée par Morrison Hershfield, il n'y a pas de matériel ignifuge sur la surface intérieure du béton Flex-o-crete, comparativement aux compositions que nous avons modélisées à partir des informations qui nous ont été données par FGMD, où un ignifuge est présent (voir figures 2 et 3 à la section 5,1 du présent document).

Les gunites ignifuges, ou *limpets*, généralement à base de ciment Portland et de laine minérale (ou autres liants inorganiques), offrent une certaine résistance thermique. Or, il n'y a aucun autre véritable isolant thermique dans la composition des mansardes. Par conséquent, la gunite ignifuge devient la composante de l'assemblage offrant la grande proportion de la résistance thermique totale de l'assemblage; elle a donc une influence significative dans la performance thermique théorique de la composition. Le fait de l'inclure ou non dans l'analyse de la performance des mansardes modifie nécessairement les résultats.

En effet, dans notre analyse, l'ignifuge isole le béton de type Flex-o-crete de la chaleur ambiante (voir la section 5,2 précédente). Le béton est donc plus froid et plus difficile à réchauffer que dans l'assemblage sans ignifuge analysé par Morrison Hershfield.

Si les deux (2) analyses s'accordent sur le fait que les risques de condensation se retrouvent en surface intérieure du béton et que l'ajout d'une certaine quantité d'isolant thermique à l'extérieur permettra d'éviter ces risques, les quantités d'isolant recommandées ne sont pas les mêmes. À cause de l'influence de l'ignifuge, les quantités d'isolation nécessaires pour réchauffer le béton et ainsi éviter les risques de condensation sur sa surface intérieure sont plus importantes selon notre analyse (du moins pour l'assemblage n°2, voir figures 4 et 6 à la section 5,2) que les quantités requises selon l'analyse de Morrison Hershfield (50 mm de polystyrène extrudé contre 38 mm).

Note : D'autres différences avec la composition de Morrison Hershfield sont présentes dans les compositions modélisées par Patenaude-Trempe, soit, entre autres, l'absence d'espace d'air et de finition intérieure dans l'assemblage n°1 (voir figure n°1), ainsi qu'un espace d'air de moindre dimension et la présence d'un bloc de terracotta dans l'assemblage n°2 (voir figure 3). Aussi, la membrane de toiture n'est pas composée du même matériel (papier goudronné pour Morrison Hershfield et membrane SBS pour les assemblages n^{os}1 et 2 de Patenaude-Trempe). Ces différences n'ont cependant pas eu d'influence significative pouvant expliquer la divergence des résultats entre les deux (2) analyses, comparativement à l'influence de la présence ou non de l'ignifuge.

*De plus, l'analyse de Morrison Hershfield a été réalisée avec une température extérieure fixée à - 26 °C, comparativement à une température de - 25 °C fixée pour les simulations de Patenaude-Trempe (*température de design hivernale pour la ville d'Ottawa selon le *Code national du bâtiment* 2005)*. Ici aussi, cette différence a eu peu d'influence et ne peut pas expliquer la divergence des résultats.*

5.3.2 Commentaires relatifs au changement d'usage des combles sous toits

En plus des modifications apportées aux toitures mansardes, il est prévu que certains combles sous toits changeront d'usage pour passer de combles ventilés à combles habitables (selon les informations recueillies auprès de notre mandant). La présence des persiennes qui percent les mansardes existantes doit être prise en compte dans ce changement d'usage.

Les persiennes ont comme fonction de ventiler les combles sous toits. Cette ventilation permet de maintenir les combles à des conditions ambiantes (température et humidité relative) similaires à celles prévalant à l'extérieur. Dans le cas de combles sous toits ventilés, de l'isolation thermique et un plan d'étanchéité à la vapeur d'eau sont requis au niveau des plafonds pour séparer les combles sous toits des locaux intérieurs.

Ces espaces ventilés ne peuvent pas être habités, car les températures et les taux d'humidité y sont donc très élevés en été et très faibles en hiver. Par conséquent, si les combles sous toits changent de vocation pour devenir habitables, les persiennes doivent nécessairement être obstruées pour stopper les échanges d'air avec l'extérieur. Le cas échéant, la nouvelle composition prévue pour l'ensemble des mansardes doit se poursuivre, en continu, sur les ouvertures des persiennes.

Pour les combles sous toits ventilés qui resteront non habités, les modifications prévues au niveau des mansardes ne devraient pas avoir d'impact sur la performance de la toiture. En effet, comme les conditions ambiantes dans les combles ventilés sont, en théorie, les mêmes qu'à l'extérieur, les composantes des toitures mansardes se retrouvant au-dessus des combles ne devraient pas avoir d'influence significative sur les performances de la composition. Cela est cependant vrai uniquement si les persiennes permettent une ventilation efficace des combles sous toits et que les combles ventilés sont séparés thermiquement et hermétiquement des espaces habitables.

Nous sommes d'avis que le changement d'usage des combles sous toits commande une étude plus approfondie avant sa mise en œuvre pour, par exemple :

- Vérifier l'efficacité de la ventilation des combles existants;
- Vérifier comment l'effet de cheminée du bâtiment actuel influe sur les niveaux de pression dans les combles et évaluer les impacts que les modifications apportées aux mansardes (comme l'obstruction des persiennes) auront sur le régime de pressions de l'édifice;
- Déterminer la façon dont la surchauffe des combles en été sera contrôlée;
- Vérifier que les travaux respectent les exigences du Code national du bâtiment, entre autres en matière de sécurité incendie;
- Etc.

PARTIE 6 - OPINION TECHNIQUE ET RECOMMANDATIONS

Les services professionnels de Patenaude-Trempe inc. ont été retenus afin de procéder à une inspection et à des simulations et d'obtenir une opinion technique relativement à l'état de l'enveloppe verticale des tours *est* et *ouest* du bloc central du parlement d'Ottawa et une opinion technique sur les modifications proposées aux toitures des mansardes des pavillons *est* et *ouest* du bloc central du parlement d'Ottawa.

6.1 ENVELOPPE VERTICALE

L'inspection des façades et des ouvertures exploratoires concernées par le présent mandat nous a permis de constater que l'ensemble est dans un bon état général. Par contre, quelques problématiques telles que des déplacements et des détériorations des pierres ou des joints ont été observées dans des endroits précis tels que les tourelles ou les ogives.

Afin de pallier les déficiences observées, nous recommandons les interventions suivantes :

- Définir la source des déplacements observés et s'assurer d'éliminer cette dernière. Par la suite, en fonction des exigences du client et des normes imposées en termes de restauration pour ce bâtiment, intervenir ou non sur le déplacement lui-même. Dans le cas où la remise en place des sections déplacées n'est pas une option retenue, s'assurer de stabiliser le déplacement et que ce dernier ne provoque pas de dégradation des zones environnantes;
- Prévoir l'élimination des produits de restauration employés causant la dégradation des surfaces telles que le crépi cimentaire appliqué sur les pierres;
- Prévoir le rejointoiement des zones endommagées;
- Intervenir sur les pierres fissurées, brisées ou éclatées, le tout selon les exigences de restauration applicables à ce type d'édifice.

De plus, dans le but de s'assurer de la performance globale de l'enveloppe verticale et de prévenir une détérioration prématurée, et ce en tenant compte de nombreuses interventions passées sur cet édifice, nous recommandons de procéder à une analyse de compatibilité entre les différents matériaux de restauration employés durant ces interventions (brique, mortier, béton, enduit, crépissage, etc.). Cette étude permettra de définir si un produit employé peut provoquer la détérioration des composantes d'origine composant l'assemblage ou même la détérioration d'autres composantes de restauration employées. De plus, il est important de noter que notre mandat se limite à une inspection sommaire des façades des pavillons *est* et *ouest* et qu'une vérification approfondie doit être faite afin de bien cerner l'ensemble des problématiques.

6.2 TOITURES DES MANSARDES

Afin de vérifier l'impact des modifications proposées par FGMD sur les toitures des mansardes existantes, des simulations informatiques ont été réalisées.

Les résultats nous indiquent que l'ajout proposé par FGMD est insuffisant pour éviter les problèmes de condensation dans l'assemblage. Des modifications à la composition proposée sont requises pour optimiser la performance de l'enveloppe des mansardes.

Nous demeurons à la disposition de nos mandants pour toute information technique supplémentaire jugée utile.

PATENAUDE-TREMPE INC.

Rapport préparé par : ______________________________

Charles Beaulé, ingénieur
Chargé de projet

En collaboration avec : ______________________________

Patrick Masson, T.P., LEED AP/BC+D
Directeur – division expertises
Bureau de Montréal

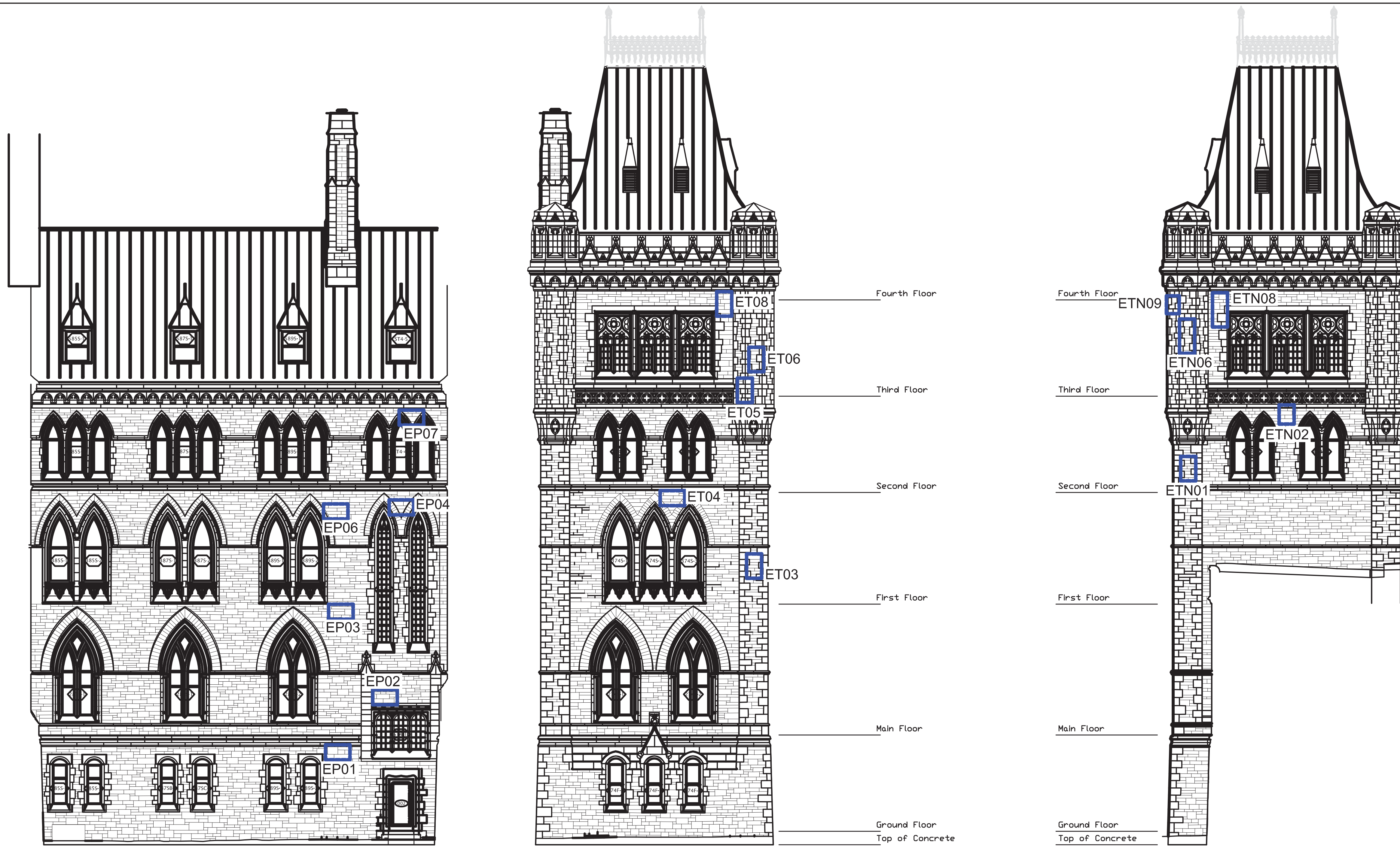
Document révisé par : ______________________________

Richard Trempe, architecte
Vice-président

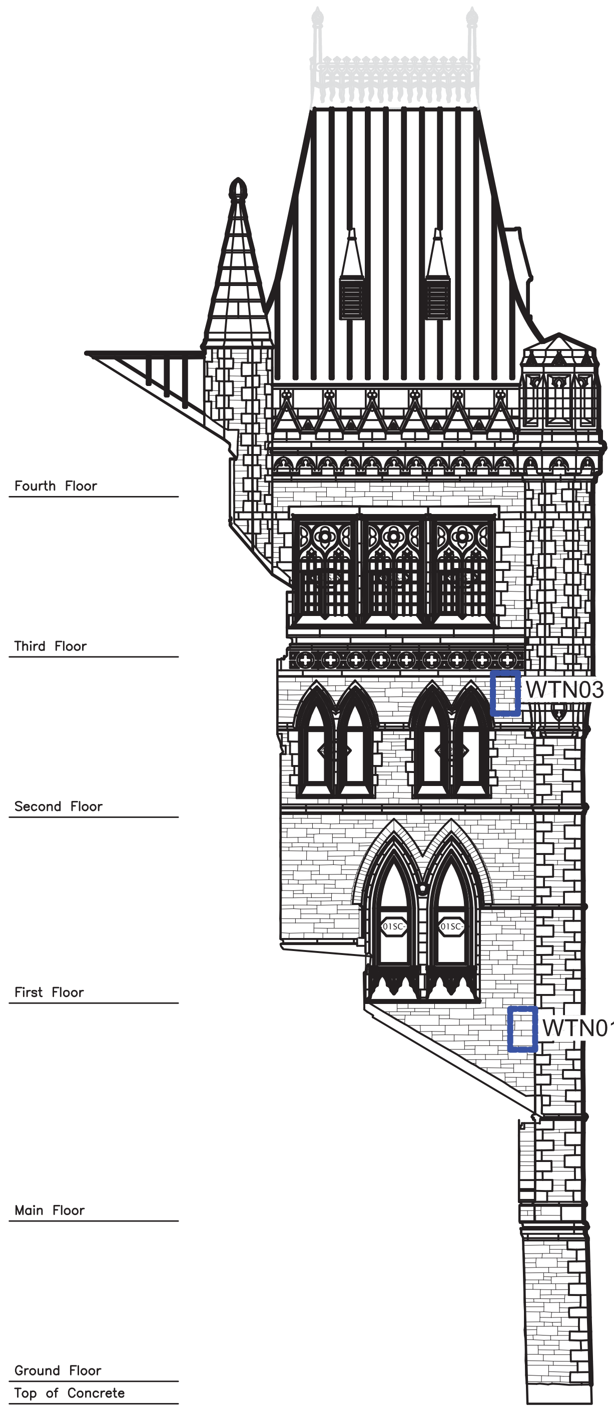
Chef de la direction, division expertises

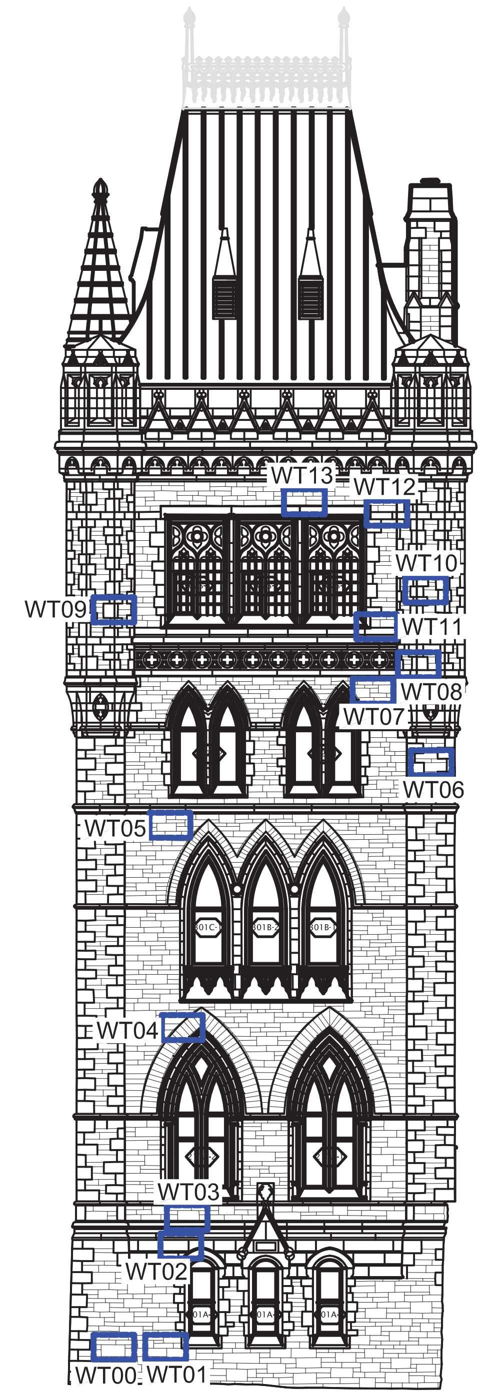
MR/PM/jw

Annexe 1 – Élévations



Consultant :	Projet :	Dessin :	Dessiné par :	Vérifié par :
PATENAUDE TREMPE EXPERTS CONSEILS - CONSULTANTS Patenaude-Trempe Inc. Bureau de Montreal 1471 boul. Lionel-Boulet, suite 30 Varennes (Québec) J3X 1P7 Fax: 450-652-6801 Tél: 450-652-2235	Parlement d'Ottawa Colline du parlement INSPECTION SOMMAIRE DES PAVILLONS EST ET OUEST	ÉLÉVATIONS Parlement d'Ottawa	M-O H.	P.M.
			Date: 2013-06-27	Échelle : AUCUNE
			Dossier : M-2751-A	Dessin # : 1



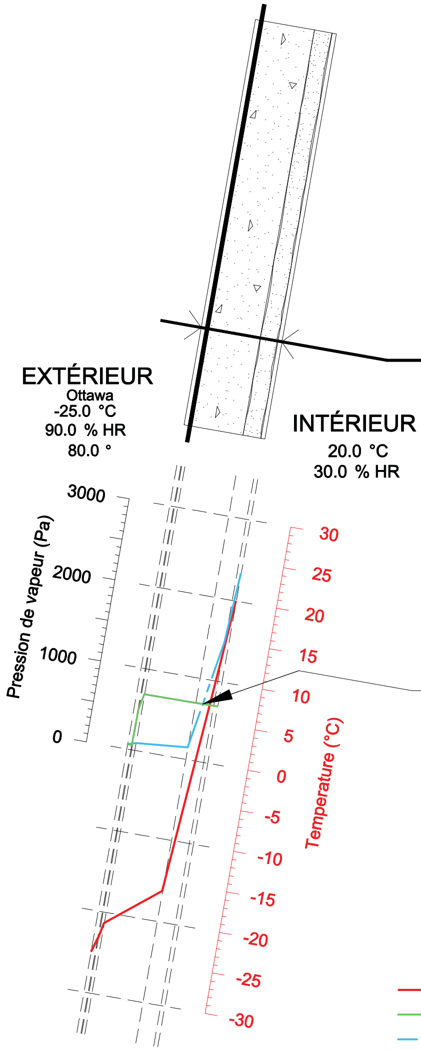


Consultant :	Projet :	Dessin :	Dessiné par :	Vérifié par :
PATENAUDE TREMPE EXPERTS CONSEILS - CONSULTANTS **Patenaude-Trempe Inc.** Bureau de Montreal 1471 boul. Lionel-Boulet, suite 30 Varennes (Québec) J3X 1P7 Fax: 450-652-6801 Tél: 450-652-2235	**Parlement d'Ottawa Colline du parlement** **INSPECTION SOMMAIRE DES PAVILLONS EST ET OUEST**	**ÉLÉVATIONS** **Parlement d'Ottawa**	M-O H.	P.M.
			Date: 2013-06-27	Échelle : AUCUNE
			Dossier : M-2751-A	Dessin # : 2

Annexe 2 – Résultats des simulations

Préparé pour:	Préparé par:	Projet:
Parlement Ottawa	Charles Beaulé Patenaude-Trempe	M-2751-A

Date :	Analyse:	Logiciel:
04-04-2013	1	CONDENSE r14



DESCRIPTION	RSI	R
Film d'air externe	0.03	0.2
Feuille de cuivre 16 oz., 0.50 mm	0.00	0.0
SBS 180 générique gris, 3.8 mm	0.03	0.2
Béton (mélange 1:2:4), 63 mm	0.09	0.5
Isolant Limpet projeté, 22.0 mm	0.51	2.9
Film d'air interne	0.12	0.7
Résistance thermique totale	0.78	4.4

Dans ces conditions, la condensation se produit à cet endroit de l'assemblage.
Le taux de condensation est de 8.379E-05 g/m2/sec.
ou 7.240E-03 litres/m2/jour.

Le taux de perte de chaleur est de 57.58 Watt/m2.
Le point de rosée est de -4.2 degrés Celsius.

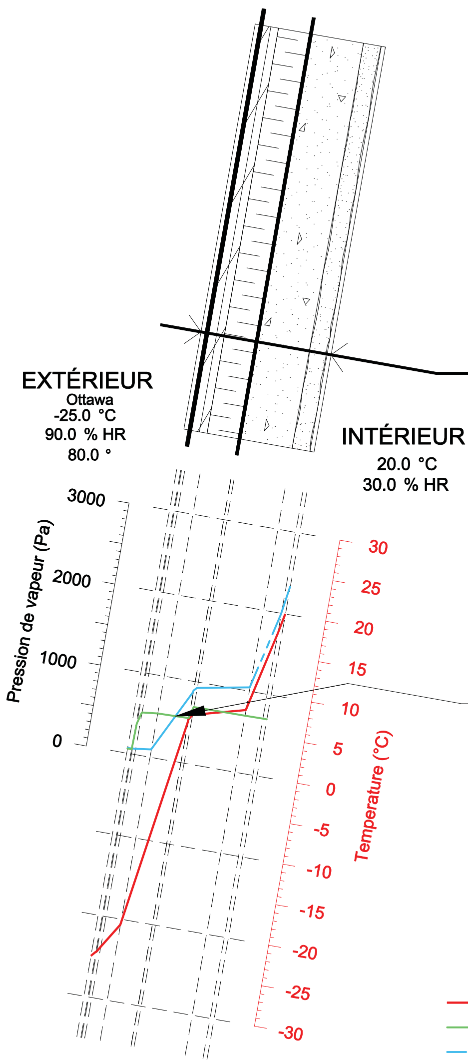
Échelle 1 = 10

Légende

Température
Pression de vapeur (diffusion continue)
Pression de vapeur à saturation

Préparé pour:	Préparé par:	Projet:
Parlement Ottawa	Charles Beaulé Patenaude-Trempe	M-2751-A

Date :	Analyse:	Logiciel:
04-04-2013	2	CONDENSE r14



DESCRIPTION	RSI	R
Film d'air externe	0.03	0.2
Feuille de cuivre 20 oz., 0.70 mm	0.00	0.0
SBS 180 générique noir, 3.8 mm	0.03	0.2
Contreplaqué générique, 19.0 mm	0.16	0.9
Polystyrène extrudé T4, 38 mm	1.33	7.6
Pare-air Tyvek, 0.10 mm	0.02	0.1
SBS 180 générique noir, 3.8 mm	0.03	0.2
Béton (mélange 1:2:4), 63 mm	0.09	0.5
Isolant Limpet projeté, 22.0 mm	0.51	2.9
Film d'air interne	0.13	0.8
Résistance thermique totale	**2.33**	**13.2**

Dans ces conditions, la condensation se produit à cet endroit de l'assemblage.
Le taux de condensation est de 1.180E-06 g/m2/sec.
ou 1.019E-04 litres/m2/jour.

Le taux de perte de chaleur est de 19.29 Watt/m2.
Le point de rosée est de -5.7 degrés Celsius.

Échelle 1 = 10

Légende

- Température
- Pression de vapeur (diffusion continue)
- Pression de vapeur à saturation

Préparé pour:	Préparé par:	Projet:
Parlement Ottawa	Charles Beaulé Patenaude-Trempe	M-2751-A

Date :	Analyse:	Logiciel:
04-04-2013	3	CONDENSE r14

DESCRIPTION	RSI	R
Film d'air externe	0.03	0.2
Feuille de cuivre 16 oz., 0.50 mm	0.00	0.0
SBS 180 générique noir, 3.8 mm	0.03	0.2
Béton (mélange 1:2:4), 63 mm	0.09	0.5
Isolant Limpet projeté, 22.0 mm	0.51	2.9
Espace d'air, 19.0 mm	0.20	1.1
Terra-cotta 1 cell., 75 mm	0.14	0.8
Plâtre gran. léger, 16.0 mm	0.07	0.4
Plâtre gran. léger, 16.0 mm	0.07	0.4
Film d'air interne	0.13	0.7
Résistance thermique totale	**1.27**	**7.2**

Dans ces conditions, la condensation se produit à cet endroit de l'assemblage.
Le taux de condensation est de 4.551E-05 g/m2/sec.
ou 3.932E-03 litres/m2/jour.

Le taux de perte de chaleur est de 35.45 Watt/m2.
Le point de rosée est de 1.6 degrés Celsius.

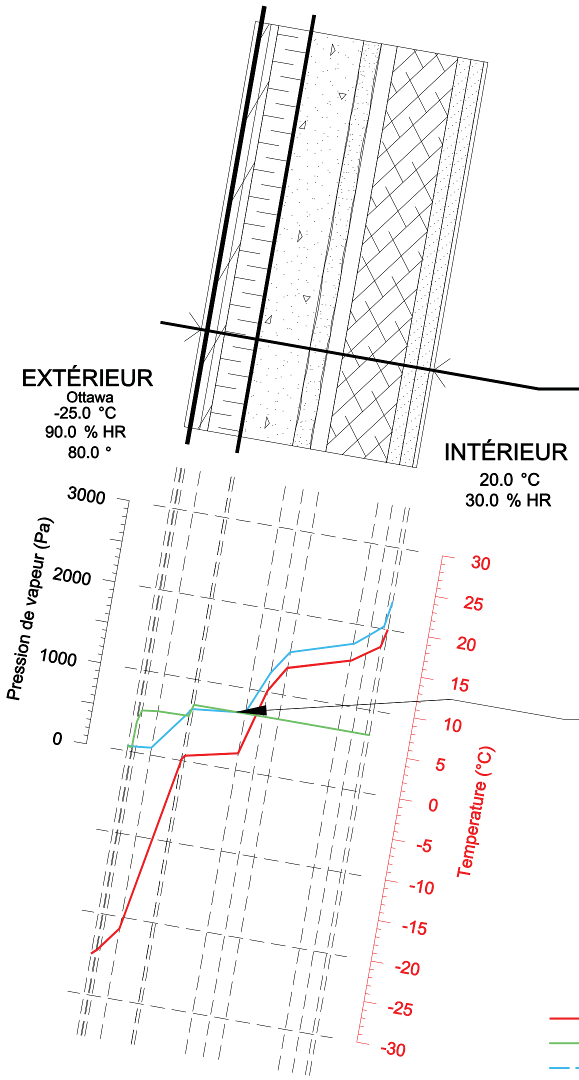
Échelle 1 = 10

Légende

Température
Pression de vapeur (diffusion continue)
Pression de vapeur à saturation

Préparé pour:	Préparé par:	Projet:
Parlement Ottawa	Charles Beaulé Patenaude-Trempe	M-2751-A

Date :	Analyse:	Logiciel:
04-04-2013	4	CONDENSE r14



DESCRIPTION	RSI	R
Film d'air externe	0.03	0.2
Feuille de cuivre 20 oz., 0.70 mm	0.00	0.0
SBS 180 générique noir, 3.8 mm	0.03	0.2
Contreplaqué générique, 19.0 mm	0.16	0.9
Polystyrène extrudé T4, 38 mm	1.33	7.6
Pare-air Tyvek, 0.10 mm	0.02	0.1
SBS 180 générique noir, 3.8 mm	0.03	0.2
Béton (mélange 1:2:4), 63 mm	0.09	0.5
Isolant Limpet projeté, 22.0 mm	0.51	2.9
Espace d'air, 19.0 mm	0.20	1.1
Terra-cotta 1 cell., 75 mm	0.14	0.8
Plâtre gran. léger, 16.0 mm	0.07	0.4
Plâtre gran. léger, 16.0 mm	0.07	0.4
Film d'air interne	0.14	0.8
Résistance thermique totale	**2.82**	**16.0**

Dans ces conditions, la condensation se produit à cet endroit de l'assemblage.
Le taux de condensation est de 2.302E-06 g/m2/sec.
ou 1.989E-04 litres/m2/jour.

Le taux de perte de chaleur est de 15.98 Watt/m2.
Le point de rosée est de 1.8 degrés Celsius.

Échelle 1 = 10

Légende

- Température
- Pression de vapeur (diffusion continue)
- Pression de vapeur à saturation

APPENDIX XII
RISK REGISTRY

CENTRE BLOCK - East & West Pavilions Rehabilitiation

Risk Management Plan

May 2013

Description	Probability	Impact	Overall	Risk Response	Allowance
Client changes before sign-off	Medium	Medium	Medium	See Risk Registry	
Client changes after sign-off	Medium	High	Medium	Description	
Security Clearance Process	Low	Medium	Low	"	
Increased Security for Delivery of materials	Low	Medium	Low	"	
Work Stoppages	High	Medium	Medium	"	
Limitations on Exploratory Work	Medium	Medium	Medium	"	
Limiting the Use of Unit Price Table	Medium	Medium	Medium	"	
Increased Security	Low	High	Medium		
Interference w/Other Projects	High	High	High		
Incomplete/Inaccurate Base Dwgs	Low	Medium	Medium		
Procurement					
Procurement of Construction Services	Low	Low	Low	"	
Availability of Trades	Medium	Medium	Medium	"	
Sole Source Procurement	Low	Medium	Low	"	
Procurement of Stone	Low	Low	Low	"	
Existing Site Conditions					
Portland Cement mortar to walls above grade	Low	Medium	Medium	"	
Lead paint covered steel	High	Low	Low	"	
Asbestos	Low	Low	Low	"	
Silica	High	Low	Low	"	
Debris falling off of building	Low	Medium	Low	"	
Unknown Rock Elevations	High	High	High	"	
Discovered Artifacts	Medium	Low	Low	"	
Project Design					
Interior Window Jamb Rehabilitation Issues	High	Medium	Medium	"	
Erection of Complicated Structures	Low	Low	Low	"	
Design for Seasonal Construction	Medium	Medium	Medium	"	
Anchor Design Strategies	Medium	Medium	Medium	"	
Regulatory Requirements					
Protection of Scaffold System & Bldg from Hazards	Medium	Medium	Medium	"	
Resources External to PM Team					
Labour Disputes	Low	Low	Low	"	
Force Majeure	Low	High	Low	"	
Construction					
Sequencing of Work	Medium	Medium	Medim	"	
Constructor Considerations	High	High	High	"	
Overall Project Delay Claims	Low	High	Medium	"	
				"	

Table A12: *Risk Registry Rating*

Appendix XV: RISK REGISTRY

1. GOVERNMENT/PWGSC/CLIENT

a. Case: Client changes before final Sign-Off

Risk: There are many stakeholders that will directly and indirectly provide input into the design and production of the design documents. It is anticipated that there will be ongoing dialogue which may require changes, additions or deletions to the design prior to the final signoff as the key objectives of the various stakeholders become apparent. The probability for changes prior to final sign-off is ranked as medium. The impact of the potential for client changes prior to sign-off is ranked at medium from a schedule and cost perspective. The earlier any requested changes are tabled, the lower the overall impact to the project schedule as changes can be incorporated into the design documentation earlier in the process. Cost mitigation can only be assessed when the requested changes present themselves.

Mitigation Strategy: Consistent and clear communication to all stakeholders as the project moves forward is a key strategy for mitigating the potential risk of changes prior to sign off. An ongoing dialogue with all stakeholders will allow the ability to provide feedback in a timely fashion which will reduce the likelihood of unanticipated changes late in the game.

b) Case: Client changes after final Sign-Off

Risk: There is a medium potential of currently unknown possible future circumstances which could lead to client changes after sign-off of the design documents. With a project of this nature there is always a possibility, however modest, that uncertainties or events external to the project as a whole, or changing stakeholder objectives could have a direct or indirect impact on the schedule and/or overall cost of the project. The impact of changes after sign-off, are considered high as they will have a direct impact on schedule and cost. Once the project is signed-off, the design is set and the project has moved forward into new phases of work. Changes at this point would have direct consequences on the project objectives. Changes before construction would incur a delay tendering the project which would lead to risk escalation and additional design costs. After the start of construction, the project is exposed to additional construction costs and potential claim for delays.

Mitigation Strategy: There is always a potential for intangible potentialities of future external drivers having an impact on the objectives of the project. These uncertainties are not quantifiable and must be addressed as the project moves forward. That being said, changes to a project after sign-off are often a result of lack of information which results in a change in stakeholder objectives. A clear communications protocol for transfer of information between the stakeholders throughout the design process to ensure that the final documentation meets the expected objectives is paramount.

c) Case: Security Clearance Process

Risk: The security clearance procedure is considered a **low** risk potential with a medium impact potential, directly affecting the cost and schedule for the project. This is and has been an ongoing issue with all projects on Parliament Hill. The level of clearance for Consultants and for Contractors is often revised based on changing requirements. There are uncertainties surrounding the process and the length of time to obtain the required security clearances both personal and corporate. There is a risk of due to improperly filled-out clearance forms which leads to delays in achieving the required clearances. The inability of Consultants and Contractors to achieve the required clearances leads to potential delays performing their respective mandates. It is also often very difficult to find out the status of clearances being processed which has a potential for impacting resource loading for the project. Delays incurred by Contractors may also have the negative consequences of client exposure to a claim for delays.
**Note: Centre Block South Façade (1997) Project incurred an additional cost of $8,000 (approx. $12,000 today with escalation) due to changes to the security screening process.*

Mitigation Strategies: It is recommended that a clear documented protocol for security clearances be put in place at the Project Management (PWGSC) level clearly defining a reasonable expectation for each stakeholder to navigate the security clearance process. A specific point of contact (Security Officer) should be appointed by the project management team, each Consultant and Contractor whose responsibility is to facilitate documentation flow. It is recommended that a protocol for advising Contractors and Consultants of the status of clearances be defined. Careful planning and scheduling of security clearance forms by the Consultants and Contractors will mitigate many of the potential delays with the security clearance process. Clear directions for the process are to be carried in the Specifications.

d) Case: Increased security for deliveries of materials

Risk: Increased security for delivery of materials is considered to have a low probability but a medium impact. There is currently in place a protocol for deliveries of materials to sites on Parliament Hill. There is a risk of a change to the security requirements due to unforeseen and potential external circumstances outside the control of the Project Team. These risks have possible consequence of delays being incurred on site and possible additional cost implications to achieve additional security protocols.

Mitigation Strategies: Communication and planning are key to reducing the overall risk incurred by additional security for materials delivery. A clearly defined and documented protocol is recommended for all deliveries to Parliament Hill. A main point person dealing with all security protocols for deliveries should be assigned by the Project Management Team that liaises between the various security stakeholders (RCMP, HOC & Senate Security etc.) and the Consultants and Contractors. A security officer should be assigned by all Contractors to deal with all security issues.

e) Case: Work Stoppages

Risk: The probability of work stoppages on site due to activities on the Hill is considered high with the impact on the project being ranked as medium to high. Work stoppages can result from a variety of sources. The area of the work is directly adjacent to highly sensitive spaces both on the House and Senate sides, where the occupants must not be disrupted by the construction work. The likelihood of stoppages due to noise considerations is very high, especially at times when the House of Commons or Senate are in session. This typically would limit activities that are noisy in nature such as masonry cut out of joints or dismantling. There is also a high probability of work stoppages for various celebrations, holidays, organized protests and visiting dignitaries.

**Note: Centre Block South Façade (1997) Project incurred an additional cost of $78,000 (approx. $118,000 today with escalation) due to work stoppages directed by HOC.*

Mitigation Strategies: An acceptable strategy must be implemented to deal with the tangible work stoppages to be expected as well as the uncertain stoppages that will inevitably occur. It is recommended that representatives from the House of Commons and the Senate provide a summary of reasonable expectations where work cannot be performed. For example, it may be a reasonable expectation that work stoppages will occur when the House of Commons is in session considering the Chamber is adjacent to the work area. A recommended strategy would be to carry a contingency defined in the contract documents of a reasonable expectation for work stoppages for the site during the construction period. Clearly defined parameters for working should also be defined in the Contract Documents to reduce the exposure to a delay claim. For example, a worst case scenario may be to mandate all noisy work to outside regular working hours (evenings/weekends) in order to not impact the operations within the Centre Block. A risk cost/benefit analysis would be required to assess the overall economic impact of any mitigation strategy.

f) Case: Limitations on exploratory work

Risk: Limiting the ability of the Consultant Team to perform exploratory openings reduces the overall assessment of the masonry walls which will lead to assumptions being made regarding the existing construction and level of deterioration of the masonry walls. The risk with <u>not</u> performing extensive exploratory openings is that many unforeseen conditions may reveal themselves during the construction process that may expose the project to additional costs and delays. The exterior openings performed to date have revealed many of the conditions of the exterior wall but since it is impossible to identify all conditions there is still a risk of unforeseen existing conditions that may reveal themselves at the interior face. The overall risk is assessed at moderate for probability and moderate for overall impact to cost and schedule.

Mitigation Strategies: Many existing wall conditions at the exterior masonry have revealed themselves during the detailed investigative surveys performed in 2012. However time was limited when performing these openings, leaving some uncertainty of the overall conditions of the exterior masonry due to the time constraint limitations imposed. A high level of careful monitoring and documentation as the work proceeds will identify problem areas in a timely fashion enabling a quick response to any issues which will greatly reduce the overall impact of any inherent risks.

g) Case: Limiting the use of the Unit Price Table

Risk: The Unit Price Table is a very good tool to use to reduce risk on a project that has a lot of unknowns, which is typical of heritage projects of this nature. All repair work to heritage components, in particular the masonry, is broken down into precise descriptions, details, quantities which can be priced on a unit basis. This will allow work to be easily quantified and priced on a numeric basis as the project proceeds, and help mitigate issues arising from unknown conditions. The potential risks associated with the use of the UPT is underestimating or overestimating quantities which leads to either a too high original contract price or an expectation of too low a contract price leading to change orders. This risk is likely moderate depending on the ability of the Consultant Team to get access to the building prior to finalizing contract documents. A more important risk is the Contractor's exploitation of the UPT to either front load their activities or to manipulate the unit prices.

Mitigation Strategies: The preparation of the unit price table requires rigour in order to reduce the risk of under or overestimating quantities. The more that is known about the building in advance, the stronger the definition of scope can be. Detailed surveys and exploratory openings is the key to truly understanding the quantities associated with proposed interventions. The challenge of potential contractor manipulation of the unit price table requires vigilance when reviewing the tender prices. On other projects it has proven difficult under current procurement rules to call into question unit prices at the time of tender. Further discussions are recommended with the Contracting Directorate prior to tendering the project to strategize options for reducing the potentialities of manipulated unit prices.

h) Case: Increased Security

Risk: There are times on the Hill when there are special events, visiting dignitaries, protests etc. where the RCMP will require additional security provisions to be taken around the construction site which will have direct impact on the cost of construction. There may be potential work stoppages and additional security fencing added. **Note: Centre Block South Façade (1997) Project incurred an additional cost of $34,000 (approx. $52,000 today with escalation) for additional security and fencing requirements directed by the RCMP for events on the Hill during the construction period.*

There is also a remote possibility that increased security measures may be implemented due to an unforeseen security violation which results in a change to the permanent security infrastructure or measures on the Hill.

**Note: Centre Block South Façade (1997) Project incurred an additional cost of $194,000 (approx. $292,000 today with escalation) for additional infrastructure added as a security precaution after a 1996 security breach whereby an individual drove his vehicle into the front doors of the Centre Block.*
Mitigation Strategies: Special events, protests and visiting dignitaries are inevitability on Parliament Hill. It is recommended that PWGSC carry a contingency for additional security fences and other measures required for additional security considerations imposed by the RCMP. With regards to security breaches, these are beyond the control of the project team and will have to be dealt with if a situation were to occur.

i) Case: Interference with other Projects
Risk: It has been brought to our attention that there are several other major projects in the vicinity of the work on the West Pavilion that will enter construction during the same time frame, which may have direct or indirect impact on construction and schedule. The projects that will be executed in the area are as follows: Visitor Welcome Centre, Rehabilitation of the House of Commons Chamber Stained Glass Windows, Ventilation Towers and the Masonry Rehabilitation at the area light well directly behind the West Pavilion. Risks inherent with multiple projects being executed directly adjacent that may impact construction costs and schedule are as follows: The Visitor Welcome Centre is a large new infrastructure project that will connect below grade the West Block and Centre Block. Depending on the schedule for the Visitor Welcome Centre, excavation activities for the two projects may be in direct conflict. With regards to the HOC Chamber Windows Rehabilitation, this project is directly adjacent to the area of work for the West Pavilions Project with access to the windows directly conflicting with the construction laydown area, mud shack and scaffold for this project. The Ventilation Towers Project is at the NW corner of the Centre Block which should not directly impact the West Pavilion Project but with three projects on the west elevation of the Centre Block at the same time there are inherent interferences. The West Area Light Well Project will potentially incur interferences at the roof level of the West Pavilions Project at the roof area. Multiple Projects also incurs a potential Constructor issue with regards to delineation of work areas to meet the requirements for Health & Safety. There is also Security considerations to be accounted for as the RCMP will require relocation of camera and security equipment on the roof to ensure that the security of the Hill is maintained.
Mitigation Strategies: Coordination of the multiple projects at is paramount at the PWGSC level. At this point of time there is little known about the overall project development, schedule and inherent interferences with the other projects in the general vicinity. It is recommended that all stakeholders meet regularly to coordinate the multiple projects. With regards to the West Pavilions Project, The Consultant Team has proposed a strategy for sequencing the above and below grade work to suit the potentiality that the Visitor Welcome Centre below grade work directly interferes with the West Pavilion below grade work.
Note: PWGSC has instructed the Consultant Team to proceed with the current mandate until further notice.

j) Incomplete or Inaccurate Base Drawings

Risk: Some of the base building documentation supplied by the client is missing some information or does not completely reflect existing conditions. Access to the site is also somewhat restricted to carry out further investigations and surveys to validate existing information provided (see item f above). Construction documentation is based upon available information and surveys. There may be a modest risk of incurring additional costs and schedule delays during construction due to unforeseen existing conditions due to limitations imposed on the Consultant Team for information gathering.

Mitigation Strategies: The Consultant Team as a matter of course advises the client when discrepancies in information provided or if there is further information gathering required. The client has been very forthcoming in providing information as it is requested. A high level of careful monitoring of documentation provided as the work proceeds will identify problem areas in a timely fashion enabling a quick response to any issues which will greatly reduce the overall impact of any inherent risks. Coordination and communication with all stakeholders, in a timely fashion is required, if additional survey is required during the preparation of Construction Documentation phases. An assessment of risk associated with assumptions made for any information not readily available to be reviewed by the Consultant Team and PWGSC on an ongoing basis as project moves forward.

2. *PROCUREMENT*

a) Case: Procurement of Construction Services

There are several possible strategies open to PWGSC for procurement of Construction Services: Lump Sum general contract (GC), prequalification of contractors, invited bids, “two envelope” system, and construction management. Each process has their benefits and drawbacks

Risk: The inherent risk with procurement of construction services is the uncertainty as to whether the most qualified contractor is selected for specialty work such as copper roofing and masonry. A low bid lump sum strategy will likely yield the best price for the work, but not necessarily the best quality workmanship as price is the single deciding factor. The two envelope system is a strategy whereby technical experience is scored for experience level with a second evaluation for price. Prequalification of contractors is a desirable strategy to ensure that only the most experienced contractors are invited to bid. This approach however is not a favoured option by RPCD as there is a risk of other potential proponents disputing the process which could lead to schedule delays and cost impact. Construction Management is a strategy being used on Parliament Hill for some of the larger projects. The advantage with Construction Management as a strategy is definitely on larger complex projects, but may not yield financial or schedule advantage on a smaller project. The Construction management strategy also works best when they are engaged early in the project to nail down budgets and scheduling considerations.

Mitigation Strategies: It is the recommendation of the Consultant Team that the Pre-Qualification process is the most suitable strategy for Heritage Conservation Projects of this type. A further clarification of the recommendation will be presented to PWGSC in the early stages of the RS-5 phase . With this is mind a careful analysis of the structuring of the technical objectives should be carried out during the Contract Documents phase to ensure the desirable qualifications criteria are defined for contractors. A further clarification of the recommendation will be presented to PWGSC in the early stages of the RS-5 phase

b) Case: Availability of Trades

Risk: The availability of qualified trades people is becoming a significant risk for future projects as the competition for qualified personnel increases. In particular, the availability of qualified stone masons and masonry conservators is a concern with the resources being tapped out by multiple masonry projects on Parliament Precinct including the West Block, East Block, Wellington Block and the former Bank of Montreal. There are also several other projects potentially coming on stream in the next several years that may have a direct impact on resources available.

NOTE: On the Centre Block South Façade Project, there was an additional cost to the contract of $38,000 (approx. $57,000 today with escalation) for Contractor Conservator as the proposed Conservator was from the UK that was unable to obtain a work visa.

Mitigation Strategies: Allocation of resources is the responsibility of the winning contractor and as such they incur the risk associated with availability of (or lack thereof) qualified tradespersons. That being said, the option of using students or apprentices may be considered for less specialized activities to reduce the overall associated risk.

c) Case: Sole Source Procurement

Risk: RPCD rules for procurement do not allow for sole sourcing contracts except under extenuating circumstances which requires extensive justification for approval. Typically, on a project of this nature, it is not anticipated that circumstances will require proprietary systems to be utilized, except for possibly the procurement of stone and the introduction of proprietary masonry stitching anchor systems. The use of proprietary systems exposes the client to inflated costs and the possibility of challenges coming from the industry regarding fair and transparent procurement practices. A challenge from the Industry will have negative consequences on schedule.

Mitigation Strategies: Ultimately, avoiding the practice of using proprietary systems is the best avenue to mitigating the risks associated with sole sourcing. However, with the example of proprietary anchoring systems, extensive research has been carried out by the West Block Consultant Team, Construction Management Team and PWGSC with regards to existing options within the industry. It has been determined from these investigations that options are very limited. A recommended strategy would be for PWGSC to draw from the lessons learned on the West Block project for review with the Contracting Directorate early in the process. A further Request for Proposals from Industry may be required as the project develops for further assessment.

d) Case: Procurement of required stone - quality and quantity

Risk: Procurement of stone represents a medium risk with consequences that could affect schedule. There are multiple ongoing projects in the Parliamentary Precinct all requiring stone from the same quarries. The quarries have limited windows of opportunity to get stone from the ground as the work is seasonal in nature and can only be quarried from late spring through late fall. Access to the stone strata in the quarry is also a concern as this could lead to delays. Clear direction for the shipping of the stone must also be addressed early due to procurement rules set by RPCD. Typically the quarries do not ship stone, and PWGSC rules make it difficult to engage transportation and customs duties requirements before a contractor is engaged. Timing of the procurement of stone may in fact have to happen prior to tendering of the project due to availability and yield at the quarry.

Mitigation Strategies: Careful planning well in advance of the tender period in collaboration of the Masonry Conservator, Heritage Architectural Team and PWGSC to assess the stone requirements for the project and strategize a procurement plan. The Consultant Team will assess the needs and PWGSC in dialogue with RPCD should determine an acceptable procurement process. Part of the planning strategy would be to have an ongoing dialogue with quarries including a possible visit to the quarry by representatives of the Consultant Team (Conservator) and the Project Management Team (PWGSC). Addressing these issues well in advance of the tender period will reduce the risk significantly as the stone supply will be secured. It is recommended that the procurement of the stone for the project be executed well in advance of construction.

3. EXISTING SITE CONDITIONS

a) Case: Portland cement mortar in walls above grade

Risk: Historic masonry buildings were designed to absorb water and then release it, as opposed to modern building technology, which emphasizes waterproofing. It is very important to use compatible materials during restoration. An incompatible mortar can destroy a historic masonry structure. This is a common mistake with old masonry buildings that have been repointed with Portland cement mortar instead of the historic lime mortar. Modern mortar mixes are made with Portland cement, which is quick-setting, inexpensive, and strong. However, it can do a lot of damage to historic buildings traditionally pointed with lime mortar. Portland cement is generally more rigid and less permeable than the historic masonry units, so cement mortars will cause damage to the brick and/or stone during expansion and contraction. Portland cement mortars are unable to wick water out of the walls, so water gets trapped and instead escapes through the historic stone or brick. This damages the building face stone as the water pressure builds up in the masonry unit until the face of the brick or the stone pops off, exposing the inside of the unit and making it more vulnerable to continued deterioration. The issue with the Centre Block is that during the reconstruction in 1916, a Portland cement based mortar was specified. The risk of leaving the Portland in place is that there is an uncertain potential that there may be future damage to the face stone for the reasons identified above. Replacing the Portland on a wholesale basis with more compatible materials is impractical as it appears the Portland was used throughout the construction of the Centre Block and this strategy would have significant cost and schedule impact.

Mitigation Strategies: The intent of the rehabilitation project is to use best practices for restoration of the exterior masonry wall. Wholesale rebuild is not a practical strategy for reasons stated above. However, there will be localized take down and rebuild in areas of greater deterioration. It is recommended that the introduction of more traditional compatible materials to reduce the potential further deterioration in these areas of major work be considered to replace the existing harder less compatible materials. Compatible materials can be identified through laboratory and other testing and through observation of the performance of other mortar mixes being employed on projects on the Hill.

b) Case: Lead paint at steel beams

Risk: There is a potential that steel beams exposed during construction may show signs of corrosion and therefore may require disturbing the existing paint finish for rehabilitation. If the paint finish contains any lead content, immediate abatement procedures will be required prior to starting any work that may disturb the paint finish. Abatement procedures will have direct impact on both cost and schedule as there is an abatement procedure that would have to be put in place. The probability of encountering such conditions is ranked at high with the overall impact to schedule and cost being ranked low.

Mitigation Strategies: Exploratory openings already performed have indicated that not all beams are corroded and require work. That being said, it has been noted that the condition does occur and it is recommended that a Designated Substances Report be performed as soon as a beam is exposed during construction and abatement procedures be proactively set at the start of the project to reduce any schedule impacts. If the condition is addressed up front, it will have a lesser impact on schedule.

c) Case: Asbestos

Risk: It is our understanding, at this time, that the Centre Block does contain non-friable asbestos containing building materials (i.e. plaster) but not the more friable materials that become airborne such as amosite. Based on knowledge to date, there is a very low probability of any asbestos being encountered in the exterior masonry walls. There is a likely probability of asbestos containing materials being present in the roof assemble and caulking materials at the windows. However, the roofing felts or building paper and caulking materials at windows are not friable in nature and will require a Type 1 or 2 enclosure to protect the workers. There is no risk to occupants of the building in these cases. If a decision is made to rehabilitate interior masonry window jambs, then there is a risk that non-friable asbestos containing materials (ie. Plaster) inside the building will be disturbed which will require a Type 2 abatement procedure. This will have a direct impact on the occupants of any room where this type of work is carried out and therefore presents a significant risk from a cost, schedule and operations perspective.

Mitigation Strategies: The current mandate clearly states that every effort is to be made not to disrupt the operations of the occupants of the Centre Block. It is recommended to respect this requirement and make every effort to ensure continued operations. However, on a case to case basis, there are areas where deterioration of masonry at windows may have consequences and risk. These areas of concern need to be isolated and a strategy with options put forth to all stakeholders to find an acceptable mitigation procedure to meet the overall objectives of the project. Since it is known that there will be some asbestos containing materials encountered, careful planning and scheduling will greatly reduce the risk of uncertainty and therefore should have a low impact on the project.

d) Case: Silica

Risk: The issue of silica has become a major consideration on masonry projects. The health and safety requirements for dealing with silica are evolving and in our experience on other projects on Parliament Hill, are being rigorously enforced. All masonry projects have silica considerations. There are new abatement and enclosure requirements surrounding safety for workers which are costly economically and schedule-wise. The risk to the project is not planning for the inevitability that these provisions will be rigorously enforced.

Mitigation Strategies: Clear and decisive communication to all potential contractor proponents during the tendering phase that the most rigorous requirements for silica and safety for workers will be enforced on this project mandate and that this is a non-negotiable and must be carried in their respective tender proposals. Contract documents must be clearly defined. Since this is a known condition, this item will fall off the risk registry once the parameters are defined and implemented into the Contract Documents.

e)Case: Debris falling off building.

Risk: Our investigations of the building would suggest that the probability of debris falling off the building is ranked as low, with an overall impact as medium.

Mitigation Strategies: Recent investigations would suggest that there is little risk of debris falling off the building at this time. Ongoing observation is recommended to ensure no change to this assessment. During construction, attention to hoarding and overhead protection will be carefully reviewed to minimize any potentials for debris falling off the building.

f) Case: Unknown rock elevations; inverts obverts elevations

Risk: Unknown rock elevations and inverts/obverts elevations at nearby manholes and catch basins has a direct impact on the overall civil design. Part of the Consultant team mandate is to provide the best solution for moving water away from the existing foundation walls to reduce the risk of future deterioration of the foundations due to hydrostatic activity and reduce the risk of capillary action causing damage to the masonry walls above the foundation. Knowing the bedrock elevations allows for an understanding of how subgrade water moves around the building. Invert and obvert elevations provides the information required to move water away from the foundations through gravity fed drainage tile system. Not knowing the bedrock elevations also exposes the project to potential delays and additional costs for future rock removal during construction.

Mitigation Strategies: If the information requested is not readily available in the PWGSC archives, then exploratory work may be necessary to obtain the required information. Locations of manholes and invert/obvert elevations can be visually inspected (requires entering manholes/catchbasins). Bedrock elevations would require a combination of borehole testing and/or test pits. There are costs associated with such testing but they would reduce the exposure to a significant change order during construction due to unknown conditions.

g) Case: Discovered artifacts

Risk: The discovery of artifacts actually is two-fold with respect to risk and consequences. The risk to the discovery of artifacts may impact schedule, depending on the nature of the artifact. If discovered during excavation, a carefully monitored and supervised excavation may be required to carefully sift through the ground material. The probability of artifacts of this nature is very low as there have been multiple projects in the vicinities of the Centre Block East West Pavilions project that required excavation. It is more probable that artifacts may be discovered in the fabric of the building. For example, a recent discovery was made at the West Block during demolition where a page from a newspaper dated July 1898 was discovered perfectly preserved. This is an example of a positive consequence of this type of project.

Mitigation Strategies: Demolition and construction activities will be carefully monitored. Contract documents will have to make provisions for the discovery of artifacts. Typically Parks Canada has input on this issue prior to tender documents.

4. *PROJECT DESIGN*

a) Case: Interior Window jamb rehabilitations

Risk: Interior window rehabilitation is not identified in the RFP for services. However, Consultant investigations have identified windows with significant deterioration in the interior stone jambs. There are several potential strategies to deal with this issue, each with their own inherent risks: 1) stabilize the windows in situ as per original mandate and only address deterioration at the exterior jambs. The risk with this strategy is that salts currently held in the interior stone jamb may migrate to the exterior causing further deterioration at rehabilitated and cleaned stone. 2) Temporarily remove the windows and rehabilitate the complete jamb stone. The risk being that this would have a direct impact on operations within the building and on the occupants. There would be a high probability of asbestos containing plaster etc. being disturbed which would require enclosures within occupied space. 3) Leave the rehabilitation of the stone window jambs to the future overall Centre Block Rehabilitation Project. This strategy exposes the window jambs to further deterioration and the appearance that the project was not completed.

Mitigation Strategies: Currently, the recommended option included stabilization through consolidation and cleaning to preserve exterior appearance. It is highly recommended that the masonry jambs be rehabilitated or replaced during the Major Rehabilitation project, when the offices will likely be unoccupied.

a) Case: Erection of complicated structures

Risk: The design and erection of the scaffold system must take into consideration the loading on the existing infrastructure. There is uncertainty regarding the existing capacities for structural loading at the existing roofs, walls and underground facilities such as tunnels and duct banks. The original RFP stated that the scaffold system must act independently to the existing building which could lead to increased costs for a freestanding structural design.

Mitigation Strategies: Preliminary investigations revealed that the existing exterior masonry wall is robust enough to enable the design team to consider some anchorage of the scaffold system to the existing pavilion exterior walls. A careful analysis of the existing below grade services and infrastructure will be carried out to determine the most logical placement and support of the scaffold system and thereby reducing the risk of undue loading on those facilities.

b) Case: Schedule - Design for seasonal construction

Risk: There are two strategies for designing for seasonal construction, each with their own inherent potential risks to cost and schedule. The first option is to only perform masonry work at a time when the environmental conditions are favourable for performing this sort of work. Typically for masonry the ambient temperatures must be between 10 and 25deg.C. The second option is to enclose the scaffold system and provide heating to achieve the recommended ambient environmental conditions.

Mitigation Strategies: A review of other similar projects carried out on the Hill has suggested that the option of seasonal work may not yield enough time to achieve the mandate for the masonry component of the project and as such a recommendation to enclose the scaffold system is proposed. A further analysis of sequencing the work will be carried out to look at other options to minimize risk to the schedule.

c) Case: Anchor design strategies
Risk: The issue with anchor design strategies is two-fold. Firstly, there is a procurement issue as identified previously above due to the proprietary nature of the varying systems available on the market. Secondly, there is a technical issue of compatibility of the anchoring system to the heritage substrate.
Mitigation Strategies: There has been a lot of research performed on anchoring systems on the various projects on currently being performed on the Hill which can be drawn from to analyze the pros and cons of each system available. Further investigations should be carried out to see if there are any *new* products available within the industry. The consultant Team will make a technical recommendation for anchoring systems but further dialogue must be had with PWGSC and the Contracting Directorate regarding procurement options available.

5. REGULATORY REQUIREMENTS

a) Case: Protection of the scaffolding system and building from Hazards
Risk: As per NBC Sentence 8.1.2.2(1), precautions are to be undertaken to mitigate the risk of a person being exposed to an unforeseen hazard. If the scaffold is enclosed during the winter months and there is a fire in the building, smoke may be able to enter the scaffold enclosure through openings and may travel to other levels of the building via the scaffolding enclosure. In addition, occupants of the scaffolding will be exposed to smoke from the fire which may lead to the incapacitation of the occupants.
Mitigation Strategies: Extend the fire alarm signaling devices to the enclosed scaffolding so that a person in the scaffolding enclosure will be notified of a fire in the occupied building. This will reduce the notification time of occupants and evacuation time.
Provide a smoke exhaust fan for the scaffolding enclosure. The addition of a smoke exhaust fan will help reduce smoke spread to other levels of the building via the scaffolding enclosure. It is recommended that the smoke exhaust fan be manually activated by trained personnel.

6. *RESOURCES EXTERNAL TO THE PROJECT MANAGEMENT TEAM*

a) Case: Labour disputes

Risk: Industry wide labour disputes are always possible, but the overall risk is low. These types of disputes typically are beyond the control of the individual project management teams. Localized labour disputes on a project by project basis can also be an issue, albeit the risk again is low. Disputes between sub-trades and the General Contractor could have a direct impact on a project cost and schedule.

Mitigation Strategies: Most labour disputes are typically to do with safety and payment issues. Communication to the Contractor regarding the terms of engagement regarding payment and safety issues must be clearly identified in the contract and specifications. Safety issues on site by all Departmental Representatives including consultants must be consistently monitored and documented and if violations are noted they should be reported to the PWGSC safety officer. This will reduce the risk of a sub-contractor withholding services due to unsafe working conditions. With regards to payment terms, the rules are clearly spelled out in the General Conditions of the PWGSC contracts. The requirement for Statutory Declarations should be strictly enforced to ensure the Contractor is fulfilling their legal obligations to their sub-contractors.

b) Case: Force Majeure

Risk: Force Majeure is a term typically referring to unexpected events that crucially affects one's ability to do something. In insurance terms this typically means *"Acts of God"* such as earthquakes or other catastrophic events. The risks of such an event are low but the consequences could potentially be high.

Mitigation Strategies: It is impossible to mitigate the probability of such an occurrence, but it is imperative that an action plan be set out in the event of an event of catastrophic potential occurring. A clear safety and evacuation plan must be implemented as part of the Contractor's required services which takes into account such an event. These requirements are to be clearly defined in the specifications. A safety plan must cover such items as emergency notifications, evacuation plans, mustering areas, directions to medical services, emergency contact info. etc.

7. *CONSTRUCTION*

a) Case: Sequencing of work

Risk: The sequencing of work will have a direct impact on schedule and cost. The CB-PAV project is essentially two identical scopes of work on the two ends of the building (east and west). There is a requirement for below grade work and above grade work which requires coordination of scheduling of the work.

Mitigation Strategies: The overall scheduling of the construction is the responsibility of the contractor. That being said, the Consultant Team will recommend a sequencing of work based on extensive experience in these types of projects to validate the construction durations set out in the contract. A preliminary schedule will be included in the RS-4 Design Development report which will speak to sequencing of construction in general terms with the caveat that the winning proponent will be providing the detailed schedule of construction.

b) Case: Constructor considerations
Risk: There are multiple construction projects that will be happening in the immediate vicinity of this project that may lead to Constructor issues.
Mitigation Strategies: It is a known that there are a few pending projects that will be happening simultaneously and in the general vicinity of the Center Block Pavilions project. PWGSC has an internal ongoing dialogue coordinating the various mandates. Careful planning and scheduling by all stakeholders to minimize the impact of multiple Contractors working on the Hill is very important. Clearly identifying zones of construction to eliminate any safety and Constructor interferences will be reviewed and coordinated through all phases of the project.

c) Case: Overall project delay claims
Risk: Overall project delay claims are typically due to poor communication, missing documentation or information in the Contract Documents, or response times that could delay or inconvenience the Contractor.
Mitigation Strategies: A clear communications protocol for transfer of information between the stakeholders throughout the design, contract documentation, and construction phases to ensure that the final product meets the expected objectives is paramount. Employing best practices measures at each phase of the project will reduce the risk of delays associated with communication and documentation. Responding to unforeseen site conditions and questions from the Contractor expeditiously will reduce the risk of an overall project delay claim.

APPENDIX XIII
DOCUMENTS RECEIVED

Drawings				
Date	**Title**	**Size (dwgs)**	**Issued By**	**Read By**
March 2009	*Screening- East Elevation*	8	PWGSC	FGMDA
March 2009	*Screening-West Elevation*	7	PWGSC	FGMDA
N/A	*Historic Drawings*	± 2500 Docs on 3 Cds	PWGSC	FGMDA
1996-2006	*Building Base Plans*	9	PWGSC	FGMDA
N/A	*Center Block- Exterior as Found: Roof CBT*	N/A	PWGSC	FGMDA
N/A	*Center Block- Exterior as Found: South Facade CBS*	N/A	PWGSC	FGMDA
N/A	*Center Block- Exterior as Found: East Elevation CBE*	N/A	PWGSC	FGMDA
N/A	*Center Block- Exterior as Found: West Elevation CBW*	N/A	PWGSC	FGMDA
1 Jul 1998	*South Façade Roof Details*	25	PWGSC	FGMDA
Nov 1995	*Emergency Masonry Repair - Turrets*	5	PWGSC	FGMDA
May 1995	*Centre Block South - Conservation (dwgs & specs)*	146	PWGSC	AAR/FGMDA
2007-2008	*Centre Block Copper Roof Repair (dwg & specs)*	25	PWGSC	FGMDA
2007-2008	*Centre Block Chimneys Stabilization Phase 1*	4	PWGSC	FGMDA/AAR
Jun-05	*Centre Block Interior Recording*	37	PWGSC	FGMDA
1915	*Plan of water, gas, and electric services*	2	PWGSC	FGMDA
1959	*Centre Block proposed gas service*	1	PWGSC	FGMDA
1961	*Underground system*	1	PWGSC	FGMDA
1988	*Drainage improvements to Parliament Hill*	1	PWGSC	FGMDA
1994	Reconstruction of Water Network and Storm Sewer	6	PWGSC	FGMDA
1996	Stabilization of old tunnels	15	PWGSC	FGMDA
1997	Centre Block underground services building	67	PWGSC	FGMDA
1998	Centre Block basement improvements and CB / EB Tunnel	47	PWGSC	FGMDA
1998	Vaux wall repair, Parliament Hill	23	PWGSC	FGMDA
1999	East Block sewer repairs	6	PWGSC	FGMDA
1999	Modification and upgrade to EB and Bytown Museum distribution centres	6	PWGSC	FGMDA
2011	Parliament Hill site utility drawing	1	PWGSC	FGMDA
N/A	Hydro undergroung system	1	PWGSC	FGMDA
N/A	PPD valve chamber 1	1	PWGSC	FGMDA
N/A	PPD water valve chamber 1	1	PWGSC	FGMDA
N/A	Repairs to roadways and parking areas	11	PWGSC	FGMDA
N/A	Tunnel between EB / CB landscaping	1	PWGSC	FGMDA
N/A	Tunnel between EB / CB landscaping details	1	PWGSC	FGMDA
N/A	Water valve chamber 1a	1	PWGSC	FGMDA
N/A	Water valve chamber 2	1	PWGSC	FGMDA
N/A	Water valve chamber 3	1	PWGSC	FGMDA
N/A	Water valve chamber 4	1	PWGSC	FGMDA
N/A	Water valve chamber 5	1	PWGSC	FGMDA

Reports				
Date	**Title**	**Size (pages)**	**Edited / Issued By**	**Read By**
	1-Center Block Rubble Foundations			
Nov 1999	*Southest Portion of CB Foundation being Repaired*	15		AAR/FGMDA
●	Pictures showing repairs work to foundation walls of CB near east pavilion in 1999.			
July 2000	*South Foundation Masonry & Drainage*	26	HCP-RPS CH/EC	FGMDA
●	Report, photograghs, budget estimate, tender drawings for excavation / dampproffing / drainage of Senate foundation wall in the South East corner.			
2 May 2001	*Specifications issued for tender*		HCP-RPS CH/EC	FGMDA
	2-CB-Recap Interim Monitoring 2011-12			
24 Feb 2012	*CB Recapitalization Interim Monitoring 2011-2012*	77	PWGSC	AAR/FGMDA
Jan 2012	*CB Recapitalization Interim Monitoring 2011-2012 - Drawings*	36	PWGSC	AAR/FGMDA
●	Report summarizes most recent condition of masonry, roof and windows, includes most recent survey findings of exterior walls and most recent readings from DEMEC points.			
●	Report mentions that DEMEC readings show little movement since 2006 or 2008 (for various locations) compared to significant movement in previous years. Report do not question or answer reasoning for change in movement pattern.			
●	Exterior wall survey findings were used as base-document during our review of the walls by lift. Little changes in condition were noted.			
	3-Designated Substance Report			
12 Jan 2012	*Designated Substances Report for the East & West Pavilions Rehabilitation Project at the Centre Block Building, Parliament Hill, Ottawa, Ontario*	10	PWGSC	AAR/FGMDA/ Golder
12 Jan 2012	*Designated Substances Report for the East & West Pavilions Rehabilitation Project at the Centre Block Building, Parliament Hill, Ottawa, Ontario*	5	PWGSC	AAR/FGMDA/ Golder
27 Feb 2013	*Designated Substances Report for the East & West Pavilions Rehabilitation Project at the Centre Block Building, Parliament Hill, Ottawa, Ontario*	18	PWGSC	FGMDA/Golder
04 April 2013	*Designated Substances Report for the East & West Pavilion Opening Project at the Centre Block Building, Parliament Hill, Ottawa, Ontario Summary Report (R.027594.007)*	17	PWGSC	FGMDA/Golder
●	Report indicates traces of asbestos in the caulking at the exterior of the building, in the 6th floor West Pavilion attic parging, as well as traces of lead in the mortar of the exterior of both Pavilions.			
	4-SustainableDev			
28 Feb 2012	*International regulations in sustainable construction and use of wood*	49	cecobois	FGMDA
Mar 2000	*the environmentally responsible construction and renovation handbook*	179	PWGSC	FGMDA
Mar 2000	*Guide pour une construction et une rénovation respectueuses de l'environnement*	185	PWGSC	FGMDA
n/a	*sustainable development strategy 2007-2009*	56	PWGSC	FGMDA
	5 - Feasibility Report Pavilion Towers			
24 Sep 2010	*Feasability report for CB - Pavilion towers. Rehabilitation Project.*	96	PWGSC	AAR/FGMDA
●	Report offers insight on reasoning and selection of current scope of work. Although condition-related information is not the latest, this report summarizes previous repair projects and summarizes concerns with regards to structural integrity (mainly related to seismic risk) based on previous reports. During our documentation review, this document served as a starting point.			
	6 - Centre Block Roof Masonry			
20 Apr 2004	*Centre Block Roof Masonry - North Towers, Parapets and Chimneys - 100% Final Report*	42	PWGSC	AAR/FGMDA
20 Apr 2004	*Appendix II - Stone Conservator's Report*	20	Trevor Gillingwater	FGMDA
●	Report discusses condition of masonry in 2004, in areas mainly outside current scope of work. However, the report discusses work completed on centre block's chimneys; it includes noted concerns and general repair work			

Reports				
Date	**Title**	**Size (pages)**	**Edited / Issued By**	**Read By**
	7 - Condition Assesment of Centre Block Masonry			
Mar 1 1999	*Condition Assesment of Centre Block Masonry Parliament Hill*	134	Real Property Services for Canadian Heritage	AAR/FGMDA
●	Report summarizes original construction of Centre Block and maintenance history.			
●	Report discusses condition of masonry and analyses causes of damage.			
	10-Center Block South Façade & Peace Tower projects			
12 Sep 1994	*Concept Design report. (Class 'C' Estimates) Conservation of the South Façade*	328	PWGSC	AAR/FGMDA
21 Mar 1995	*Investigation and Report. (Class 'D' Estimates). Conservation of the exterior envelope*	665	PWGSC	AAR/FGMDA
30 Nov 1994	*Design Development Report. (Class 'B' Estimates) Conservation of the South Façade.*	295	PWGSC	FGMDA
20 Feb 1995	*Final Design Report. (Class 'A' Estimates) Conservation of the South façade*	51	PWGSC	FGMDA
●	Reports are reviewed as standards for each stage of current project, in relation with *Lessons Learned* and *Retrospective on Methods and Materials.*			
	16-Retrospective on Methods and Materials			
Mar 2009	*Retrospective on Methods and Materials for Centre Block South Façade Project*	36	PWGSC	AAR/FGMDA
●	Report offers comments based on experience of repairs to South Façade, many of which may be used in current project.			
●	Report offers details on seismic analysis of chimneys and turrets.			
●	Report includes drawings of repairs details to tower, chimneys and turrets (STR1, STR2 and STR3).			
	18 - Monitoring Data from DEMEC instalations			
n/a	*Data from Demec points*	1	n/a	AAR
n/a	*Data from Demec points*	1	n/a	AAR
●	Very little data included – does offer significant information.			
	19 - Centre Block Pavilions Class D			
Apr 2008	*CB Pavilions Class D Investigation and report. 70%*	42	PWGSC	AAR/FGMDA
●	Report summarizes original construction of Centre Block and maintenance history until 2008.			
●	Report offers some information of condition of masonry and some recommendations for conservation work.			
	22 - Study of Old Tunnels			
30 Mar 1995	*Report on study of Old Tunnels of Parliament Hill Vol.1*	29	McRostie Genest St.Louis	AAR
30 Mar 1995	*Report on study of old tunnels of Parliament Hill Vol.2*	114	McRostie Genest St.Louis	AAR
	PR 10.1 Documents			
4 Feb 2008	*Hazardous Building Materials Assessment Report*	28	Pinchin Environmental	AAR
4 Feb 1987	*CB Heritage character statement*	2	FHBRO	FGMDA
4 Feb 1987	*Library Heritage character statement*	1	FHBRO	FGMDA
4 Feb 1987	*Parliament Complex Heritage character statement*	2	FHBRO	AAR/FGMDA
4 Feb 1987	*Édifice du Centre. Énoncé des Valeurs.*	2	FHBRO	FGMDA
4 Feb 1987	*Complexe Parlementaire. Énoncé des Valeurs.*	2	FHBRO	FGMDA
4 Feb 1987	*Bibliothèque. Énoncé des Valeurs.*	1	FHBRO	FGMDA
1986	*Centre Block, Historical associations*	20	Robert Hunter	FGMDA
●	As title suggests, reports identifies the heritage value and character defining elements.			

Reports

Date	Title	Size (pages)	Edited / Issued By	Read By
	PR 10.2 Documents			
14 Sep 2000	*Lessons Learned from Masonry Conservation Project. Conservation of the South Façade.DRAFT*	22	PWGSC	AAR/FGMDA
●	As title suggests, report offers insight on mistakes and discoveries noted during previous repairs and projects. This report will be continuously referred to during current project.			
Mar 2009	*CB Recapitalization Interim Monitoring 2008-2009*	29	PWGSC	AAR/FGMDA
●	Report offers information on condition of masonry in 2009 and provides DEMEC point data from 2006-2008.			
29 Mar 2010	*CB Recapitalization Interim Monitoring 2009-2010*	9	PWGSC	AAR/FGMDA
●	Report offers information on condition of masonry in 2010 and provides DEMEC point data from 2006-2009 and elevation drawings showing condition of exterior walls.			
11 Feb 2011	*CB Recapitalization Interim Monitoring 2010-2011*	4	PWGSC	FGMDA
11 Feb 2011	*Appendix A. Monitoring Data Results*	10	PWGSC	AAR/FGMDA
11 Feb 2011	*Appendix B. Exterior Survey Condition Assessment Drawing Set*	37	PWGSC	AAR/FGMDA
•	Report provides summary of data monitoring for pressure and humidity. Report also includes exterior elevation drawings showing condition of masonry walls.			
30 Nov 2011	*CB Recapitalization Interim Monitoring 2011-2012*	3	PWGSC	FGMDA
●	Very limited report with summary of condition.			
Mar 2006	*CB Building Envelope Screnning 2005-06*	27	PWGSC	AAR/FGMDA
Mar 2007	*CB Building Envelope Screnning 2006-07*	29	PWGSC	AAR/FGMDA
Mar 2008	*CB Building Envelope Screnning 2007-08*	51	PWGSC	AAR/FGMDA
26 Mar 2009	*CB Level 2 Building Envelope Screening 2008-09*	7	PWGSC	AAR/FGMDA
	CB Level 2 Building Envelope Screening 2009-10	6	PWGSC	AAR/FGMDA
n/a	*CB Level 2 Building Envelope Screening 2010-11*	6	PWGSC	FGMDA
●	Reports generally discuss condition of masonry, provide information on monitoring of data (DEMEC, pressure, humidity) and include exterior elevation drawings showing condition of masonry walls.			
19 Jan 1995	*CB Masonry Stabilization Seismic Study for Towers of Pavilion and Chimneys*	135	National research Council	AAR
●	Report not reviewed in detail at this time – information will become more significant as seismic analysis continues and becomes more detailed.			
Apr 2002	*CB Ventilation Towers. Seismic Evaluation & Class B Report*	54	PWGS, Canada	AAR
●	Generally not structurally relevant to current scope of work			
5 Feb 2004	*Peace Tower Preliminary Seismic Study*	17	PWGS, Canada	AAR
●	Generally not structurally relevant to current scope of work			
Aug 2008	*Testing of Walls Representative of Those on Parliament Hill*	131	Univ. of Calgary	AAR
●	Report offers summary and insight on construction of walls and general performance, including with CINTEC anchors. This report will be further reviewed as seismic analysis continues and becomes more detailed.			

Reports

Date	Title	Size (pages)	Edited / Issued By	Read By
May 1998	*Conservator Report CB South Facade 1998*	51	Trevor Gillingwater	FGMDA
Oct 1994	*Thermographic Inspection - Centre Block*	21	Technology Architecture & Engineering Services	FGMDA
Feb. 2011	*Geotechnical Investigation for Center Block Ventilation Towers*	110	Golder Associates	FGMDA
Apr. 1995	*Investigation Research Program on the Impact of Various Stone Cleaning Techniques on the Physical Properties of Stone Common to the Parliamentary Precinct*	66	National research Council	
31 Mar 2004	*A Study of Building Stones from the Parliamentary Precinct*	42	National research Council	
May 2011	*Mortar Analysis Report*	14	High Bridge Materials Consulting	FGMDA
Jan 2012	*Stone Testing and Examination Report*	50	High Bridge Materials Consulting	FGMDA
Dec 2011	*X-Ray Diffraction and Chemical Analysis Report*	7	High Bridge Materials Consulting	FGMDA
Jan 2012	*Mortar Testing Report*	9	High Bridge Materials Consulting	FGMDA
Jan 2012	*Brick Testing and Examination Report*	21	High Bridge Materials Consulting	FGMDA
March 2004	*Comparative Analysis of Laboratory and Field Test Results on the Durability of Mortar for Historic Masonry in Canada*	74	NRC	FGMDA
April 2001	*Exploratory Tests to Evaluate Factors Improving the Bond Between Mortar on Ohio Stone*	35	NRC	FGMDA
May 1997	*Identification of Efflorescence Staining on Pier #57 of the Wellington Street Wall Parliamentary Complex*	4	John Stewart, Parks Canada	FGMDA
July 2002	*Third Party Expertise on Hydraulic Lime Mortar*	115	Suter Consultants Inc.	FGMDA
Feb 1996	*Centre Block Parliament Hill, Ottawa - Inspection Report on the Centre Block Exterior Carvings*	25	Maurice Joanisse, PWGSC	FGMDA

Specifications

Date	Title	Size (dwgs)	Issued By	Read By
1916	*Specification - Parliament Building, Ottawa*	57	Darlin & Pearson, Architects & J.O. Marchand, Associate	
June 1995	*Centre block. Conservationof South Façade.*	589	PWGSC	FGMDA
June 1995	*Édifice du Centre. Conservation de la façade sud.*	720	PWGSC	FGMDA
July 1995	*Emergency Masonry Work - Centre Block*	6	PWGSC	FGMDA
2008	*Copper and Membrane repair. Project:119853*	64	PWGSC	FGMDA
2008	*Supply Labour, Equipement and Materials to Repair Roof.*	56	PWGSC	FGMDA

APPENDIX XIV
SPECIFICATIONS

SPECIFICATIONS:

SECTION TITLE **No. OF PAGES**

DIVISION 00 - Procurement and Contracting Requirements

DIVISION 01 - General Requirements

DIVISION 02 - Existing Conditions

DIVISION 03 - Concrete

DIVISION 04 - Masonry

DIVISION 05 - Metals

DIVISION 06 - Wood Plastics and Composites

DIVISION 07 - Thermal and Moisture Protection

DIVISION 08 - Openings

DIVISION 09 - Finishes

DIVISION 21 - Fire Suppression

DIVISION 22 - Plumbing

DIVISION 23 - Heating, Ventilation, and Air Conditioning (HVAC)

DIVISION 26 - Electrical

DIVISION 27 - Communications

DIVISION 28 - Electronic Safety and Security

DIVISION 31 - Earthwork

DIVISION 32 - Exterior Improvements

DIVISION 33 - Utilities

APPENDICES

Appendix A Designate Substance Reports

PLANS

Architecture - General, Site & Landscape

Architecture- Masonry Interventions

Architecture - Roofing Interventions

Architecture - Window Interventions

Structural Engineering

Mechanical Engineering

Electrical Engineering

Civil Engineering

Scaffold Design

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