

## **MUNICIPAL COMPLEX STRUCTURAL UPGRADE**

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### **EXECUTIVE SUMMARY**

The City owns and operates civic facilities which are essential to the delivery of services to citizens, including the Calgary Municipal Complex. In Q3 2016, external specialist structural engineers determined that Truss 'A' in the northeast corner of the Municipal Complex did not meet the life safety requirements of the Alberta Building Code. Subsequently, on 2016 September 18, out of an abundance of caution the Administrative Leadership Team (ALT) activated the City's Municipal Emergency Plan (MEP) and directed that all City staff located within the impacted portions of the Municipal Complex be temporarily relocated. As a means of addressing the identified safety issues, City staff engaged a third-party engineering firm, which recommended the installation of redundant structural shoring and additional remedial truss work. These recommendations were further confirmed by an external forensic engineering firm. Since Q3 2016 significant work has been completed, including urgent installation of the shoring system, along with the re-occupancy of 99.1 per cent of temporarily relocated staff. Further, additional remedial work to upgrade Truss 'A' and Truss 'B' has commenced and is expected to be completed in Q1 2018.

Administration's main priority is to ensure safety for citizens and City employees while also working within existing budgets to absorb as much of the cost of the Municipal Complex Structural Upgrade project as possible. Existing budgets were reprioritized by reallocating funds for building operations and maintenance projects, along with cancelling and deferring planned lifecycle projects, including energy efficiency and building automation upgrades. Through this reprioritization, a total cost of \$4.6 million was absorbed through prioritizing existing budgets. Following the absorption of \$4.6 million, Administration still requires \$12.2 million to complete the project, for a total estimated project cost of \$16.8 million. This is significantly less than the \$20.7 million preliminary class five estimate to address the affected area. Recognizing that this project responded to a corporate emergency, Administration recommends that these costs be funded from the Corporate Cost Program 861. This funding ensures the long-term structural integrity of the Municipal Building along with required building codes compliance, safe re-occupancy of impacted areas and reactivation of the space within. In addition, this work supports the avoidance of future real estate costs, as the remediation process is increasing useable office capacity for floors 8-12 by 38 per cent, resulting in an estimated \$6.6 million in future cost avoidance.

### **ADMINISTRATION RECOMMENDATION(S)**

That the Priorities and Finance Committee recommends:

That Council approve the transfer of \$12.2 million in project costs to be spent in 2017 and 2018 to the Corporate Cost Program 861 for the Municipal Complex Structural Upgrade.

### **PREVIOUS COUNCIL DIRECTION / POLICY**

On 2002 May 27, Council approved the Emergency Management Bylaw 25M2002 which describes how The City declares local emergencies, develops emergency plans and directs emergency response.

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### BACKGROUND

The Calgary Municipal Complex was constructed in 1983, and includes the Municipal Building, Administration Building and Annex. The Municipal Building itself is comprised of a large concrete multi-story structure with a small triangular shaped structural steel framed pinnacle area that spans over the existing Annex and Administration Building. This area includes five floors which are suspended by two structural hangers from Truss 'A' and a single structural hanger from Truss 'B'. The two trusses are two floor levels high and directly support a mechanical floor, a mid-level floor and a portion of the roof.

#### Initial Discovery & Emergency Response

In 2016, during work being conducted in the northeast section of the Municipal Complex, a structural engineering consultant noticed that Truss 'A' is constructed differently from what is shown on the original design drawings and following detailed analysis and review, it was determined that the truss as constructed did not meet the life safety requirements of the Alberta Building Code.

Subsequently, on 2016 September 18<sup>th</sup>, out of an abundance of caution the Administrative Leadership Team activated The City's Municipal Emergency Plan (MEP) and Emergency Operations Centre (EOC) to ensure safety, asset protection and facilitate entry to the building while a number of affected areas were cordoned off. Within 36 hours the EOC then handed-off the emergency and operational response to Facility Management's (FM) Tactical Operations Centre (TOC) to coordinate the relocation and accommodation of affected staff. The FM TOC included Corporate representatives from Calgary Emergency Management Agency (CEMA), Environment and Safety Management (ESM), Corporate Security, Roads, Information Technology (IT), Human Resources, Finance, and Law. Measures were taken to ensure the safety of City employees and the public, manage and coordinate immediate communications and information regarding the emergency and tactical response, provide and analyze information to support decision-making and implement response plans.

#### Impacts to City Employees and Services

In total, 257,893 square feet or 27 per cent of the Municipal Complex was affected by the Municipal Complex Structural Upgrade, impacting 345 City staff initially and later an additional 155 staff when the shoring system was installed. Facility Management collaborated with Human Resources, IT, City Councillor offices, and impacted business units to ensure all relocated employees were accommodated to meet their short-term space and technology needs within the first week of the emergency event. Maps of the affected areas of the Municipal Complex can be found in Attachment 1.

Some City services based on the third floor of the Municipal Building were interrupted, however City Cashiers reopened within 24 hours and the Fair Entry and Tax Counters within 72 hours. Fair Entry was subsequently relocated to the Atrium lobby and the City Cashiers and Tax Counters were re-opened with some modification in their existing space. While a number of affected areas were cordoned off, the TOC was able to work with City business units to ensure service levels were maintained with as minimal an impact to citizens as possible.

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### **INVESTIGATION: ALTERNATIVES AND ANALYSIS**

Shifting from the emergency response and staff relocation process, Administration moved into addressing the structural issue itself. This process included leveraging expertise from third party engineering and architectural firms specializing in structural analysis and risk management.

In total, The City leveraged five different third-party specialists to provide input on the project which included, specialist welding engineers, strain gauge quality assurance testing, steel inspection and testing, concrete materials testing, along with utilizing a forensic engineering firm and the University of Calgary to review the work.

Through sophisticated computer analysis and testing, a third-party report was provided indicating that Truss 'A' in the northeast corner of the Municipal Building did not meet the life safety requirements of the Alberta Building Code. In addition, further testing revealed concerns with 'Truss B' and certain joints associated with both truss assembly's. These findings supported the declaration of an emergency situation as the failure of any connection relating to Truss 'A' could lead to a failure in the structural integrity of the complex. Third-party engineering analysis highlighted that despite the fact that the Municipal Complex has stood for 33 years, it was not Alberta Building Code compliant, and without interim shoring and future structural remediation, heavy snow loads or seismic events could impact future structural integrity and result in the collapse of the Municipal Building's suspended floors (portions of floors 8-12). Attachment 2 includes pictures of the Structural Collapse Model along with the associated structural shoring and structural upgrades for Truss 'A' and Truss 'B'.

### ***Interim Shoring System***

At the request of Administration, engineering consultant Read Jones Christofferson Ltd (RJC) in collaboration with the prime contractor EllisDon, presented multiple shoring options to temporarily support the structural load carried by Truss 'A', with the primary objectives of addressing the life safety requirements of the Alberta Building Code and allowing the vacated portions of the Municipal Building to be reoccupied safely. All shoring options included reliability testing and building codes inspections to ensure structural integrity and staff safety.

After review and consideration, a final shoring option was selected based on the third-party engineering expertise with safety as its first consideration, while also being cost effective, less time intensive, and the least intrusive for staff and the general public. As an additional safety measure, on 2016 November 4<sup>th</sup> Administration expanded the partial closure of the Administration Building, Annex and Municipal Building to accommodate the shoring work. This resulted in the relocation of an additional 155 employees, bringing the total number of staff safely relocated to 500.

The selected option consisted of stabilizing Truss 'A' with a shoring tower installed on a new transfer beam system constructed on the roof of the Administration Building (Attachment 2). The new transfer beam system distributes the shoring tower load to three existing columns within the Administration Building, with one of the existing columns being further reinforced to carry the shoring loads. Controlled jacking of the shoring tower was then utilized to remove tension loads from the central hangers and from Truss 'A'.

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By April 2017, the redundant shoring system was in place. Once installed, structural engineers from two separate third-party consultants independently inspected Truss 'A', using specialized equipment to test reliability. Based on these inspections, building codes officers from Calgary Building Services provided approval to re-occupy the Municipal Complex and begin remediation of Truss 'A'.

Administration began moving staff back to the Municipal Complex in a phased approach starting on Monday, May 15, 2017 and continuing into Q3 2017. To date, 99.1 percent of staff affected by the Municipal Complex Structure Upgrade have successfully and safely re-occupied the affected portions of the Administration Building, Annex and Municipal Complex.

### ***Structural Remediation***

With temporary shoring complete, the prime contractor commenced remediation of Truss 'A' and Truss 'B'.

#### ***Truss 'A'***

Truss 'A' is a primary truss which suspends load from five floors in the Municipal Building (8<sup>th</sup> floor to 12<sup>th</sup> floor) and directly carries partial loads from the 13<sup>th</sup> floor while also supporting portions of the roof. The engineering firm of Amec Foster Wheeler (AFW) conducted the advanced structural assessment of the truss system and identified concerns with the condition of the welds, joints, and associated connections to Truss 'A'. AFW indicated that Truss 'A' did not meet the minimum requirements of the Alberta Building Code, and upon further investigation, that the truss exhibited high level stresses that could result in a sudden failure if additional strain was placed on the structure. AFW confirmed the original finding that Truss 'A' was fabricated differently than in the original design drawings, and that a steel member used was a different size and type than what was identified on the original drawing, which was an additional cause for concern.

#### ***Truss 'B'***

In terms of Truss 'B', AFW completed a detailed element analysis and strength investigation. The results of this detailed analysis indicated that Truss 'B' met the Alberta Building Code under existing loading conditions, but failed the reliability requirements under the maximum design loads as shown on the original design drawings. These results further indicated that the existing actual loads on Truss 'B' pose no imminent concern, however the truss must be upgraded in order to achieve the maximum design loads for the complex. Without remediation ongoing floor load monitoring would be required to ensure a safety risk did not develop based on future accommodation or occupancy changes, and would prevent any future densification of the Municipal Complex. To support the Truss 'B' remediation process, a temporary box truss was installed on the roof of the Municipal Building. A controlled jacking process was then used to transfer the weight of Truss 'B' onto the temporary box truss assembly so remediation efforts could proceed.

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### ***Remediation Progress***

In order to address the structural issues with both Truss 'A' and 'B', it was determined that a significant number of additional steel plates, or "stiffeners", would need to be welded into place to support the connections between the truss and surrounding structures. For Truss 'B', this process also required the installation of a "pre-stress system" prior to the installation of the stiffeners to reduce the load on Truss 'B' enough to safely install the stiffeners in question.

To date, the "pre-stress system" has been successfully installed for Truss 'B' and 80 "stiffeners" of varying sizes and shapes have been welded into place on nine separate joints for Truss 'B'. For Truss 'A', 61 "stiffeners" have now been welded into place supporting 8 joints and ensuring enhanced structural stability and safety code compliance. The 141 total number of "stiffeners" utilized weigh over 6,480 kilograms and represent 7,218 linear feet of required welding. All required welding for both Truss 'A' and 'B' is now complete. An infographic outlining key facts and figures related to the upgrade project can be found in Attachment 3. Final remediation work is still ongoing and scheduled to be complete by Q1 2018. This includes refinishing interior spaces impacted by the upgrade efforts along with ongoing testing and third-party review of the work done to date. For example, ongoing monitoring of 245 digital strain gauges installed on both Truss 'A' and Truss 'B' continues to evaluate how they respond to changes in temperature/weather and to determine if any adjustments are required to completed remediation efforts. Further, work is also required to remove the interim shoring system from the roof of the Administration Building and return the roof to its previous condition.

In addition to addressing Alberta Building Code requirements, it's important to note that this project also significantly improved the building's usable office space capacity by increasing the weight load the complex can handle. This project in conjunction with Facility Management's Long-term Accommodation Strategy, will provide 38 per cent more capacity to increase the number of employees on floors 8 through 12. This approach of increased utilization through mobility in the Municipal Complex and rationalizing other Corporate space will allow for enhanced space utilization and an estimated \$6.6 million in future capital cost avoidance.

### **Stakeholder Engagement, Research and Communication**

All affected business units and staff were engaged throughout this emergency event to meet their mid to long-term accommodation and information needs. A communications plan was developed and implemented covering all facets of communicating with public, internal and other stakeholders. This plan included ongoing structural upgrade updates to senior leadership and City staff, along with communication and change management support for relocated staff.

### **Strategic Alignment**

Prudent and timely capital investments in lifecycle and maintenance align to and support Council Priorities for 2015-2018, including a well-run City. In addition, the Municipal Complex Structural Upgrade response also aligned with the Municipal Emergency Response Plan and associated Emergency Management Bylaw.

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### **Social, Environmental, Economic (External)**

The redundant shoring and remedial work serve to enhance the long-term structural integrity of the Municipal Building, mitigate a major safety risk and support the continuation of programs and service delivery through the maintenance of critical civic infrastructure. Investments in The City's building assets ensure continuity of City operations and safer and more sustainable space for occupants and visitors. These prudent and timely capital investments contribute to The City's Corporate Economic Resiliency Strategy and improve the productive potential of the economy by creating employment.

### **Financial Capacity**

#### **Current and Future Operating Budget:**

A total cost of \$4.6 million between 2016 and 2017 have been absorbed to date through prioritization of existing City budgets. In order to address the outstanding costs and to complete the remainder of the work, Administration is requesting approval to transfer \$12.2 million of project costs to the Corporate Cost Program 861. This amounts to a total estimated project cost of \$16.8 million. This is significantly less than the \$20.7 million preliminary class five estimate to address the affected area. A more detailed overview of project costs can be found in Attachment 4.

#### **Current and Future Capital Budget:**

Not applicable.

### **Risk Assessment**

The structural upgrades outlined in this report mitigate safety risks to staff and visitors of the Municipal Complex and ensure the long-term sustainability of the facility moving forward. This includes bringing the complex into full compliance with the life safety requirements of the Alberta Building Code and facilitating the safe re-occupancy of affected areas.

#### **REASON(S) FOR RECOMMENDATION(S):**

In Q3 2016, Administration in conjunction with external specialist structural engineers determined that Truss 'A' in the northeast corner of the Municipal Complex did not meet the life safety requirements of the Alberta Building Code. Subsequently, out of an abundance of caution the Administrative Leadership Team activated the City's Municipal Emergency Plan and directed that all City staff in impacted portions of the Municipal Complex be temporarily relocated as a safety precaution. As a means of addressing the identified safety issues, specialized third-party engineering firms determined the need for the installation of redundant structural shoring and additional remedial truss work. In order to address the outstanding costs and to complete the remainder of the work, Administration is requesting approval to transfer \$12.2 million of project costs to the Corporate Cost Program 861. This funding request ensures the long-term structural integrity of the Municipal Building along with safety codes compliance, safe re-occupancy of impacted areas and reactivation of the space within.

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**ATTACHMENT(S)**

1. Maps of the Municipal Complex Structural Upgrade Affected Areas
2. Pictures of Project Structural Shoring, Remediation and Collapse Model
3. Municipal Complex Structural Upgrade Infographic
4. Municipal Complex Structural Upgrade Project Cost Overview