



ONTARIO SCIENCE CENTRE - RAAC SUMMARY REPORT FOR ALL BUILDINGS

FACILITY

Ontario Science Centre
Building A – B14175
Building B – B14174
Building C – B14176
770 Don Mills Road, North York, ON

PREPARED FOR

Infrastructure Ontario and Ministry of Infrastructure
June 18, 2024

RIMKUS MATTER NUMBER

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SUMMARY OF FINDINGS

Background

Reinforced Autoclaved Aerated Concrete (RAAC) is a lightweight concrete product which has been shown to have the potential to degrade due to water infiltration. To identify potential risks associated with existing RAAC an investigation of the both the in-situ RAAC roof panels as well as the roofing assembly is required.

Rimkus Consulting Group (Rimkus) was retained by Infrastructure Ontario (IO) to perform a visual condition assessment of each individual RAAC roof panels, and the overlying roof assembly components of the Ontario Science Centre (OSC) Buildings A, B and C located at 770 Don Mills Road, in Toronto, Ontario. All three buildings were constructed circa 1968 and contain both RAAC panels and other roof deck types. Some RAAC panel areas within the buildings, were not reviewed based on accessibility challenges and observed conditions at adjacent roof areas of each building were used to formulate likely RAAC condition in these areas.

This summary report provides an overview of the methodology, and key findings and recommendations of the RAAC panel evaluation. The reader is recommended and referred to the individual RAAC panel assessment reports for buildings A, B and C, dated June 18, 2024, for further details.

Risk Assessment & Recommendations

The majority of the panel anomalies were the result of water ingress through the roof assembly. RAAC panel field modifications were also observed at many locations. The field modifications included unreinforced openings to facilitate localized roof penetrations. Both water ingress and unreinforced field modifications have permanently reduced the load carrying capacity of the RAAC panels. As such, the compromised panels have been functioning with a reduced factor of safety, when compared to the original design intent. A significant snow or rain loading occurrence could exceed the reduced load carrying capacity of the distressed panels, placing them at an increased risk of sudden collapse.

Risk mitigation for roof areas containing high risk panels is the immediate concern. Reinforcement or replacement of all high risk panels is recommended to be completed prior to October 31, 2024. The construction timing to remediate all identified high risk panels, varies by building and is estimated to be a minimum of three months per building. Prior to construction, additional time would be required for preparation of remediation drawings/specifications, procurement and the building permit application process. Given the timing challenge, alternative risk mitigation strategies are outlined later in the summary report.

With either remediation strategy, floor areas directly below the high risk RAAC panels would need to be treated as construction zones within the building. The individual construction zones would require overhead horizontal hoarding, or vertical hoarding/barrier walls to completely eliminate all pedestrian traffic. OSC programming would be severely impacted, and need to be adjusted to accommodate construction scheduling. The operations within the building C shop areas, would need to be temporarily shut down as each workshop room houses specialized equipment and machinery not easily relocated.

Further invasive openings would be required to complete a 100% level inspection of RAAC panels for buildings A and B. Extensive efforts would be required to provide safe access including RAAC panel removal, cutting through concrete walls to create wall access hatches, and installation of ceiling hatches to be completed under abatement procedures.

Based on our review of exposed RAAC panels to date, and that shoring has been installed to support critical risk panels, it is our opinion that buildings A, B and C are currently safe for occupancy until October 31, 2024.

In the interim, weather forecasts should be monitored for anticipated heavy rainfalls. Rainwater monitoring and management strategies should be implemented as outlined on the Rimkus document titled 'Rainwater Management Plan' dated, April 26, 2024. IO has undertaken steps in alignment with the risk mitigation plan.

To completely mitigate all risk associated with RAAC it is recommended that all RAAC roof panels be replaced with new steel deck in alignment with the next roofing assembly renewal.

As roof renewals are not required immediately at all areas, a risk management strategy is recommended. The site survey information was evaluated, and each individually reviewed panel was placed into one of four risk categories as summarized in **Table 1**. The extent of reviewed RAAC roof areas, and RAAC classification percentages within each risk category are presented for each building at the end of the report.

Table 1 - Risk Assessment & Recommendations

<i>Risk Level</i>	<i>Recommended Measures</i>
Blue – Critical Risk	Immediate restriction of access to occupied spaces below the RAAC panels followed by installation of shoring or replacement/reinforcement of the affected panels.
Amber – High Risk	Replacement or secondary support prior to the next major loading event. In Ontario, gravity snow loading is the governing load for most roof systems. As such, a date of October 31 st , 2024 in the same calendar year of assessment has been suggested as a target for completion of the work.
Yellow – Medium Risk	Annual reassessment required.
Green – Low Risk	Reassessment at three-year intervals.

All risk types of panels were identified in all three buildings at the OSC. In alignment with **Table 1**, supplemental recommendations were provided for the critical risk and high risk panels as follows:

Critical Risk (Blue) Panels (All Buildings)

- Installed shoring (reinforcement) to remain in place until panel remediation has been completed.
- Implementation of a Rain/Snow load monitoring plan. Refer to the Rimkus document titled 'Snow Loading & Rainwater Management Plan', for further details until the remediation

has been completed. It is important to note that this document requires proactive site management even with reinforcement of both critical risk and high risk panels.

High Risk (Amber) Panels (All Buildings)

- Replacement or reinforcement prior to October 31, 2024.
- Implementation of a Rain/Snow load monitoring plan. Refer to the Rimkus document titled ‘Snow Loading & Rainwater Management Plan’ , for further details until the remediation has been completed.
- Where remediation cannot be completed within the recommended time frame, then one of the following supplemental risk mitigation options is recommended and should be implemented in conjunction with the snow/load monitoring program.

Option 1: Restricted access or full closure to prevent any persons from walking in areas where high risk panels are present.

Option 2: Installation of temporary shoring (reinforcement) to the underside of RAAC panels.

Option 3: If shoring is not possible, installation of horizontal hoarding near the underside of hard ceiling levels, or other building interferences (sprinkler mains/process piping etc.).

The above three recommended options are listed order of preference, with option 1 completing eliminating the risk to public or staff.

Roof replacement or reinforcement would significantly impact the activities that could be undertaken within and near the replacement areas.

Budgetary Costs

At roof areas with a lower concentration of high-risk panels, localized RAAC panel remediation is recommended. Total budgetary costs for buildings A, B and C for localized RAAC panel remediation, and reassessment are summarized in **Table 2**. Costs provided are for construction only, including materials and labour, and exclude applicable taxes, consulting fees, construction contingencies designated, substance survey (DSS) investigations and/or unknown site conditions.

Table 2 – RAAC Panel Remediation & Reassessment Costs

Year	RAAC Panel Recommendations	Budget Cost
2024	Localized RAAC panel remediation at amber (high) risk category locations	\$522,500
2025	Reassessment of RAAC panels identified as yellow (medium) risk category	\$30,000
2026	Reassessment of RAAC panels identified as yellow (medium) risk category	\$31,500
2027	Reassessment of all RAAC panels within facility	\$135,000
2028	Reassessment of RAAC panels identified as yellow (medium) risk category	\$34,500
2029	Reassessment of RAAC panels identified as yellow (medium) risk category	\$36,000

At roof areas with a higher concentration of high-risk panels, complete roof assembly and RAAC replacement is recommended for the roof area by October 31, 2024. Other roof areas require both roof assembly and RAAC panel replacement (where applicable) over the next 10 years based solely on the end of useful life of the roof assembly. Total budgetary costs for buildings A, B, and C for recommended roof maintenance, and roof assembly & RAAC panel replacement are summarized in **Table 3**. Costs provided are for construction only, including materials and labour, and exclude applicable taxes, consulting fees, construction contingencies designated, substance survey (DSS) investigations and/or unknown site conditions.

Table 3 – Roof Assembly and RAAC Replacement

Recommended Year	Roof Assembly & RAAC Recommendation	Budget Cost
2024	Roof Maintenance & Roof Assembly & RAAC Replacement	\$7,196,480
2026-2029	Roof Assembly & RAAC Replacement	\$4,466,105
2029-2034	Roof Assembly & RAAC Replacement	\$13,077,312

RAAC Panel Risk Synopsis

The building and roof area metrics, percentage of RAAC panel areas not reviewed, and risk level classifications are summarized below by building. The percentage of RAAC panels classified below are based on the reviewed RAAC panel areas only, please refer to the individual building reports and associated drawings which identify the RAAC panel risk classification.

Building A

- 146,780 gross square footage
- 66,500 sq. ft total roof area
- 46,100 sq. ft RAAC panel roof area
- 13,000 sq. ft (28%) RAAC area not reviewed but are similar construction methodology to the adjacent roof panels in this building. The roof panel condition in these area was presumed to have similar percentages of high and medium risk panels to what was observed in roof areas A2 and A3.
- <1% (one panel) classified as critical risk
- 6% of RAAC panels classified as high risk
- 9% of RAAC panels classified as medium risk
- 84% of RAAC panels classified as low risk

Building B

- 148,182 gross square footage
- 44,600 sq. ft total roof area
- 28,600 sq. ft RAAC panel roof area
- 10,200 sq. ft (35%) RAAC area not reviewed, but are similar construction methodology to the roof areas in this building. The panel conditions at these concealed roof areas are anticipated to have similar deterioration issues due to water ingress adjacent to skylights and at roof penetration locations, as observed at adjacent roof areas.

- <1% (one panel) classified as critical risk
- 5% of RAAC panels classified as high risk
- 2% of RAAC panels classified as medium risk
- 92% of RAAC panels classified as low risk

Building C

- 273,465 gross square footage
- 174,000 sq. ft total roof area
- 78,000 sq. ft RAAC panel roof area
- 1,000 sq. ft (1%) RAAC area not reviewed
- <1% (four panels) classified as critical risk
- 2% of RAAC panels classified as high risk
- 6% of RAAC panels classified as medium risk
- 92% of RAAC panels classified as low risk

All percentages shown above are relative to the total reviewed RAAC panel areas of each building.

The percentage of RAAC panels is only one indicator of next steps, as indicated above, the roof assembly condition and concentration of high RAAC panels also contribute to the remaining useful life of the complete RAAC panel/roof assembly for any individual roof area.

Limitations

This report was prepared for the exclusive use of Infrastructure Ontario (IO), Ministry of Infrastructure (MOI) and other Governmental Agencies and Ministries to which IO reports and was not intended for any other purpose. Our report was based on field observations, and a review of information publicly available to us at this time. Should additional information become available, we reserve the right to determine the impact, if any, the new information may have on our opinions and conclusions and to revise our opinions and conclusions if necessary and warranted. No other person or organization may rely on this report without expressed written authorization from Rimkus and Infrastructure Ontario. If any of the above limitations conflict with the Agreement, the Agreement governs.

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