Strata Engineering Inc.
Absolute Building Science

Engineering Investigation

Parkade Condition Assessment

LMS280

Chateau Comox

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Cover Letter

Absolute Building Science
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March 7, 2024

Strata Plan LMS280
Chateau Comox
1272 Comox Street,
Vancouver, BC V6E 1K7

Attention: Edward Jang, Strata Property Manager of Sterling Management Services

RE: Parkade Condition Assessment for Strata Plan LMS280

Dear Mr. Jang,

The subject of this report is a review of the underground parking garage and its exterior waterproofing at Chateau Comox, a 21-unit and 8-storey mid-rise building constructed in 1992. Our investigation is aimed to visually identify deficiencies inside the parking garage and its exterior waterproofing to provide our recommendations on repair and maintenance strategies as appropriate.

This report describes our findings, analysis, and conclusions regarding the deficiencies, along with our recommendations. This report is based on observations made during our on-site inspection and our review of the relevant documents provided to us by the Strata.

Respectfully yours,

Absolute Building Science
Strata Engineering Inc.

Per:

David Shi, P.Eng., CEAIT
Senior Engineer

Table of Contents

1.0 Introduction

1.1 Background

Chateau Comox consists of an 8-storey residential building with 3 levels of underground parking garage constructed in 1992. The Strata has reported signs of water ingress within the parking garage and had repaired them with crack injections and similar methods in the past. Strata Engineering was engaged to conduct a Parkade Condition Assessment to assess its waterproofing membranes.

1.2 Objectives

The primary objective of this assessment is to identify the waterproofing membranes of the parking garage. In this report, we provide our findings and recommendations based on our investigation.

2.0 Methodology

2.1 Design Review

The following design documentation was made available for review:

- Depreciation Report, prepared by RDH Building Science and dated April 25, 2023.
- Visual Building Envelope Condition Assessment, prepared by RDH Building Science and dated September 30, 2018.
- Depreciation Report, prepared by RDH Building Science and dated January 23, 2015.
- Proposed Apartment Building, prepared by Hywel Jones Architect and dated May 3, 1991.

2.2 Field Review

The inspection was performed by David Shi, P.Eng. CEAIT, Senior Engineer, on January 24th, 2024 at 1272 Comox Street, Vancouver, BC. During the visual review, we inspected the inside of the parkade for water ingress.

The scope of our study does not include a specific review of design drawings for compliance of with the Vancouver Building By-law. We rely on design professionals to have prepared designs that comply with Code. However, for the code violations that were discovered on site, they have already been duly recorded within our report.

2.2.1 Areas visually surveyed

During the visual review, we visually inspected the inside of the parkade for water ingress. We were also provided access to Unit 204's patio which is situated directly above the parking garage.

3.0 Results

3.1 Building Information

Table 1: Building information.

Chateau Comox	
Municipal Address	1272 Comox Street, Vancouver, BC
Real Property Type	8-storey residential building 3 levels of underground parking garage
Units	21-units
Year of Construction	1992
Construction	Cast-in-place reinforced concrete structures throughout

Photo

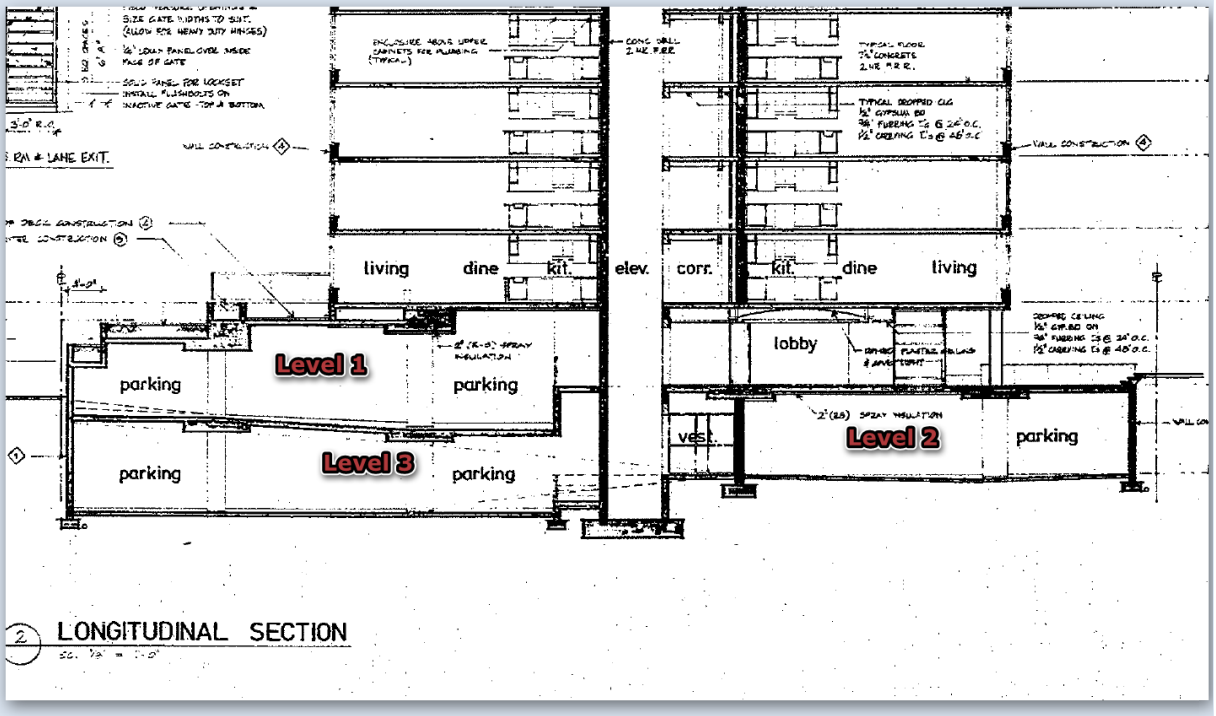


Figure 1: layout of the parking garage

3.2 Observations

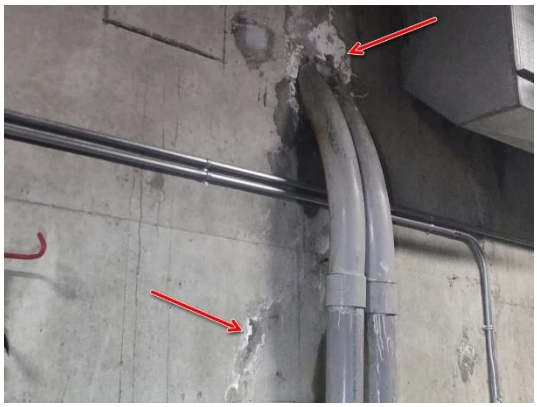
Photo	Observations
 *Figure 2*	Location: Level 3 parking garage foundation wall pipe penetrations. Defect: Efflorescence deposits indicating water ingress and failed waterproofing membrane. Remarks: Efflorescence deposits indicate moisture is penetrating the foundation wall at pipe penetrations.
 *Figure 3*	Location: Foundation wall pipe penetrations. Defect: Efflorescence deposits indicating water ingress and failed waterproofing membrane. Remarks: Efflorescence deposits indicate moisture is penetrating the foundation wall at pipe penetrations.
 *Figure 4*	Location: Underside of slab pipe penetration. Defect: Efflorescence deposits indicating water ingress and failed waterproofing membrane. Remarks: Efflorescence deposits indicate moisture is penetrating the foundation wall at pipe penetrations.

Photo	Observations
 *Figure 5*	Location: Second floor parkade ceiling. Defect: Corrosion on piping. Remarks: There may be water ingress in this location which has caused heavier than expected corrosion on the pipe and hardware.
 *Figure 6*	Location: Between first and second floor of the parkade. Defect: Efflorescence deposits. Remarks: Efflorescence deposits indicate moisture is penetrating the foundation wall.
 *Figure 7*	Location: Electrical room. Remarks: Previous leaks have been sealed by polyurethane injections, which appears to have been effective in this location.

Photo	Observations
 *Figure 8*	Location: Electrical room. Remarks: Previous leaks have been sealed by polyurethane injections, which appears to have been effective in this location.
 *Figure 9*	Location: Second floor parking garage. Defect: Previous repairs. Remarks: Past concrete leak repairs indicate a failed waterproofing membrane. Some of the repairs have been effective.
 *Figure 10*	Location: Second floor parking garage. Defect: Previous repairs. Remarks: Past concrete leak repairs indicate a failed waterproofing membrane. Some of the repairs have been effective.

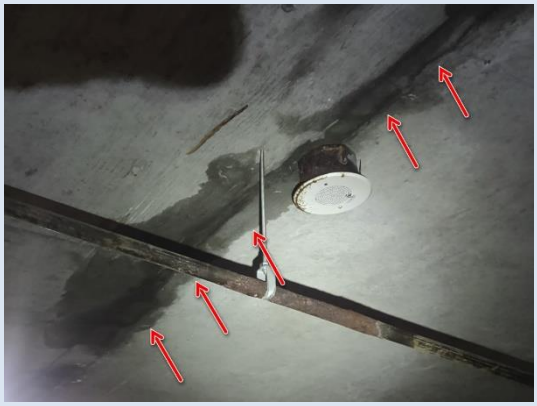
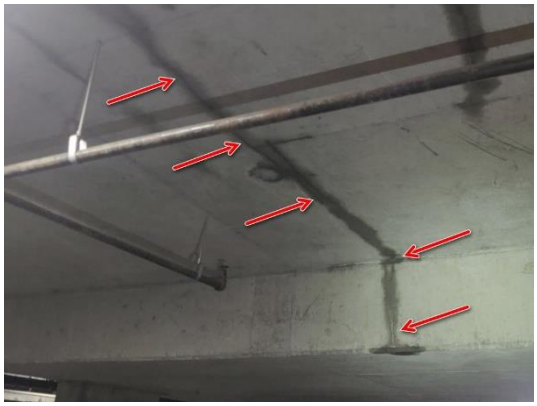
Photo	Observations
 *Figure 11*	Location: First floor parking garage ceiling. Defect: Failed previous repairs. Remarks: Some previous repairs have failed, with visible water ingress dripping down.
 *Figure 12*	Location: Ceiling within the level 3 of the parking garage. Defect: Active water ingress and rusted intercom speaker. Remarks: The water ingress is originating from Level 1 above, which does not currently have a traffic coating.
 *Figure 13*	Location: Ceiling within the level 3 of the parking garage. Defect: Active water ingress. Remarks: The water ingress is originating from Level 1 above, which does not currently have a traffic coating.

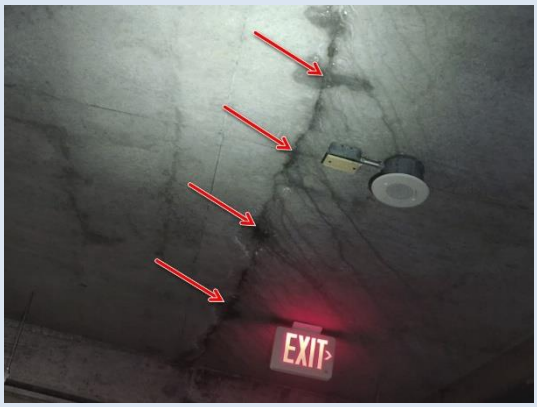
Photo	Observations
 *Figure 14*	Location: Ceiling within the level 3 of the parking garage. Defect: Active water ingress. Remarks: The water ingress is originating from Level 1 above, which does not currently have a traffic coating.
 *Figure 15*	Location: Ceiling to wall transition, third floor parking garage. Defect: Active water ingress from the level above. Remarks: Active water ingress originates from level 1 above, which lacks a traffic coating.
 *Figure 16*	Location: Wall to ceiling transition of the second to third floor ramp. Defect: Efflorescence and active water ingress. Remarks: Active water ingress observed at the underside of suspended slab to foundation wall interface.

Photo	Observations
 *Figure 17*	Location: Base of foundation wall. Defect: Active water ingress. Remarks: Water is infiltrating through the exterior foundation walls.
 *Figure 18*	Location: First floor level of the parking garage, by pedestrian entrance. Defect: Active water ingress. Remarks: Active water ingress observed at the underside of suspended slab. There is a planter above.
 *Figure 19*	Location: First floor of the parking garage. Defect: Active water ingress through the ceiling. Remarks: Water is infiltrating through the planters above, the water is them penetrating the slab and entering the third level below.

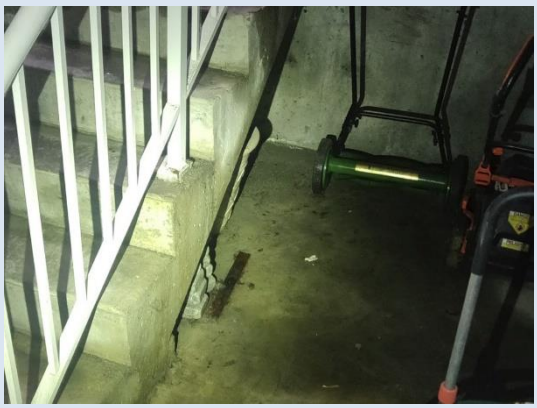
Photo	Observations
 *Figure 20*	Location: First floor-to-second floor ramp of the parking garage. Defect: Active water ingress through the ceiling of the first floor trickles down the ramp towards the second floor. Remarks: Water is infiltrating through the planters above, the water is them penetrating the slab and entering the third level below due to lack of a traffic coating.
 *Figure 21*	Location: First floor level of the parking garage. Defect: Active water ingress through the base of the exterior wall. Remarks: Water is infiltrating through the exterior foundation walls.
 *Figure 22*	Location: Parkade stairwell. Defect: Active water ingress. Remarks: Water is infiltrating through the exterior foundation walls.

Photo	Observations
 *Figure 23*	Location: A general view of the front of the property. Remarks: The waterproofing below has failed. Based on our observations from within the garage.
 *Figure 24*	Location: A general view of typical walkways along the sides of the property. Remarks: The waterproofing below has failed. Based on our observations from within the garage.
 *Figure 25*	Location: Unit 204 planters. Defect: The waterproofing below the planters have failed, based on our observations of the membrane under the pavers. Remarks: The membrane has failed systemically.

Photo	Observations
 *Figure 26*	Location: Unit 204 planters. Defect: The waterproofing below the planters have failed, based on our observations of the membrane under the pavers. Remarks: The membrane has failed systemically.
 *Figure 27*	Location: Unit 204 patio. Defect: The waterproofing membrane was observed to be in poor condition with many failures throughout. Remarks: The membrane has failed systemically and requires replacement.
 *Figure 28*	Location: Unit 204 patio. Defect: The waterproofing membrane was observed to be in poor condition with many failures throughout. Remarks: The membrane has failed systemically and requires replacement.

Photo	Observations
 *Figure 29*	Location: Empty planter by Unit 204. Defect: The waterproofing membrane is visible, it is in poor condition with poorly detailed transitions. Remarks: The membrane in poor condition is likely causing water ingress.
 *Figure 30*	Location: Interior flooring by the main entrance to the building. Defect: Elevated relative moisture reading. Remarks: The failed waterproofing might be allowing some water to travel under the front door. This would be addressed during a waterproofing membrane replacement projects. No other problems or damages were evident around the door.
 *Figure 31*	Location: Exterior elastomeric membrane on the exterior of planter walls. Defect: The failed waterproofing membrane inside the planters is allowing water ingress behind the concrete wall, causing the paint to bubble and blister. Remarks: The waterproofing membranes within the planters situated above the parking garage have failed.

4.0 Key Findings

The following deficiencies were observed during the our inspection:

- Efflorescence deposits indicating prolonged water ingress
- Visible water ingress at the foundation walls and ceilings in various locations throughout the parkade
- The waterproofing membrane as observed from Unit 204's patio has failed throughout, and likely reflects the condition of the rest of the waterproofing system based on similar age and construction.
- Missing traffic coatings on the suspended slabs

The parking garage's waterproofing membrane is reported to be original to the construction of the building, i.e., 31 years old. During out inspection we lifted pavers in Unit 204 to inspect the membrane directly, the waterproofing membranes of the parking garage appear to be a liquid applied membrane. The membrane was flexible and still retained elasticity, however there are visible signs of failure in the form of water blisters below the membrane. This was also consistent with the systemic active water ingress we observed within the ceiling of the parking garage below. Generally, parkade liquid-applied waterproofing membranes under landscaping and pavers for below-grade parking garages have a service life of between 30-40 years, depending on design, the quality of materials used, and service conditions. Currently the waterproofing membranes of the parkade have reached their service life based on age and condition

The suspended slabs on the first floor level is missing a traffic coating, which is required to protect the level below it from water penetration through the slab against water brought in from the undercarriage of vehicles. The second floor is not situated over the level below due to the staggered configuration of the parking garage, and therefore the second and third floor slabs are situated on soil and do not require a traffic coating. Over time, water ingress into suspended floor slabs can cause structural damage in the form of rusting steel reinforcement and concrete spalling.

5.0 Recommendations

While the concrete structure of the parking garage can sustain water ingress for a period before significant deterioration occurs, the waterproofing membrane has failed and should be budgeted for replacement within the next 2-5 years. This would require removal of all landscaping, pavements atop the footprint of the parkade including planter areas, and patios to access to the membrane.

A traffic coating should be installed on the first floor level of the parking garage to protect the suspended slab from water ingress. Traffic coating should also be applied over various stairs leading to the parking garage as necessary. As part of a comprehensive parking garage waterproofing project.

Until such time that the waterproofing membrane can be comprehensively replaced, internal repairs for parking garage leaks such as polyurethane injections or crystalline waterproofing can be used to control active water leaks, however these are not effective in all situations and will never match the effectiveness of a full waterproofing replacement. For vertical surfaces such as the foundation walls, it may not be feasible to access the membranes for replacement due to the depth of the walls and proximity to neighboring properties. Leaks in the foundation walls can be repaired from the interior of the parking garage as necessary

We have provided an opinion of probably cost based on our experience with projects of similar scope. Please note that the cost estimates are based on Class D (order of magnitude) cost estimates and may vary by up to 25%. An accurate construction cost can only be obtained in a formal tender process based on design documents.

Recommended Project Renewal Summary

5.1 Cost estimates (Comprehensive restoration Scope)

Component and description	Low-end Estimate	High-end Estimate
Comprehensive waterproofing membrane replacement	$600,000	$780,000
Traffic coating installation	$40,000	$52,000
Access and mobilization	$50,000	$65,000
Demolition	$50,000	$65,000
Sub-Total	$740,000	$962,000

Estimated Recommended Project Costs (Total)

Item	Costs	
	Low	High
Design, tendering, permits and legal fees	$740,000	$962,000
Construction Administration (8%)	$32,000	$32,000
Construction Contingency (10%)	$70,004	$91,005
GST (5%)	$74,000	$96,200
Total	**$961,804**	**$1,240,265**