Building Enclosure Condition Assessment Report | Project 3436.095

888 Beach, 888 Beach Avenue, 1500 Hornby Street, and 1501 Howe Street, Vancouver, BC

To: The Owners, Strata Plan LMS712
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Submitted: December 6, 2024, by
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Executive Summary

This report documents a Building Enclosure Condition Assessment (BECA) of the mixed-use complex known as 888 Beach and is intended to document the current operating conditions of the building enclosure assemblies and identify potential repair and renewal needs.

Over the past 15 years, 888 Beach has undergone several building enclosure renewals and water shedding improvement projects, including exterior sealant upgrades, balcony re-coating, and roof, deck, and podium membrane renewals. These renewals and maintenance projects have helped to decrease incidents of water ingress and extend the service life of the building enclosure.

Most of the current condition observations at the walls, windows, and balconies relate to maintenance of these assemblies and may be addressed by:

- → Repairs to damaged or deteriorated sealant.
- → Localized repairs to cracked mortar joints at brick veneer walls.
- → Localized repairs to sheet metal cap flashing drip edges, and cleaning of stained walls.
- → Cleaning of exposed balconies to address ponding water until wider membrane renewals are completed.

Other condition observations requiring further investigation or action include:

- → The original tiled balcony edges at the townhouses and exterior walkways are stained and the soffit paint is peeling. These locations should be reviewed in further detail to determine the condition of the underlying concrete at balcony edges.
- → At a representative sample of the tower windows, complete a localized investigation to determine the potential impacts of window condensation on the concealed fasteners securing the window frames to the building structure. This review will require localized removal of interior finishes to document potential fastener corrosion.
- → Adjacent to a fireplace vent at Suite 1501, an existing window frame coating appears to be locally damaged. This location should be reviewed in more detail to determine the cause of the damage and potential corrective actions.
- → At the deck of Suite 516, there is an approximate 125 mm wide gap between the new deck guardrail and the adjacent glazing assembly. The gap between the guardrail and the adjacent window frame should be filled to ensure compliance with the Vancouver Building By-law (VBBL).
- → The high-traffic areas of the parkade have increased wear and damage to the traffic bearing membrane. If left unaddressed, the damaged areas will continue to expand and eventually delaminate from the concrete substrate. These areas should be repaired as part of maintenance to prevent further damage.

We understand that the Owners are considering adding electrical cooling systems to the buildings to address summer overheating in suites. Given the low thermal insulation

provided by the existing windows, a window system upgrade may need to be considered to realize the full benefits of added cooling systems. The Owners may wish to complete a feasibility study to compare the relative costs and increased energy usage of added cooling compared to window replacement.

Several suites have installed air conditioner units through existing windows. The Owners should consider instituting a design review procedure for new air conditioner installations through windows, including review by a registered professional engineer or architect, for each unique installation.

1 Introduction

1.1 Terms of Reference

RDH Building Science Inc. (RDH) was retained by The Owners, Strata Plan LMS712 (Owners) to undertake a Building Enclosure Condition Assessment (BECA) of the mixed-use complex known as 888 Beach, located at 888 Beach Avenue (Garden Tower), 1500 Hornby Street (Beach Tower), and 1501 Howe Street (Ocean Tower), Vancouver, BC.

This report has been undertaken for the Owners and is not to be relied on by others.

1.2 Scope of Services

The scope of services for this review were defined in our proposal, dated October 20, 2023, and are summarized as follows:

1) Provide an online occupant questionnaire to be completed by each Owner/resident to assist in determining the extent, nature, and location of any building enclosure related problems.
2) Review available documentation pertaining to the original design and construction of the building enclosure.
3) Review any documentation relevant to building enclosure related problems.
4) Field investigation services, including a visual review of the interior conditions of sample suites, a visual review of the exterior of the complex from the ground, ladders, accessible roofs, balconies and decks, as well as 12 rope access drops.
5) Develop conceptual renewals and repair work recommendations based on the results of our investigation. These will include a discussion of alternative approaches, including phasing of potential work, where appropriate.
6) Summarize opportunities to improve the energy performance of the building enclosure; and develop a high-level plan that assesses the opportunities for changes.
7) Prepare and submit a draft report to the Strata Council and meet with the Council to present the report to better explain the report's findings.
8) Revise and submit the final report after the Strata Council's review.

This report does not cover the podium areas, including the interior courtyard, as these assets were renewed in 2022 and 2023.

1.3 Organization of Report

This report is organized into seven sections:

1) Introduction – Information relevant to the initiation, scope, and structure of the review and this report.
2) Background – A description of the building and history relevant to the performance of the building enclosure.
3) Occupant Questionnaire – A summary of the results of the information provided to us by Owners/residents through the questionnaire.

4) Document Review – A list of the documents available for review in preparation of this report.

5) Field Review – A description of the building enclosure assemblies, and a discussion of our on-site observations and overall recommendations for remediation.

6) Energy Efficiency and Greenhouse Gas Emissions – A discussion on opportunities to improve energy efficiency and reduce greenhouse gas emissions during building enclosure repairs, renewals, and rehabilitations.

7) Next Steps and Closure – A discussion of the tasks to be completed going forward.

1.4 Purpose of Report

The purpose of this report is to discuss our observations of the condition of the building enclosure assemblies, and the implications with respect to current and future performance. Recommendations for renewal of building enclosure assemblies are provided, where appropriate.

1.5 Assumptions and Limitations

This report documents the current condition of the building enclosure elements. It may also provide information related to the specific sources of moisture or other physical factors, which have resulted in the observed conditions. This report is not intended to provide our opinions regarding the actions or services provided by individuals or organizations that may have contributed to, or caused, the observed conditions.

This report, and the scope of services provided by RDH, does not address mechanical ventilation systems, indoor air quality, mould, or the potential health concerns related to the presence of mould.

Our assessment has been based on a review of a representative sample of the building enclosure. Observations regarding specific maintenance items may be made if they relate to a proposed rehabilitation or renewals recommendation; however, this report does not constitute an overall maintenance and renewals plan.

2 Background

2.1 Description of Complex

888 Beach is a mixed-use complex consisting of three high-rise buildings adjoined with 26 townhouse units, and four commercial strata lots. The buildings are of cast-in-place concrete construction with steel stud walls and are constructed above a four-level below-grade parkade. The construction on the complex was completed in approximately 1992.

A site plan is provided in Figure 2.1. The buildings include:

1) Beach Tower – a 33-storey building located at the intersection of Beach and Hornby. The principal entry is located at 1500 Hornby Street.
2) Ocean Tower – an 18-storey building located at the intersection of Howe and Seabreeze. The principal entry is located at 1501 Howe Street.
3) Garden Tower – an 8-storey building located at the corner of Beach and Howe. The principal entrance is located at 888 Beach Avenue.
4) Beach Avenue Townhouses – a series of 2-storey townhouses (Townhouse 20 to 26) located along Beach Avenue.
5) California Walkway – a series of suites located along Beach Avenue, above the Beach Avenue townhouses. Suites are accessed via exterior walkways connected to Garden Tower and Beach Tower.
6) Seabreeze Way Townhouses – a series of 3-storey townhouses (Townhouse 5 to 13) located along Seabreeze Way.
7) Hornby Street Townhouses – a series of 3-storey townhouses (Townhouse 1 to 4) located along Hornby Street.
8) Howe Street Townhouses – a series of 3-storey townhouses (Townhouse 14 to 19) located along Howe Street.

Figure 2.1

Aerial view of 888 Beach

(Imagery: © Google 2024)

A description of the complex is provided in Table 2.1. Overall photographs of the principal elevations of the complex are provided in Figure 2.2 to Figure 2.7.

TABLE 2.1 DESCRIPTION OF BUILDING	
Name	888 Beach
Addresses	888 Beach Avenue – Garden Tower 1500 Hornby Street – Beach Tower 1501 Howe Street – Ocean Tower
Approximate year of construction	1992
Number of floor levels (including roof mechanical rooms)	35 – Beach Tower 19 – Ocean Tower 9 – Garden Tower 3 – Townhouses
Number of suites	259 (including 4 commercial strata lots)
Floor area (approximate)	66,300 ft²
Applicable building codes	Vancouver Building By-law (1987)
Building code classification	Part 3 – Group C (residential)
Building enclosure requirements	Part 5
Type of construction	Non-Combustible
Sprinklered	Yes
Principal occupancy	Residential
Other occupancies	Commercial
Structural system	Cast-in-Place Concrete

Figure 2.2

Beach Tower, as viewed from the northwest.

Figure 2.3

Garden Tower, as viewed from the east.

Figure 2.4

Ocean Tower, as viewed from the southeast.

Figure 2.5

Townhouses and exterior walkway along Beach Avenue, as viewed from the north.

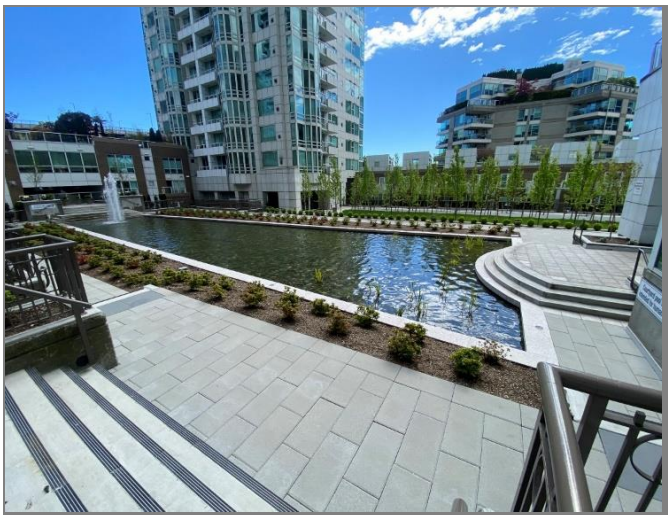


Figure 2.6

General view of the courtyard and Ocean Tower, as viewed from the north.

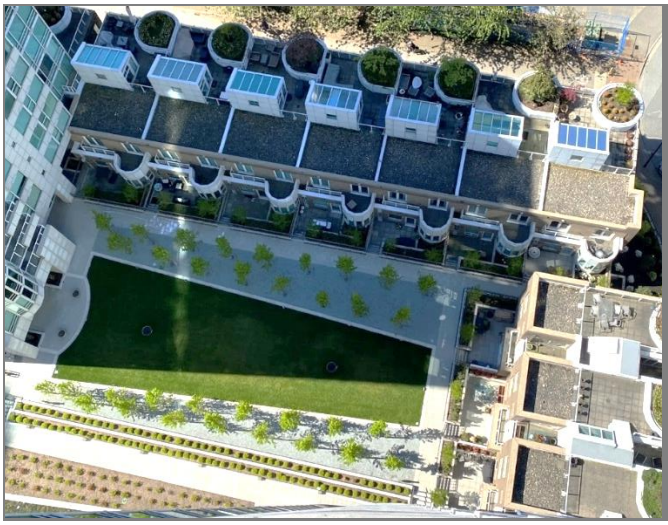


Figure 2.7

Courtyard and south townhouses, as viewed from Beach Tower above.

2.1 Exposure Conditions

Design and environmental factors will determine the level of exposure to wetting a building or assembly will experience during rainfall events. Design factors include building orientation and building features, such as roof overhangs or balconies that

deflect water away from the walls and windows below. Environmental factors include the duration and intensity of rainfall, and wind velocity and orientation during rainfall (i.e. wind-driven rain). The topography of the site also has an impact on the degree to which enclosure assemblies are exposed to wetting. Together, these factors will determine how often, and for how long, the building assemblies will be wet.

At 888 Beach Avenue, the typical weather conditions in the Metro Vancouver area typically result in south and east-facing walls being exposed to more wetting than those facing other directions. Additionally, walls facing False Creek have a further increased potential for wetting. Therefore, at 888 Beach, the south and east elevation walls are more susceptible than others to wetting.

2.2 History of Events

A summary of the major building enclosure renewals completed with RDH involvement since 2012, is listed in Table 2.2.

TABLE 2.2 BUILDING ACTIVITIES RELATED TO ENCLOSURE PERFORMANCE

DATE	DESCRIPTION
2023	→ Replaced the podium waterproof membrane, pond liner, and landscaping in the central courtyard. → Locally replaced townhouse courtyard doors with new fiberglass swing doors. → Repainted the metal frame canopies including targeted repairs.
2022	→ Replaced the podium waterproof membrane at the exterior perimeter of the complex.
2010 to 2022	→ Replaced various roof and deck waterproof membranes (multiple targeted projects).
2020	→ Replaced the davit arm equipment for fall protection and scaffold anchors.
2019	→ Targeted renewal of the podium waterproof membrane at the main entrance of Ocean Tower. → Renewed sealant at the townhouse brick veneer clad walls.
2018	→ Renewed all balcony membranes and sealants at Ocean Tower and targeted south balconies at Garden Tower. → Replaced balcony guardrails at Ocean Tower and targeted south balconies at Garden Tower. → Applied new sealant at all window frames and insulating glazing units (IGUs) interfaces at the townhouses. → Installed new corrugated metal panel cladding over the EIFS panel cladding in select areas on the Ocean Tower roof.

TABLE 2.2 BUILDING ACTIVITIES RELATED TO ENCLOSURE PERFORMANCE	
	→ Targeted replacement of the podium waterproof membrane at the patios and planters at Townhouse Units 6 to 11.
2015	→ Locally replaced targeted balcony aluminum guardrails at Ocean Tower.
2013	→ Targeted replacement of patio swing doors with new fibreglass swing doors at Townhouse Units 5 to 11 and 23 to 26. → Renewed all balcony membranes at Beach Tower and Garden Tower. → Replaced balcony guardrails at Beach Tower.
2012	→ Applied new sealant at all window frame interfaces at Beach, Garden, and Ocean Towers.

2.3 Investigative Techniques

A variety of investigative techniques were used to assess the condition of the building enclosure, including the following:

- → Questionnaires issued to residents.
- → A review of the original architectural drawings and other relevant documents.
- → A visual review of the exterior of the buildings from the ground level and roof, as well as from balconies and decks of the available representative suites.
- → A visual review by rope access means to review the exterior of the towers.
- → A visual review of the interior of representative suites.

The information collected from the questionnaire, drawings, and on-site assisted us in determining locations with the potential for water ingress. Documents provided to RDH are listed in Section 4 of this report.

3 Occupant Questionnaire

An occupant questionnaire was provided for distribution to all 259 suites. A total of 114 questionnaires were returned representing approximately 44% of all suites. Table 3.1 summarizes the responses.

TABLE 3.1 SUMMARY OF QUESTIONNAIRE RESPONSES

QUESTION	YES	%
Does your suite have any ongoing or undiagnosed leaks associated with the building enclosure—walls, windows, ceiling, floor, etc.? (Not including plumbing leaks.)	18/114	16%
Has your suite had leaks in the past that have been repaired? (Not including plumbing leaks.)	20/114	18%
Do you have condensation problems at the inside face of any windows or doors?	34/114	30%
Do you have any condensation problems between the panes of glass at any windows or doors (fogging)?	46/114	40%
Do you have problems with mould, fungi, or mildew on walls or windows? This is typically black, brown, or orange staining.	22/114	19%
Do you feel cold drafts in your suite?	45/114	39%
Have you had problems relating to decks or balconies?	12/114	11%
Do you use your natural gas fireplace?	94/114	82%
Do you use a portable air conditioner?	42/114	37%
Do you experience overheating in your suite (uncomfortably hot during sunny weather?)	65/114	57%
Do you leave your windows open throughout the summer?	92/114	81%

The following observations were made based on the results of the occupant questionnaire:

→ The primary reported items from most respondents relate to window performance including, fogging and condensation, air tightness (drafts), and insulation (overheating in summer and heat loss in winter).

4 Document Review

Relevant portions of the documents listed in Table 4.1 were referenced in the preparation of this report.

TABLE 4.1 DOCUMENTS PROVIDED

DOCUMENT	PREPARED BY	DATE	PAGES
Architectural Drawings	James KM Cheng Architects Inc.	April 15, 1991, Issued for Construction	Drawings AF-1 to AF 11-2 (64 Pages)
Building Enclosure Condition Assessment Report	RDH Building Engineering Ltd.	June 18, 2010	Pages 1-75
Depreciation Report Update – R1	RDH Building Science Inc.	July 5, 2023	Pages 1-47

The key findings from the document review are below:

- The 2023 Depreciation Report Update forecasted recoating the liquid-applied urethane membranes at balconies in 2025 and at parkade traffic lanes in 2028.
- Based on the findings of the Depreciation Report Update, the largest renewals projects at 888 Beach within the next five to 10 years are not likely to be related to the building enclosure and include:
  - Elevator modernizations.
  - Fire safety system renewal.
  - Domestic water re-piping.

5 Field Review

This section discusses the building enclosure assemblies at 888 Beach Avenue, and the conditions observed during the site visits. Recommendations for repair and renewals are made, as required, and are summarized in Section 5.6.

On-site reviews of the complex were completed on May 2 and 3, 2024. A second date was included to complete the rope access review at each building. The weather during the reviews ranged from partially clouded to clear skies, and the temperature was approximately 12ºC to 15ºC. The weather and temperature for three days prior to the review were similar.

The following suites were reviewed during the site visit:

- Ocean Tower: 402, 405, 501, 601, 1003, and 1501
- Beach Tower: 1008, 1108, 1410, 1807, 2103, 2205, 2506, and 3301
- Garden Tower: 516
- Townhouse Units: T2, T3, and T5

Areas of the building reviewed by rope access are identified in Figure 5.1.

Figure 5.1

Rope access drop locations.

Twelve rope access drops were completed at 888 Beach:

- *Garden Tower: 3 Drops*
- *Ocean Tower: 4 Drops*
- *Beach Tower: 5 Drops*

5.1 Interior Review

Interior operating conditions, the temperature and humidity of indoor air, and natural and mechanical ventilation patterns can sometimes have a significant effect on the performance of the building enclosure. Although building enclosure problems most commonly result from water ingress from the exterior, condensation of interior humidity can result in a range of secondary problems. For this reason, it is important when investigating building enclosure performance to also assess and consider the design and performance of heating and ventilation systems. A description of the typical in-suite heating system and ventilation equipment are presented in Table 5.1 and Table 5.2. Examples of the typical heating components at the building are shown in Figure 5.2 and Figure 5.3.

TABLE 5.1 TYPICAL IN-SUITE HEATING SYSTEMS		
HEATING SYSTEM TYPE	DESCRIPTION	CONTROLS
Primary	Electric baseboard heaters	Thermostat
Supplementary	Gas fireplace	Switch

TABLE 5.2 TYPICAL IN-SUITE VENTILATION EQUIPMENT		
EXHAUST MECHANISM	CONTROLS	OTHER PROVISIONS
Bathroom fan	Humidistat and timer	Natural ventilation (windows)
Kitchen range hood fan	Switch	Natural ventilation (windows)
Clothes dryer	Duct	Booster fans (some suites)

Figure 5.2

Typical electric baseboard heater at Suite 601.

This is the primary heating system in each suite.

Figure 5.3

Typical gas fireplace at Suite 1501.

This is the supplementary heating system.

The gas fireplaces are directly ducted to the exterior ether directly through the exterior cladding and windows or via bulkheads below the ceiling. At the exterior, significant staining is visible at several gas fireplace exhaust vents. The staining is indicative of a fireplace operating at low efficiency and improper combustion (Figure 5.4 and Figure 5.5). The fireplaces should be reviewed and repaired as part of regular maintenance.

Figure 5.4

Stained fireplace vent.

Beach Tower, Suite 1901, east elevation.

Figure 5.5

Stained fireplace vent.

Ocean Tower, Suite 303, west elevation.

Some suites have replaced the original electric baseboard heaters with in-floor radiant heating or electric heaters installed at interior walls (Figure 5.6).

Figure 5.6

Electric wall convection heater at Townhouse 3.

Mechanical ventilation is provided by exhaust fans in bathrooms and kitchens. Humid air is exhausted through ductwork to the exterior when the fans operate. Conditioned make-up air is provided to suites from the rooftop and parkade air handling units via undercuts at the suite entry doors. At the townhouse units, fresh air is provided by natural ventilation through windows and doors.

Interior humidity becomes a problem when ventilation systems do not operate as designed and the humid air is not removed quickly enough from inside the suite. Condensation occurs when warm, humid air contacts a cold surface. Some condensation is common in older buildings, particularly during cold weather. The results of the questionnaire survey suggest that many suites at 888 Beach are experiencing interior humidity issues.

Many residents reported condensation on the window interior surfaces during the winter. The aluminum-framed windows at 888 Beach do not include a thermal break and are susceptible to condensation in cold weather. Window performance is discussed further in Section 5.3.

At Suite 2103, there are localized condensation stains along the interior drywall due to thermal bridging of the steel studs (Figure 5.7). Thermal bridging occurs when one part of the building enclosure assembly is more thermally conductive than the surrounding area, creating a path of least resistance for the transfer of thermal energy, resulting in localized cold surfaces and condensation.

Figure 5.7

Thermal bridging stains on interior drywall at Suite 2103, Beach Tower.

Within suites, condensation can be controlled by:

1) Improving general ventilation. Operating fans in the bathroom and kitchen and opening windows to exhaust humid air from the suite.

2) Improving circulation of heat and air. Drapes and furniture placed in front of windows can limit the circulation of warm air at these locations, limiting the potential for drying. Also, ensuring the suite heating system is used to maintain temperatures within the recommended range.

3) Improving the thermal resistance of the building enclosure. Better enclosure assemblies and components, such as concrete walls and windows with improved insulating qualities will not be as cold and may experience less condensation.

We recommend that the Owners be reminded of the strategies that can be used to control interior humidity and avoid condensation problems. A bulletin published by the Homeowner Protection Office regarding condensation control strategies is included in Appendix A of this report.

RECOMMENDATION	
1	Distribute the BC Housing bulletin to provide Owners with information on controlling condensation within suites.

5.2 Exterior Walls

Conditions and performance of the wall assemblies at interfaces that occur between the walls and other major elements of the building enclosure are discussed in later sections of this report. This section therefore focuses on the wall assembly itself, as well as penetrations and other features within the wall areas.

5.2.1 Description

There two primary cladding types at 888 Beach include pre-formed metal panels and brick veneer cladding.

Figure 5.8

Alternating pre-finished metal cladding and brick cladding at the courtyard suites, facing north.

Pre-Formed Metal Panels

The pre-formed metal panel cladding assembly is located at all elevations of all buildings (Figure 5.9) and consists of the following (listed from exterior to interior):

- → Pre-formed metal panels,
- → Horizontal aluminum girts,
- → Shims,
- → Sheathing paper,
- → Glass-reinforced gypsum sheathing,
- → Steel stud infill walls with batt insulation within the cavities,
- → Polyethylene sheet vapour barrier, and
- → Interior gypsum board.

The pre-formed metal wall cladding assembly includes an air space between the metal panels and the sheathing paper. This air space acts as a rainscreen cavity which allows a measure of drainage and ventilation to prevent water ingress to the interior. This assembly differs from a typical rainscreen cladding assembly, as is does not include cross-cavity flashings to direct water away from the wall sheathing.

The successful performance of this cladding system relies on the detailing of the water-resistant barriers at joints and penetrations through the cladding. Based on our history with 888 Beach, we are aware that there were previous issues with water ingress at vent penetrations.

Several water-shedding improvements were completed in conjunction with similar work at windows over the past 15 years to successfully mitigate previous water ingress. The water-shedding improvement projects included re-detailing vent penetrations, installing additional weepholes at panels, and installing sealant and silicone strips at exposed joints between coupled metal panels.

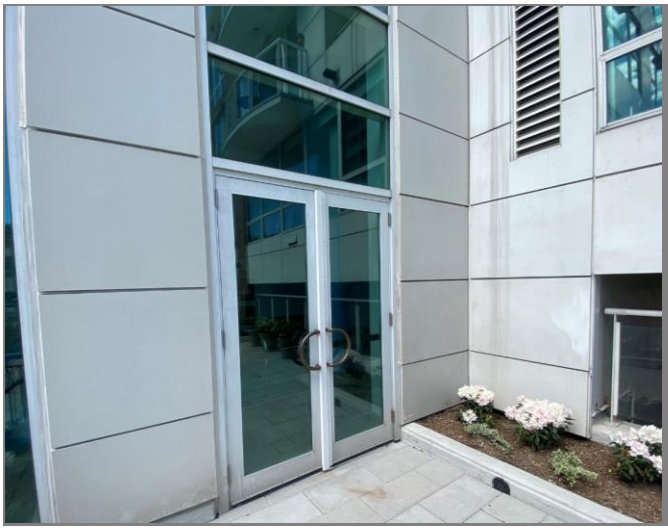


Figure 5.9

Pre-formed metal panel clad walls at the base of Beach Tower in the courtyard.

Brick Veneer Cladding

The brick veneer cladding is typically located at townhouses, at lower levels of the towers, and street facing elevations of Garden Tower (Figure 5.10).

The brick veneer clad wall assemblies consist of:

- → Bricks,
- → Drainage cavity,
- → Sheathing paper,
- → Glass reinforced sheathing,
- → Steel stud infill framing, with fibreglass batt insulation,
- → Polyethylene sheet vapour barrier, and
- → Interior gypsum board.

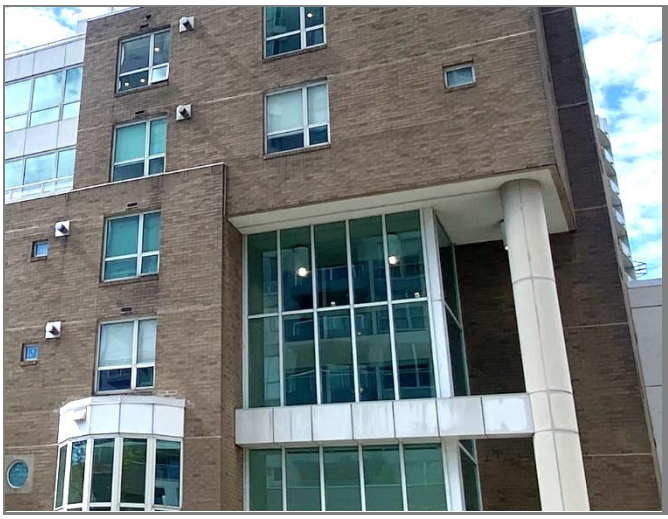


Figure 5.10

Brick veneer cladding at the east elevation of Garden Tower.

Steel angles are installed along each floor slab and above windows, supporting the brick cladding above. Similar to the prefinished-metal panel cladding, brick veneer clad walls can be classified as rainscreen assemblies. Weepholes are installed above steel angles and at the base of walls to allow drainage and ventilation between the brick and sheathing.

5.2.2 Visual Review

The following condition observations were made during the on-site visual review:

→ The exterior sealants at the brick veneer cladding were renewed in approximately 2020. There are localized areas where the sealant has failed and debonded from the substrate (Figure 5.11).

Figure 5.11

Failed sealant at brick veneer wall.

Townhouse 19, east elevation.

→ There was a section of missing sealant between the brick veneer cladding and prefinished metal panels adjacent to Suite 301 (Figure 5.12).

Figure 5.12

Missing or incomplete sealant between brick veneer cladding and pre-finished metal panel.

Ocean Tower, Suite 301, west elevation.

→ The sealant at vent hood flashings was cracked and deteriorated at several locations throughout the complex (Figure 5.13).

Figure 5.13

Cracked sealant and corroded fasteners at vent flashing.

Ocean Tower, Level 16, west elevation.

→ At the roofs of Beach Tower and Ocean Tower, the perimeter sealant at the air handling unit louvers were roughly troweled along the metal panel and there appeared to be multiple blisters and voids along the sealant joints (Figure 5.14). The repairs to have been done by others and not part of the comprehensive sealant renewal project.

Figure 5.14

Blistered sealant at the Ocean Tower Roof air handling unit louver.

→ There are localized areas where the brick veneer walls are stained from concentrated water runoff at the cap flashings above (Figure 5.15).

Figure 5.15

Localized staining on brick veneer cladding. The water runoff is occurring at a seam in the cap flashing.

Beach Tower, above Suite 609, north elevation.

→ There are localized step cracks in the mortar joints at brick veneer walls (Figure 5.16).

Figure 5.16

Cracked mortar at brick veneer head joints.

Beach Tower, above commercial suites, north elevation.

→ There is surface corrosion on the brick veneer steel shelf angles (Figure 5.17).

Figure 5.17

Surface corrosion on a brick veneer shelf angle.

Garden Tower, Suite 616, south elevation.

5.2.3 Analysis and Recommendations

Most of the condition observations at the metal panel or brick veneer wall assemblies relate to maintenance of the building enclosure and may be addressed by an ongoing building enclosure maintenance program including:

→ Localized sealant repairs,

→ Localized brick repointing, and

→ Localized repairs of the metal cap flashing above brick walls, including drip edges, where concentrated water runoff is occurring.

→ Cleaning of stained walls,

→ Corrosion removal and repainting of brick veneer shelf angles, and

→ Repair and maintenance of natural gas fireplaces.

As discussed in the 2010 BECA, sealants require renewal on a 10- to 15-year frequency, and slightly longer for higher performance sealants. Therefore, the Owners should plan

for another cycle of sealant renewals improvements to further extend the life of the wall assemblies, until full renewal is planned in coordination with the windows.

5.3 Windows and Doors

The windows at 888 Beach include the following glazing systems:

- → Punch windows
- → Punch windows with slab panels
- → Curtainwall
- → Storefront windows
- → Glass block windows
- → Glazed enclosures

The door types at 888 Beach include the following:

- → Aluminum-framed sliding glass doors
- → Wood-framed swing doors
- → Steel-framed swing doors
- → Aluminum-framed storefront swing doors
- → Fibreglass-framed swing doors

5.3.1 Description

Windows

Punch window applications are where the window is surrounded on all sides by a wall assembly. These windows do not extend floor to ceiling; however, by using coupler bars to join several units together, they may extend from wall to wall, form a curved assembly, or create a corner window (Figure 5.18 and Figure 5.19). In this configuration, these windows can be considered strip windows, but are essentially a variation on a typical punch window.

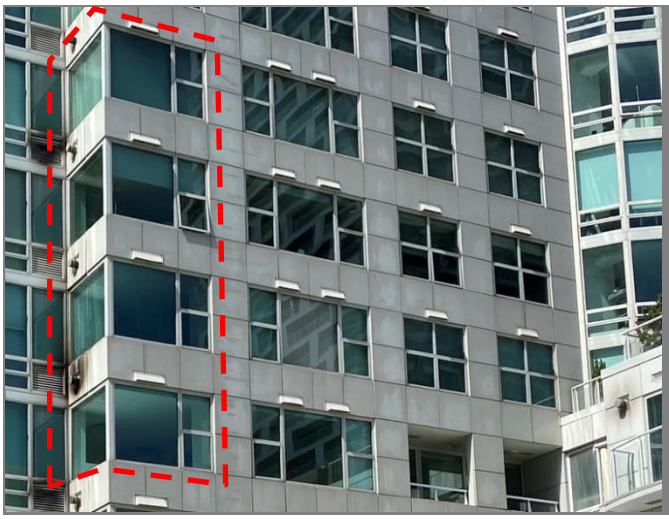


Figure 5.18

Examples of punched windows at metal panel clad wall assembly. The red dashed lines indicate coupled corner windows.

Ocean Tower, partial west elevation.

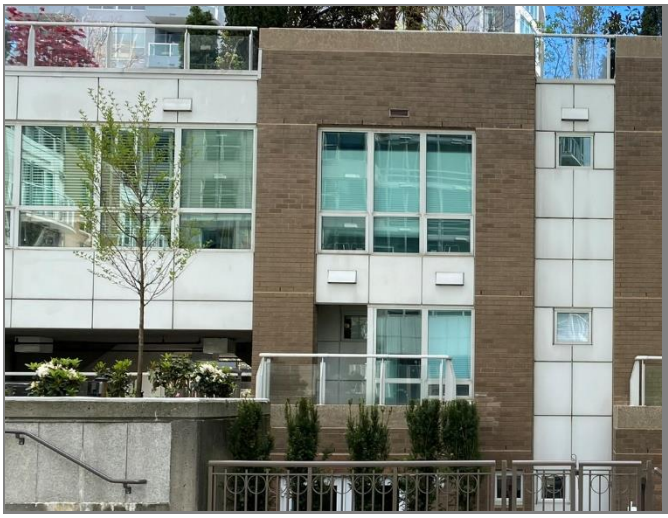


Figure 5.19

Examples of punched windows in the metal panel and brick veneer clad wall assemblies.

Courtyard, facing north.

There are also areas where the punch windows extend from floor to ceiling or are on very low curbs. At the slab edges between the windows, there is an aluminum panel which fits between the upper and lower window frames and covers the slab edges (Figure 5.20).

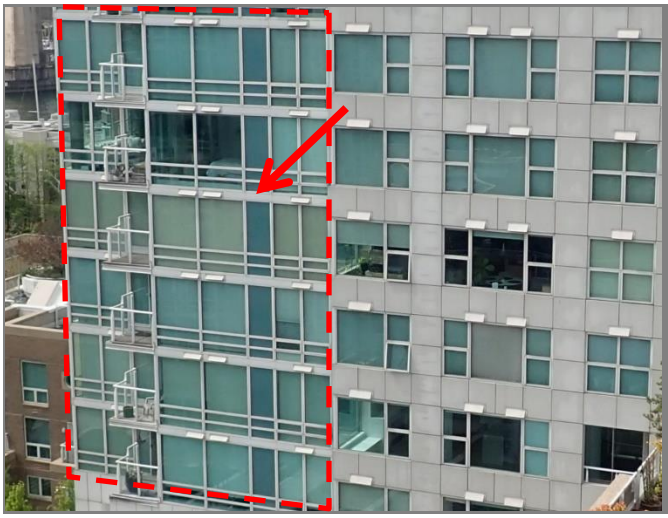


Figure 5.20

Example of punch windows (red dashed line) with slab panels (red arrow).

Both variations of the punch windows are aluminum-framed, exterior-glazed, non-thermally broken assemblies with awning-style operable vents. Drainage is provided at the windows by small weepholes at the sill, which were added post-construction. As mentioned in Section 5.2, water-shedding improvements have been completed over the past 15 years including:

- → Replacement of failed insulated glazing units (IGUs).
- → Replacement of gaskets at operable vents, and replacement of hardware latches, as required.
- → Targeted application of waterproof membranes around windows, behind the metal panel cladding.
- → Replacement of deteriorated sealant at exposed locations.
- → Installation of new sealant and silicone strips at exposed joints in window frames or between coupled window frames.

Curtainwall glazing systems are installed at the lobbies of each tower (Figure 5.21). Curtainwall windows are designed as rainscreen assemblies with drainage cavities built into the aluminum frames. These window assemblies are typically installed at areas where large spans of glass are required.

Figure 5.21

Curtain wall at Garden Tower lobby.

There are storefront windows and doors at the ground level commercial suites below Beach Tower (Figure 5.22). Storefront glazing systems are designed for low exposure areas, such as at the ground level. At 888 Beach, the storefront doors are protected by glass canopies. There are louver vents at the upper sections of some of the storefront windows (Figure 5.23).

Figure 5.22

Storefront glazing at commercial suites adjacent to Beach Tower.

Figure 5.23

Louver vent at west elevation storefront window head.

Glazed enclosures are located above the Seabreeze Way Townhouses. The enclosures consist of storefront glazing on the south and west elevations, a swing door at the west elevation, a sliding style operable vent at the west elevation, and pressure plate skylight system (Figure 5.24) that acts as a sloped roof. The skylight does not overhang the glazing and the storefront glazing is fully exposed to wetting. There has been a history of water ingress related to these glazed enclosures and water shedding improvements should be completed as they get reported, similar to the aluminum-framed punch windows.

Figure 5.24

Aluminum-framed glazed enclosure at Townhouse 5.

Note the silicone strips at the joints in the glazing assembly as a form of water-shedding improvement (red arrow).

Doors

Sliding glass doors are installed at most balcony and deck locations. In general, the detailing at sliding glass doors is similar to that of the punch window assemblies. Typically, the sliding glass doors are coupled to adjacent punch windows as side lites.

Figure 5.25

Sliding glass doors coupled with punch window assemblies, as viewed from the courtyard facing north.

Glazed swing doors are located at townhouse and courtyard-facing suites for deck and courtyard access (Figure 5.26). The original wood-framed doors at the courtyard level (i.e. patio doors) were replaced with fiberglass-framed swing doors over the past several years with the remaining original doors replaced in 2023 in conjunction with the podium membrane renewals project (Figure 5.27). A few of the original swing doors at the decks of the townhouses have also been replaced with fiberglass-framed swing doors when water ingress-related issues are reported.

Figure 5.26

Wood swing door at Townhouse 2 deck.

Figure 5.27

New fiberglass-framed swing doors at typical courtyard suite entrance.

5.3.2 Visual Review

The following condition observations were made during the on-site visual review:

→ There were localized areas where the exterior silicone strip seals were damaged or not adhered to the window frame substrate (Figure 5.28 and Figure 5.29).

Figure 5.28

Damaged silicone seal.

Ocean Tower, Suite 701, south elevation.

Figure 5.29

Unadhered exterior window silicone seal.

Beach Tower, Suite 3301, west elevation.

Figure 5.30

Cracked sealant at window mitre joint.

Garden Tower, Suite 516, south elevation.

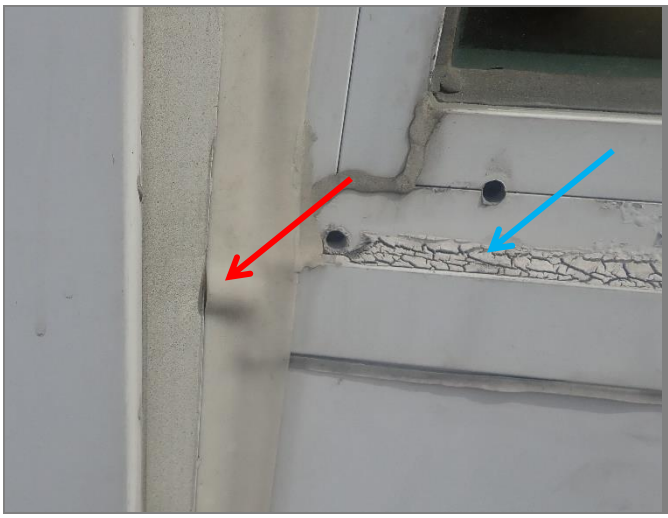


Figure 5.31

Void in silicone strip (red arrow).

Note that the original sealant (blue arrow) has deteriorated.

Beach Tower, Suite 906, south elevation.

Figure 5.32

Sealant adhesive failure.

Ocean Tower, Suite 1302, south elevation.

→ The window and door perimeter sealant at protected balcony locations are deteriorated and/or reverted (Figure 5.33). Reversion occurs when urethane sealants age and the polymers in the sealant return to their original state (i.e. sticky and flexible). These sealants appear to have been excluded from previous renewals or

maintenance work; however, since they are protected by overhangs, they are less exposed to weathering or potential water ingress.

Figure 5.33

Cracked sealant at protected balcony location.

Ocean Tower, Suite 1501, south elevation.

→ Several operable awning windows have misaligned hinges resulting in gaps at the top of the windows (Figure 5.34 and Figure 5.35). Some windows have damaged or missing handles (Figure 5.36). Damaged window hinges or handles prevent the windows from closing properly and will result in drafts and heat loss during the winter.

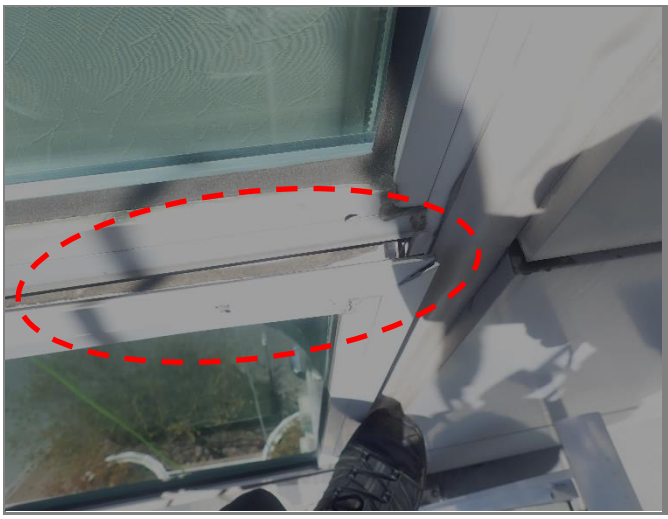


Figure 5.34

Misaligned window vent.

Ocean Tower, Suite 1002, east elevation.

Figure 5.35

Misaligned awning window.

Beach Tower, Suite 809, west elevation.

Figure 5.36

Damaged operable window handle.

Ocean Tower, Suite 901, west elevation.

→ Some of the weepholes at window frames appeared to be partially obstructed with debris (Figure 5.37).

Figure 5.37

Blocked weephole (red arrow) above operable awning window.

Beach Tower, Suite 2205, south elevation.

→ The existing original swing door wood frames at townhouse balconies and decks have localized water damage at the base of the wood frames (Figure 5.38).

Figure 5.38

Localized deteriorated wood at the base of the deck swing door at Townhouse 2.

→ The perimeter steel frames at most of the glass block windows are locally corroded along the bottom edges and at corners (Figure 5.39 and Figure 5.40).

→ The glass masonry unit is cracked at the bottom corner of the glass block window at Suite 301 (Figure 5.40).

→ Localized concerns at glass block walls should be addressed by targeted maintenance repairs to replace damaged glass blocks and treat frame corrosion, as required.

Figure 5.39

Corroded glass brick frame, Garden Tower roof.

Figure 5.40

Cracked glass brick (red arrow) and corroded glass brick frame.

Ocean Tower, Suite 301, west elevation.

→ Localized suites are using air conditioning units for cooling in summer months. Some air conditioners have been permanently installed with penetrations through the window IGUs. However, at Suite 1601, the air conditioner penetrations do not appear to include water shedding provisions and have an increased risk of water ingress during rain (Figure 5.41).

Figure 5.41

Air conditioning unit installed with penetrations through window IGU. The penetrations do not include water shedding protection to prevent water ingress.

Ocean Tower, Level 16, south elevation.

→ Some residents have installed supplementary foam gaskets to improve the air tightness and reduce drafts at double-hung sliding glass doors (Figure 5.42).

Figure 5.42

Supplementary foam gasket at double sliding glass door.

Beach Tower, Suite 3301, east elevation.

5.3.3 Analysis and Recommendations

Most of the observations at windows are maintenance-related and can be addressed by an ongoing building enclosure maintenance program including:

→ Sealant repairs,

→ Replacement of damaged silicone strips,

→ Repair or replacement of operable window hardware and hinges, and

→ Repairs to the cracked glass block and corroded frames at glass block windows.

The Owners should continue to be diligent with window maintenance until this approach is no longer cost effective or possible due to limited availability of replacement parts. Condensation will continue to be an issue at aluminum-framed windows until they are replaced with more thermally efficient products at some time in the future.

As mentioned in Sections 3 and 5.1, condensation is a widespread ongoing concern at most suite windows during cold weather. The weather conditions at the time of our site visit were not conducive to a review of window condensation; however, we are familiar with this issue due to our experience with 888 Beach. Over time, condensation can increase the potential deterioration of adjacent materials, including the corrosion of the fasteners which secure the window frames to the building structure. Additional investigation should be completed to determine if the existing structural window fasteners are corroded, including removal of interior finishes to expose the window frame perimeters.

Based on the implementation of potential future energy and cooling strategies, the Owners should consider instituting a building enclosure design review procedure for new air conditioner installations through the IGUs. Air conditioner penetrations should include water shedding and waterproofing details to protect against water ingress. It is also important to note that the Vancouver Building By-law (VBBL) regulations require that penetrations through window IGUs be designed and reviewed by a registered professional engineer or architect.

The windows at 888 Beach are performing relatively well in terms of water management, in part due to the history of maintenance and water shedding improvement projects. The windows are approximately 32 years old and ongoing maintenance is typical for windows of similar design and age. The remaining service life will depend on the effectiveness of future sealant and water shedding improvement projects; however, the Owners may wish to complete a comprehensive window replacement program for greater thermal comfort, water penetration performance, sound mitigation, reduced draftiness, and energy savings.

The wood swing doors at the townhouse balconies and decks should be reviewed further to assess the extent of existing wood deterioration at the door frames, and determine if targeted repairs or door replacement are appropriate. The Owners will need to consider if the existing doors are compliant with the VBBL in terms of accessibility. Furthermore, the dimensions of the openings as modern door frames are thicker, which could reduce the width of the doors. The Owners may wish to explore installing canopies at exposed doors.

Other doors will likely continue to perform adequately with continued routine maintenance and should be planed for renewal in coordination with window system replacements.

Energy Performance

The existing non-thermally broken aluminum-framed windows provide minimal thermal insulation and have a high solar heat gain. As the frequency of extreme heating weather events increases due to climate change, summer overheating within suites will continue to be an increasing concern.

The 2022 Depreciation Report Update estimated that the windows will be renewed in approximately 2040 to 2042. While it is possible that the windows will continue to perform for this time with ongoing maintenance, it is likely that energy performance concerns may motivate renewal sooner rather than later.

We understand that the Owners are considering adding electrical cooling, which will increase the overall electrical usage per suite, especially if completed prior to window renewal. Currently, 37% of residents report using portable air conditioner units in their suites during the summer. Upgrading to new thermally broken window systems would reduce cooling and heating demands and provide improved water resistance and air tightness.

In some cases, such as south- or west-facing suites with higher sun exposure, a window system upgrade may be necessary to realize the full benefits of added cooling systems. The Owners may wish to consider completing a feasibility study to compare the relative costs of electrification and added cooling compared to or in conjunction with window renewals.

RECOMMENDATION	
2	Complete an investigation of a representative sample of the existing window frames to review and document the condition of the existing fasteners.
3	Consider implementing a design review procedure for new air conditioner installations through the aluminum-framed windows.
4	Complete further review of the wood swing doors at the townhouse balconies and decks to assess the extent of existing wood deterioration and determine repair needs.

RECOMMENDATION	
5	Consider completing a feasibility study to compare the relative costs of electrification and added cooling compared to window renewals.

5.4 Balconies

Prior to the discussion of balconies, it is useful to define the difference between a balcony and a deck.

→ 'Balcony' refers to a horizontal surface exposed to outdoors and intended for pedestrian use, but projecting from the building so that it is not located over a living space.

→ 'Deck' refers to a horizontal surface exposed to outdoors, located over a living space, and intended for pedestrian use in addition to performing the function of a roof.

The importance of the distinction between the two types of assemblies lies in the degree of risk associated with failure of waterproof membranes in each case. A leak in a balcony membrane will not generally result in water entering the interior of the building and is therefore, to some degree, not as serious as the consequences of leakage in a deck where it is likely that water will penetrate to the interior of the building. For this reason, liquid-applied urethane membranes are often used on balconies. Decks, on the other hand, are commonly designed with higher quality roofing membranes and are protected with a traffic-bearing surface.

Based on these definitions, there are both balconies and decks at 888 Beach.

Per our proposal, decks are excluded from this report given the past renewals projects completed at various decks with RDH assistance.

5.4.1 Description

The typical balcony assembly consists of a liquid-applied urethane membrane adhered to the concrete substrate. The membrane terminates in a drip edge flashing and the balcony edges are covered with prefinished metal flashings (Figure 5.43). This assembly was installed to replace the original tiled balconies at Beach Tower in approximately 2012 and at Ocean Tower in 2018.

Figure 5.43

Typical balcony edge detail showing urethane membrane on drop edge flashing (red arrow) and slab edge cover flashing (blue arrow).

Ocean Tower, Suite 1601, west elevation.

There are original tiled balconies located at the townhouses and the exterior walkway above Beach Avenue. The assembly consists of tile bonded to the cast-in-place concrete balcony. These balcony locations are recessed and include overhangs that provide a greater degree of protection than the typical tower balconies.

Figure 5.44

Typical original tiled balcony at Level 2 of Townhouse 14.

Ocean Tower, Level 2, south elevation

The undersides (soffits) of most balconies are painted concrete (Figure 5.45). Some balcony soffits include stucco cladding (consisting of gypsum board with a cementitious coating and acrylic finish) finish where interior space at the floor above extends over the balcony below (Figure 5.46).

Figure 5.45

General view of a typical balcony.

Ocean Tower, Suite 501, south elevation.

Figure 5.46

Stucco soffit above the balcony at Suite 1501, below Suite 1601 interior space.

Note the perforated ventilation strip to reduce condition issues within the soffit.

Ocean Tower, Suite 1501, south elevation.

5.4.2 Visual Review

The following condition observations were made during the on-site visual reviews:

→ There was moss and staining along the metal flashing joints of the tiled balconies (Figure 5.47).

Figure 5.47

Moss growth at tiled balcony slab edge flashings.

Beach Tower, Suite 408, north elevation.

→ There were localized areas of peeling paint, efflorescence, and corrosion of exposed steel reinforcing or embedded formwork nails at the underside of various tiled balconies (Figure 5.48 and Figure 5.49).

Figure 5.48

Peeled paint at townhouse balcony soffit.

Beach Tower, Suite 410, west elevation.

Figure 5.49

Corrosion staining at tiled balcony soffit. The corrosion appeared to be caused by locally exposed reinforcing steel.

Beach Tower, Suite 408, north elevation.

→ At tiled balconies, the sheathing paper and tape were visible through gaps at the saddles of the tiled balconies and the surrounding metal panel cladding (Figure 5.50).

Figure 5.50

Exposed wall sheathing paper and red sheathing tape visible at a gap between a tiled balcony and the metal panel cladding.

Townhouse 13, south elevation.

→ There is a localized area of delaminated paint or aluminum finish coating at the balcony of Suite 1501. The exact cause of this damage in unclear but the damaged coating is directly adjacent to a stained black fireplace vent (Figure 5.51).

Figure 5.51

Delaminated paint or aluminum finish coating at balcony.

Ocean Tower, Suite 1501, west elevation.

→ At Suite 516, there is a 5" gap between the guardrail and the adjacent glazing assembly (Figure 5.52). Per the VBBL, gaps within guardrails or between guardrails and adjacent assemblies cannot exceed 100 mm (approximately 4").

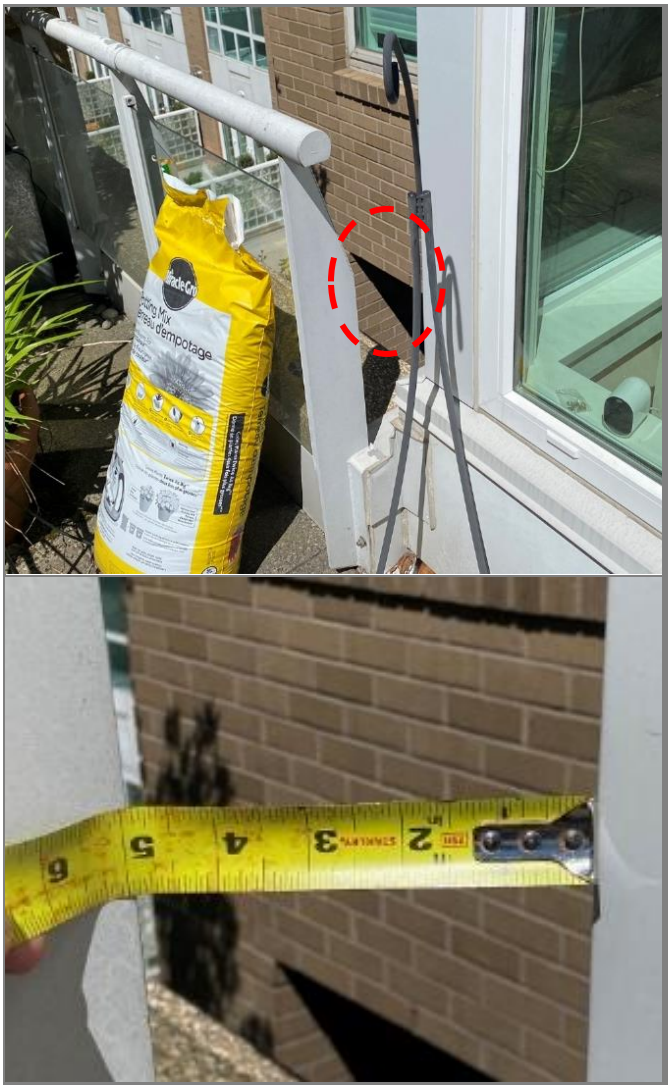


Figure 5.52

Guardrail gap at Suite 516.

The gap exceeds the allowable size for gaps within guardrails or between guardrails and adjacent structures, per the VBBL requirements.

→ Some balconies include steel-framed guardwalls with pre-finished metal cladding panels, which are similar to the metal panel wall cladding. These guardwalls include exposed silicone seals, which were locally damaged at some suites (Figure 5.53).

Figure 5.53

Damaged exposed silicone strip at balcony guardwall.

Beach Tower, Suite 2502, north elevation.

→ The stucco soffits below some balconies were locally stained or water damaged, causing the stucco finish to partially delaminate from the gypsum board substrate. It is our understanding that these areas of localized damage were caused by past water ingress which has been addressed, and the stains have not spread past the original areas. The delaminated portions of the soffit may eventually become a safety concern if left unaddressed.

Figure 5.54

Localized water damage at the stucco soffit above Townhouse entrance.

Townhouse 2, west elevation.

→ Some residents reported localized ponding on their balconies after rain or cleaning (Figure 5.55). Staining was observed on a few of the balconies reviewed.

Figure 5.55

Stained balcony surface due to localized ponding water.

Beach Tower, Suite 3301, west elevation.

→ The exterior edges of the balcony membranes were stained due to their increased exposure to weathering; however, we did not observe any areas of high wear or membrane deterioration (Figure 5.56).

Figure 5.56

Typical urethane membrane staining pattern at balcony edge.

Ocean Tower, Suite 601, south elevation.

5.4.3 Analysis and Recommendations

The condition observations at the balconies typically relate to the tiled balconies and interfaces with adjacent assemblies, such as the stucco soffits or balcony saddles.

Maintenance at tiled balconies should be completed to address peeling soffit paint and corroded concrete. At the exposed gaps between the balconies and metal panel cladding, new sealant diverters should be installed to prevent water ingress. Prior to completing maintenance, the underlying slab edge should be reviewed for potential concrete damage. The metal slab edge flashings will require temporary removal to assess underlying conditions.

The damaged coating at the Suite 1501 balcony should be reviewed in more detail to determine the cause of the damage.

At Suite 516, the gap between the guardrail and the adjacent window frame should be filled to ensure compliance with the VBBL. Refer to applicable warranties, as required.

The damaged sealant at balcony guardwalls should be repaired on a localized basis as part of maintenance activities in conjunction with the sealant repairs at exterior walls and windows.

The damaged gypsum stucco soffits should be addressed on a localized basis as part of maintenance repair.

Some balconies are experiencing localized ponding. This is most common at exposed balconies and large balconies where rainfall must travel longer distances to reach the drain. Small areas of localized ponding should be managed by maintenance cleaning, as required. It is possible to locally correct reverse-sloped or ponding areas; however, this is recommended as part of wider membrane renewals rather than a targeted re-sloping repair.

Polyurethane membranes on concrete balconies typically have a service life of around 20 years, which can vary depending on the manufacturer, quality of the installation, and frequency of in-service maintenance. The balcony membranes are generally in good condition and may be reassessed in approximately five years prior to membrane renewals.

RECOMMENDATION	
6	Complete a localized assessment of the tiled balcony edges behind the slab edge flashings prior to targeted maintenance repairs and/or renewals.
7	Investigate the damaged coating at the Suite 1501 balcony in more detail to determine the cause of the damage and repair options.
8	Locally fill the gap between the guardrail and the adjacent window frame at Suite 516 to ensure compliance with the VBBL.

5.5 At- and Below-Grade Assemblies

5.5.1 Description

The at-grade assemblies at 888 Beach include the podium waterproof membrane (the roof over the parkade) and associated assemblies, such as the courtyard pond, townhouse entrances and planters, and the locations where these assemblies intersect with the base of walls, windows, and doors.

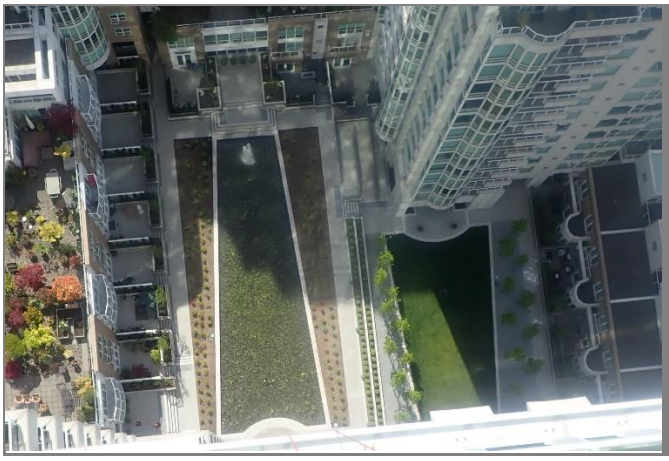


Figure 5.57

Overall view of the courtyard podium area from Beach Tower.

The below-grade assemblies include the vertical waterproofing at the perimeter foundation walls, and the urethane traffic coating membrane applied to the reinforced concrete suspended floor slabs (Levels P1 to P3) within the parkade. The traffic coating is

similar to the urethane balcony membranes, although typically with a more robust chemistry and thicker application to withstand vehicle traffic. Localized renewals and repairs of the traffic coating at P1 has been completed in recent years (Figure 5.58).

Figure 5.58

General view of the parkade traffic coating at parkade Level P1.

The bottom floor in the parkade consists of an uncoated concrete slab-on-grade. As opposed to suspended concrete slabs, concrete slab-on-grade is directly supported by an underlying layer of drain rock over soil and is not typically coated.

Figure 5.59

General view of the concrete slab-on-grade at parkade Level P4.

The podium waterproof membrane and courtyard pond were recently renewed with RDH assistance and are still under the contractors' labour and materials warranties. These assemblies are excluded from our review and the remainder of this Section covers the assemblies within the parkade.

5.5.2 Visual Review

There were several locations within the parkade where the existing traffic coating membrane was worn down to expose the underlying base layer of coating or the concrete substrate. This condition is a common occurrence at high traffic areas, such as parkade entrances, turning lanes, and visitor parking areas (Figure 5.60, Figure 5.61, and Figure 5.62).

Figure 5.60

Existing wear at the traffic bearing membrane at the base of the east parkade entrance ramp.

Figure 5.61

Localized exposed concrete substrate at the parkade traffic aisle.

Parkade Level P1, Visitor Parking area.

Figure 5.62

Localized exposed concrete substrate at the parkade traffic aisle.

Parkade Level P2.

5.5.3 Analysis and Recommendations

The areas of wear and damage to the traffic bearing membrane are localized to the higher traffic areas within the parkade. Currently the damaged areas include small sections of

exposed underlying base layer or concrete substrate. If left unaddressed, the damaged areas will continue to expand, and the membrane will eventually delaminate from the concrete substrate. The high-traffic areas within the parkade should be recoated with new traffic bearing membrane to prevent further damage.

At the time of the review, no evidence of active water ingress inside the parkade was observed or reported to us by the Owners. If water ingress is observed that is related to the foundation walls, targeted repairs, such as concrete crack injections, can be completed as part of regular maintenance.

RECOMMENDATION	
9	Recoat the high-traffic areas within the parkade with new traffic bearing membrane.

5.6 Summary of Recommendations

Our recommendations are based on a combination of factors, including a review of design drawings and other available documentation; information collected at the building through visual observations and exploratory openings; as well as experience and knowledge gained from investigations of many other buildings with similar assemblies and details.

Table 5.3 lists all building enclosure rehabilitation and renewal tasks that were identified in Section 5 of this report.

TABLE 5.3 SUMMARY OF RECOMMENDATIONS	
1	Distribute the BC Housing bulletin to provide Owners with information on controlling condensation within suites.
2	Complete an investigation of a representative sample of the existing window frames to review and document the condition of the existing fasteners.
3	Consider implementing a design review procedure for new air conditioner installations through the aluminum framed windows.
4	Complete further review of the wood swing doors at the townhouse balconies and decks to assess the extent of existing wood deterioration and determine repair needs.
5	Consider completing a feasibility study to compare the relative costs of electrification and added cooling compared to window renewals.
6	Complete a localized assessment of the tiled balcony edges behind the slab edge flashings prior to targeted maintenance repairs and/or renewals.
7	Investigate the damaged coating at the Suite 1501 balcony in more detail to determine the cause of the damage and repair options.
8	Locally fill the gap between the guardrail and the adjacent window frame at Suite 516 to ensure compliance with the VBBL.
9	Recoat the high-traffic areas within the parkade with new traffic bearing membrane.

6 Energy Efficiency and Greenhouse Gas Emissions

While BECAs assessments typically focus on moisture-related issues, they also provide an opportunity to assess aspects of the complex's energy efficiency and greenhouse gas emissions performance that are affected by the building enclosure. This Section discusses opportunities to lower energy consumption and provide other benefits at 888 Beach.

Windows

Windows are typically the weakest link in the building enclosure with respect to thermal performance and may account for significant heat loss, as well as cold surfaces and drafts inside residential suites. If a future window replacement is planned, new windows will have to meet the current building code requirements for thermal performance. Upgrading windows beyond the minimum (building code) performance requirements can deliver additional energy savings, as well as more comfortable living spaces. Glass can also be selected to reduce heat gains in the summer to improve comfort in spaces that experience overheating. Building code requirements are considered to be the minimum standard allowed; products with much better performance are available and provide additional benefits. It should be noted that newer window systems often have thicker frames so considerations for sizing and glazing area will need to be considered. Options for thicker IGUs, such as triple-glazed panels, will need to be considered.

Wall Insulation

Exterior insulation may be added during a cladding renewal project to further reduce heating energy and bring the building up to current code requirements for buildings. Exterior insulation can also improve the durability of building enclosure assemblies, as it reduces the potential for stresses caused by thermal cycling of wall components.

Air Leakage

A well-planned window maintenance program can significantly reduce air leakage, lowering heating energy and improving comfort in residential units (e.g. less cold air drafts). In order to realize these improvements, a continuous air barrier needs to be maintained at operable windows. Ultimately, a window replacement project will improve the overall airtightness of the window assemblies beyond the current maintenance approach. Window replacement will also improve the windows' resistance to solar heating, reducing overheating incidents, and lowering cooling energy loads.

Ventilation

Since most building enclosure renewals projects lead to a more airtight building, which is good for energy efficiency and reducing cold drafts, there is a need to make sure buildings get enough ventilation to prevent excessive indoor condensation, remove odours, etc. Many buildings are under-ventilated prior to building enclosure work, and so a renewal project provides an opportunity to improve the ventilation to that of a new building.

Ventilation can be delivered efficiently through Heat Recovery Ventilators (HRVs) or Energy Recovery Ventilators (ERVs). There are a variety of options, such as through-wall units that require only discrete building enclosure penetrations, or larger units that require interior ducting. Some units allow for the use of higher performance air filters that can filter smoke particulate during wildfire events. Some units also have settings that can provide limited cooling to reduce overheating in the summer.

Other Opportunities

Beyond the building enclosure and ventilation renewal opportunities described above, there are various other ways to reduce energy consumption and greenhouse gas emissions in existing buildings. Examples include replacing domestic hot water and heating equipment at the end of its service life with more efficient equipment (including electric heat pump technology), replacing lighting with LED technology, and adjusting controls.

Our climate has already experienced warming in recent years and will continue to warm. While some of the measures identified above can help reduce overheating, many buildings will look to add mechanical cooling (i.e. air conditioning) in the future. There are a variety of ways to add cooling, and if done well, these measures can also reduce heating energy and associated greenhouse gas emissions. A building enclosure renewal project can incorporate cooling or plan for a future addition via enclosure penetrations and ventilation design.

It is important to plan building enclosure renewals in the context of future mechanical renewals, such as equipment replacements or adding cooling, to reduce overall building maintenance and renewal costs. For example, an improved building enclosure may enable smaller mechanical equipment sizes or different system strategies, and future cost savings.

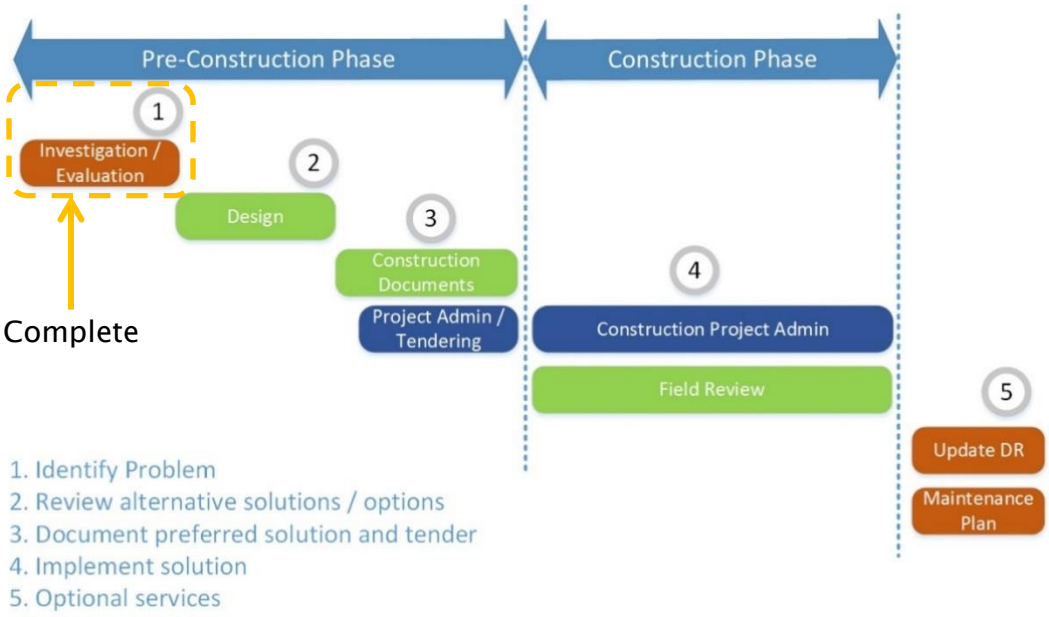
7 Next Steps and Closure

7.1 Next Steps

This BECA presents conceptual-level recommendations with respect to renewal activities. It is important to understand that these recommendations do not provide a basis for implementing remedial work. Conceptual recommendations need to be developed, refined, and documented in detail, and cost estimates prepared, before the construction work can be tendered to contractors or a building permit obtained.

The next step typically begins with the design process where the consultant considers alternative ways of addressing existing problems and assists you in making decisions with respect to specifics of the renewal program. Once decisions are made, the selected design is developed and documented in greater detail in the form of drawings and specifications. These documents indicate the exact extent and nature of the remedial work, materials to be used, etc.

The drawings and specifications are used to obtain bids from pre-qualified contractors, obtain a building permit to carry out the work, and as the basis to carry out the rehabilitation work. Once a contractor has been selected, usually on the basis of the lowest submitted bid, the project can move into the construction stage. During this stage, the work program that has been designed by the consultant (with Owner involvement and agreement) is implemented, and renewals take place on-site. The consultant administers the construction contract and undertakes periodic field review of construction as the work proceeds. It is also common for the consultant to provide a maintenance and renewals plan (or update an existing plan) for the renewed enclosure assemblies upon completion of construction.



7.2 Closure

We trust this report meets the Owners' requirements at this time. Please do not hesitate to contact the undersigned to discuss this report, or if we can be of any further assistance.

Yours truly,

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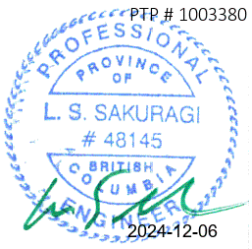

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Appendix A

BC Housing Bulletin – Condensation

Number 3

MAINTENANCE MATTERS

BC HOUSING RESEARCH CENTRE

Avoiding Condensation Problems

Have you ever noticed water droplets on your window or black staining on the drywall of your walls? Have you ever wondered why the moisture returns around your windows after you have wiped it away? This type of moisture is from the interior air and is commonly referred to as condensation.

What is Condensation and How Does it Form in My Home?

Condensation occurs in your home when moist air comes into contact with a surface which is at a lower temperature. Moist air contains water vapour — commonly referred to as humidity. Indoors, we can increase humidity through our activities and lifestyle. If a surface in your home is cold enough, the air in the immediate vicinity of the surface will be cooled, sometimes causing the moisture in the air to condense or change into a liquid on the surface.

Condensation forms first on the coldest surfaces of a room, usually on glass surfaces of windows and doors. These surfaces are typically cooled by lower exterior temperatures during the winter months much more easily than the walls which are kept warm by insulation. For example, if it is cold enough outside and/or warm and humid enough inside, condensation may occur on or around your windows resulting in fogging, water or ice on the windows themselves or even a puddle of water on the window frame or sill. Other examples of condensation in your home can include damp spots or mildew on outside wall corners, closet walls or baseboards. Areas of your home with poor air circulation, such as behind furniture or in a cupboard or closet, can also be susceptible to condensation.

Condensation forms first on the coldest surfaces of a room, usually on glass surfaces of windows and doors.

Use your kitchen exhaust fan or range hood to remove humidity generated by cooking. The exhaust fan should be vented to the outside.

Maintenance Matters

This series of bulletins and companion videos is designed to provide practical information on maintaining residential buildings. Produced by BC Housing, in collaboration with Polygon and Canada Mortgage and Housing Corporation, this bulletin was prepared by a consortium of building envelope experts.

A small amount of condensation appearing on a surface may not necessarily be a problem. It depends on the amount of moisture that forms, how long it stays, and whether it accumulates on surfaces that can be damaged by water. Condensation can be short-term during a severe cold spell, or occur in a localized area such as kitchen, bathroom or laundry room.

In many instances, condensation moisture simply evaporates back into the air once the surfaces warm up or the moisture source is reduced. An example of this is moisture that condenses on a bathroom window during a shower and quickly disappears shortly after the shower is turned off. However, as a general rule, steps should be taken to avoid condensation problems wherever possible as moisture can lead to damage.

Why Must I Avoid Condensation Problems?

Condensation can cause serious damage to the interior and structural elements of your home or building. If condensation occurs frequently enough and for prolonged periods of time, materials in contact with the moisture may be damaged. Drywall and wood finishes around windows are two examples of materials in your home that can readily absorb moisture and become damaged if they remain wet for a sustained period of time. If left unchecked, condensation problems can cause:

- crumbling or soft spots in drywall
- decay in wood framing or corrosion of steel framing
- peeling paint
- damage to the insulation inside the walls
- mould and mildew problems in your home

Most importantly, taking preventative steps to avoid condensation from occurring in your home will help prevent avoidable and expensive problems in the future.

Sources of Moisture in the Home

We add to humidity levels in our home through our activities and lifestyle. Water vapour is added to the air in large quantities by our breathing and perspiration, cooking, bathing, cleaning and other daily activities.

How we produce humidity in our homes

- A family of four can add moisture to the air equivalent to 30 to 40 litres of water per week
- Showering, cooking, bathing and washing can add 15 to 20 litres per week
- Drying clothes indoors can add 10 to 15 litres per week

Source: Natural Resources Canada

Newly constructed homes may temporarily exhibit a higher potential for condensation as moisture in plaster, cement and other building materials escapes into the air during the first heating season. This elevated level of moisture in the air should taper off after a month or two. If it doesn't, you should inform your building or maintenance manager of the situation.

Evidence of problems resulting from condensation can be seen on the interior window sill.

Condensation has led to mould problems on the drywall.

What Should the Indoor Temperature and Humidity Levels be?

Interior temperature and relative humidity is often a matter of personal preference, but exceeding recommended humidity levels for extended periods of time can lead to a higher risk of condensation problems in your home. The recommended relative humidity level varies between winter and summer, and by location.

As a rough "rule of thumb," interior air temperatures should generally be maintained between 18°C and 24°C with relative humidity falling between 35% and 60% for the coastal temperate climate regions of British Columbia during the winter months. In colder and drier regions of the province, interior humidity levels should be limited to between 25% and 40% during the winter months. If you are unsure of the relative humidity in your home, small devices called "hygrometers" can be purchased that will allow you to measure the humidity levels.

Humidity cannot be eliminated from the air altogether. It is needed to maintain a comfortable and healthy interior environment. Without humidity we would suffer from chapped lips and dry skin, sore throats, breathing problems, static electricity, and damage to equipment and furniture. However, if humidity gets too high, problems will arise in your home such as condensation, musty smells, mould growth, allergic reactions and damage to walls and interior finishes.

How do I Avoid Condensation Problems?

There are number of steps that you can take to prevent condensation problems from occurring in your home.

1) Reduce the amount of moisture or humidity generated in your home

- Do not regularly hang large amounts of clothes to dry indoors. Wherever possible, dry your clothes in a dryer with an outside vent.
- Shut off the humidifier if you are using one.
- While cooking, put a lid on boiling water — it will also boil faster!
- Try to have shorter showers. You will save energy required to heat the water and conserve water.
- Ensure the lint trap in your clothes dryer is clean. The lint trap should be inspected and cleaned before each use.
- As much as possible, try to wash full loads of dishes in the dishwasher.
- Do not store wood for your fire place indoors.

2) Promote good air circulation in your home

- Open blinds and drapes so that air can circulate freely over the windows.
- Direct heat towards exterior walls and windows.
- Where condensation at window sills is a persistent problem, remove any objects on the window sill such as books, photographs, and knickknacks as they prevent air from circulating and removing the moisture.
- Move furniture such as sofas and bookcases so they are not touching outside walls. This will improve air circulation around the cooler outside wall and reduce condensation potential.

3) Promote good ventilation in your home

- Use the kitchen exhaust fan or range hood to remove humidity generated by cooking.
  Note: the exhaust fan or range hood should be vented to the outside.
- Use bathroom fans and humidistats (if you have one) while bathing or showering. Some bathroom exhaust fans are connected to a humidistat that can be preset to ventilate the room when the humidity reaches a certain level, and keep the fan running until the humidity is below that set point. It is important that humidistats be set to the appropriate level and not turned to "off." If the bathroom does not have a humidistat, the exhaust fan should be left running for a period of time after bathing or showering to remove the excess moisture from the bathroom. The exhaust fan should be vented to the outdoors.

- Some newer homes have a pre-set principal exhaust fan. Ensure that this fan is set to run for two 4-hour periods per day.
- Open windows periodically and ensure that fresh air intake vents are not blocked.
- Make sure exterior vent hoods for your dryer, bathroom and kitchen vents are unobstructed and operating freely. Clothes dryers that take longer to dry than usual, and kitchen or bathroom fans that seem to not move the air could be signs of some obstruction in the duct or the outlet. Keeping vent hoods and lint traps clear will also reduce the amount of energy required to dry the clothes, thus reducing utility bills. Qualified professionals should be used to carry out this maintenance item.
- Consider upgrading your kitchen or bathroom fans. If you feel that your kitchen or bathroom fans make noise, but don't seem to do anything, you may be right. Some older or cheaper units may not work effectively and tend to be noisy. A simple upgrade is relatively inexpensive and will often dramatically improve performance. Look for units with high air movement measured in cubic feet per minute (cf/m) or litre per second (L/s), and a low noise rating measured in decibels (dB) or sones.

In most cases you can address high humidity and condensation through reducing the amount of humidity generated in your home. Ventilation may only reduce humidity levels if the air introduced into the room is drier than the interior air. When ventilation is not effective at lowering the humidity sufficiently, you may need to incorporate the use of a dehumidifier (or air conditioner) to further reduce humidity levels. However, this should be considered as a last resort after you have taken necessary steps to reduce the amount of humidity generated in your home. Also, dehumidifiers require electricity to operate and, therefore, may be an expensive option.

Use bathroom fans, and humidistats if you have one, while bathing or showering.

Dealing with Persistent Condensation Problems

Condensation is usually a localized problem that you can address by taking the steps described above to reduce the humidity or to promote good air circulation and ventilation in your home. However, if you have taken these steps and continue to experience condensation problems, other problems may exist that are more appropriately addressed by your maintenance manager or a qualified professional. Symptoms related to persistent condensation problems include:

- windows that continue to have water droplets or that fog up, frost or get ice build-up, even after you have taken necessary steps to lower humidity levels and prevent condensation in your home
- black staining on the inside of walls, mainly in corners and near the floor or ceiling
- mould or mildew growth
- ice or frost under roof sheathing boards
- delamination of plywood materials
- damp or moist basement walls or floors

Report persistent condensation problems to your maintenance manager. Persistent condensation problems may relate to air leakage in your home, typically at the base of the wall, (sometimes causing black staining at carpet edges) or at electrical lighting and receptacle outlets, and around windows[1] and doors. This air leakage can allow cold air into the wall assembly and thus cool the wall and increase the potential for condensation. In other cases, it may be necessary to bring warm air to cold

surfaces, either by changing the building's heating patterns or by providing dedicated heat sources to problem areas.

Blowing warm air at problem areas has the additional effect of encouraging evaporation at the problem location. In some cases the solution may be to insulate surfaces against cold temperatures, usually by increasing insulation levels in the walls behind the problem areas. The solutions to each of these potential problems, however, must be carried out by qualified professionals and co-ordinated by your maintenance manager.

[1] In some climates, such as central and northern British Columbia, a historical remedy for condensation around windows was to open the window slightly to allow the very dry outdoor air to mix with the relatively humid indoor air and reduce the potential for condensation. This approach is NOT recommended as it can result in condensation and serious damage in parts of the wall that are not visible to the occupants. It also results in a large consumption of energy.

Action Plan Tips

- Take steps to avoid condensation problems in your home:
  - Reduce the amount of moisture or humidity generated in your home. For example, do not hang laundry to dry indoors and take shorter showers.
  - Promote good air circulation in your home. For example, open blinds and drapes and move furniture so that it is not touching an outside wall.
  - Promote good ventilation in your home. For example, use kitchen exhaust fans, bathroom fans and humidistats as well as consider upgrading your exhaust fans if they are performing poorly.
- If a persistent condensation problem becomes evident (after taking the above steps), notify your maintenance manager. A qualified professional may be needed to address the underlying cause of this problem.

More Information

- Moisture Problems: Why Should I Worry About Moisture Problems?, available at www.oee.nrcan.gc.ca
- Building Enclosure Design Guide – Wood-Frame Multi-Unit Residential Buildings, available at www.bchousing.org
- See your building's maintenance manual
- Subscribe to receive Maintenance Matters bulletins at www.bchousing.org

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