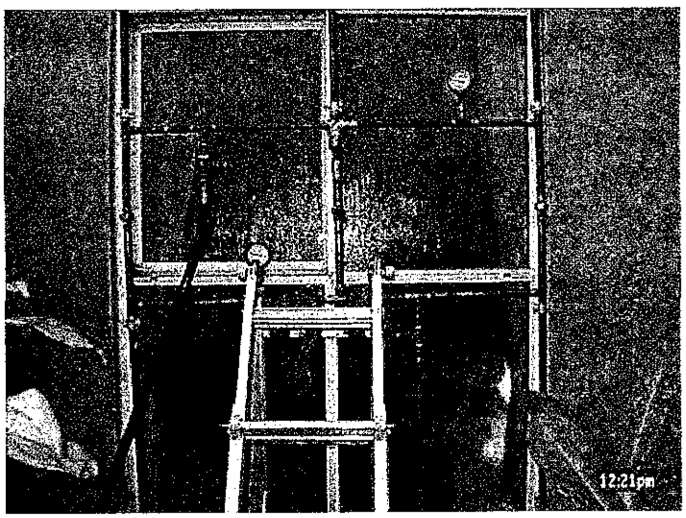
Pacific Point

W1 - Setup A

W1 - Setup B



W1 - Setup C

W1- 01

W2 - 01

W2 - 02

Pacific Point

W2 - 03

W2 - 04

W2 - Post Test

W3 - 01

W4 - 01

W5 - 01

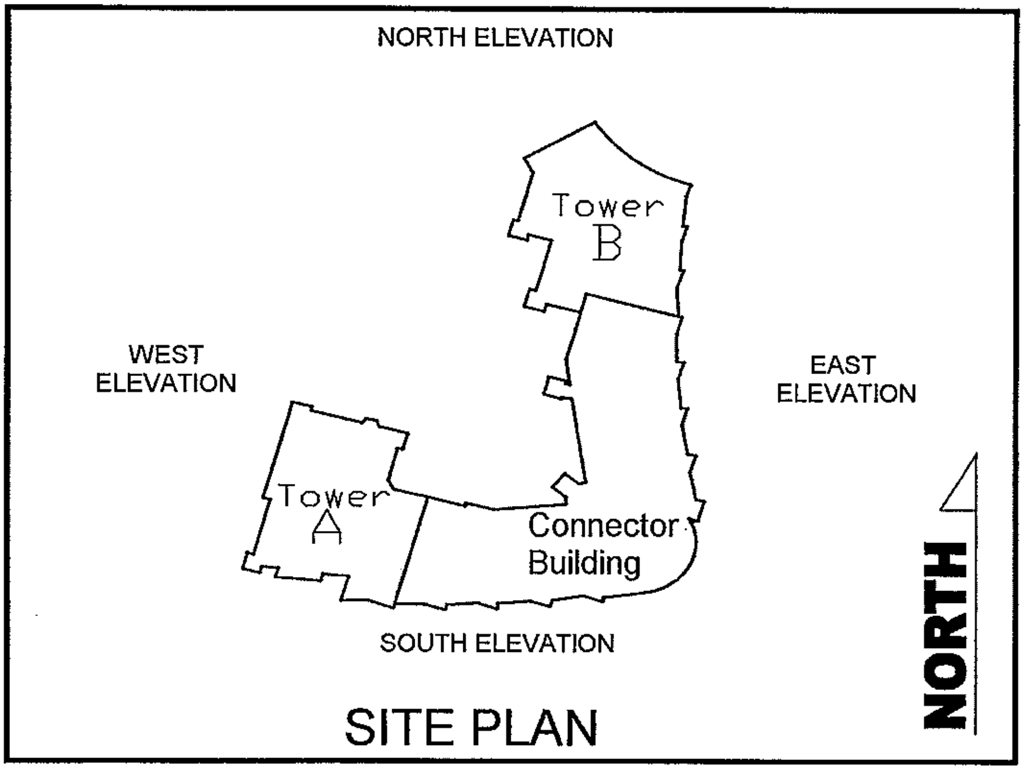
Pacific Point

W5 - 02

W5 - 03

Roof Observations

Our visual examination of the roof and roof deck areas revealed the following:



Site Plan Layout

Roof Observations– Tower A

- The main roof assembly consists of the following: gravel ballast, filter cloth, rigid insulation, EPDM membrane.

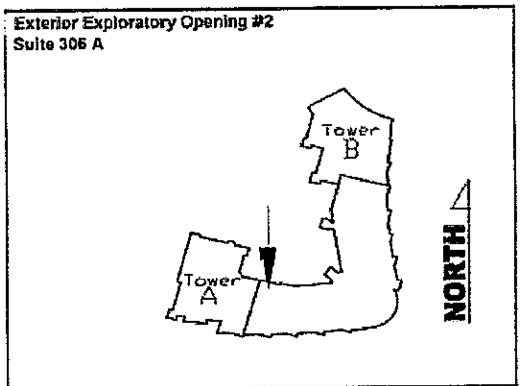
- A concrete parapet encloses the perimeter of the roof. The EPDM membrane terminates at the inner sidewall of the parapet. A metal flashing covers this interface. (Photo J-01)

- A segmented metal cap flashing covers the top surface of the parapet. A caulking sealant has been applied at the flat joints between flashing segments. A standing seam joint was observed at various corner joints.

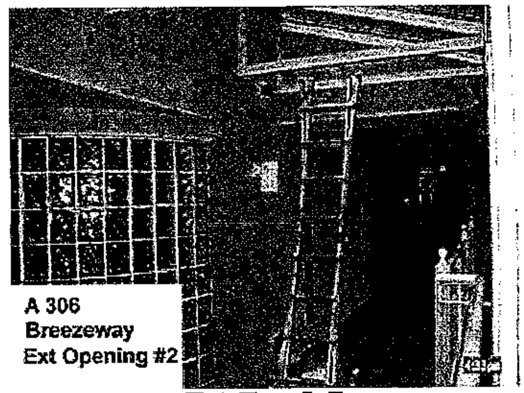
- Various overflow scuppers involve penetrations through the parapet assembly. The pipe inserts do not extend all the way through the parapet and the outer EIFS cladding. Typically the inserts terminate at the back of the EIFS cladding where a hole was cut to accommodate water flow. The penetration through the EIFS is sealed with caulking. (Photo J-02)

Pacific Point

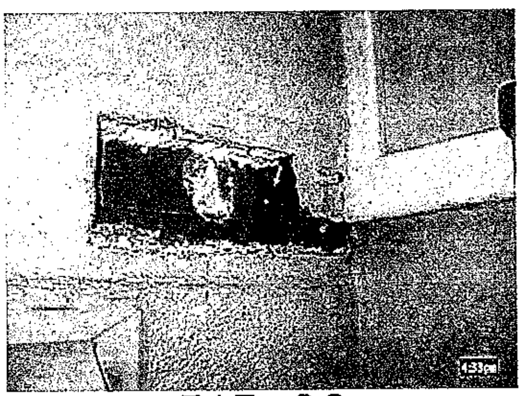
Exterior Exploratory Opening #2
A 306



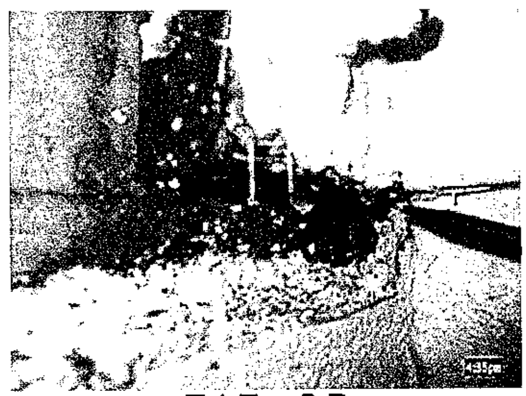
Ext Exp 2-A



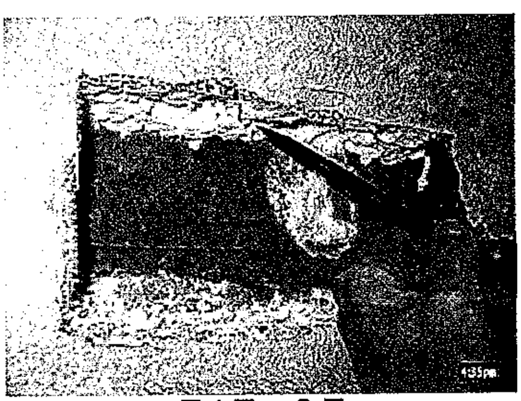
Ext Exp 2-B



Ext Exp 2-C



Ext Exp 2-D



Ext Exp 2-E

RDH
Building Engineering Limited
224 West 8th Avenue, Vancouver, BC, V5Y 1N5
Phone: 604 873-1181   Fax: 604 873-0933

BUILDING ENVELOPE CONDITION ASSESSMENT

Pacific Point

431 Pacific Street and 1331 Homer Street,

Vancouver, B.C.

Presented to:

The Owners - Strata Plan VR 2540
c/o Brian Carleton
Crosby Property Management
Suite 600, 777 Hornby Street
Vancouver, B.C. V6Z 1S4

RDH Report No. 1808.10   **February 21, 2003**

1 INTRODUCTION

1.1 Terms of Reference

RDH Building Engineering Limited (RDH) was retained by the Owners of Strata Corporation VR 2540 to undertake an assessment of the current condition of the building envelopes of the buildings located at 431 Pacific Street and 1331 Homer Street, Vancouver, BC.

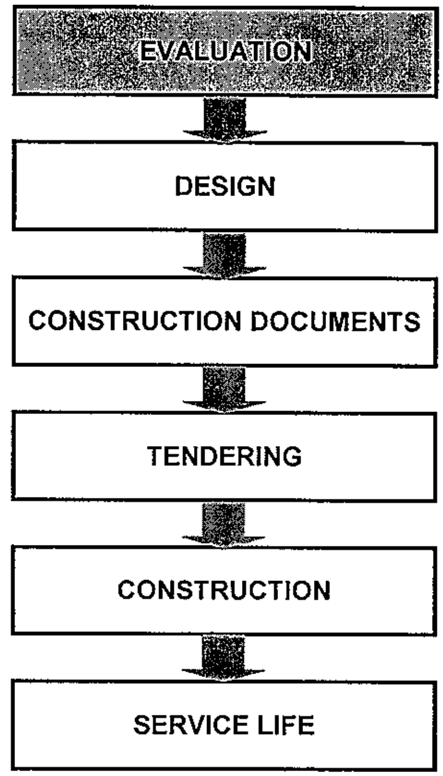


Figure 1 – Rehabilitation Process

Documented in this report are the current conditions of elements of the building envelope. It may also provide information related to the specific sources of moisture or other physical factors which have resulted in the observed conditions. The 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. Based on the findings of the condition assessment, recommendations for rehabilitation and renewals are provided.

The condition assessment work documented in this report represents the completion of the first step in the building envelope rehabilitation or repair process (Fig. 1). Subsequent phases include the design phase in which a specific plan for the rehabilitation, repair or maintenance is developed. The design stage considers alternative approaches, risks, benefits and costs. It is the stage that requires the most owner input. The construction document stage simply records the decisions made during the design stage in the form of drawings and specifications so that the work can be tendered to a contractor(s) and a building permit obtained (if required). The construction stage is the actual implementation of the rehabilitation or repair work. The final stage represents the normal service life at completion of the rehabilitation or repair process and involves routine maintenance, monitoring and renewal activities.

1.2 Section Organization

Section 1 of this report provides background information relevant to this building and the condition assessment.

Section 2 presents our observations of current conditions as well as a discussion of our findings. Based on these findings, conceptual rehabilitation and renewals recommendations are presented. This chapter is focused on five primary building envelope assemblies and interior operating conditions.

- Walls
- Windows & Doors
- Roofs & Decks
- Balconies
- At-Grade Assemblies.

Section 3 presents a summary of rehabilitation needs for the building incorporating all envelope assemblies that formed part of the assessment and provides preliminary order of magnitude cost estimates associated with the recommendations made in Section 2. It also presents a discussion of alternate approaches, phasing and advantages of various implementation scenarios where appropriate.

A glossary of technical terms used within the report is included immediately after Section 3.

1.3 Scope of Services

The scope of services to be provided by RDH Building Engineering Limited is included in Appendix A.

1.4 Documents Reviewed

The following is a partial list of the documents provided to RDH to assist with the assessment.

Table 1.1 Documents

DOCUMENT DESCRIPTION	PREPARED BY	DATE
Wall Moisture Analysis and Condition Report	RJC Ltd.	April 23, 2002
Mould Investigation	PHH Environmental for RJC Ltd.	April 17, 2002
Building Envelope Investigation (Various)	RJC Ltd.	1999
Leakage Investigations (Various)	RJC Ltd.	Various
Sealant and cap flashing replacement program (Various)	RJC Ltd.	Various
Various envelope related documents	Various	Various
Architectural Drawings (35 sheets) issued for construction March 15, 1988	Eng & Wright Partners, Architects	March, 1988
Window Shop Drawings (14 sheets)	Wescraft Windows Ltd.	August, 1988

1.5 Building Description

Table 1.2 below provides a general description of the building. The photograph on the cover provides a general view of the building. Other photographs of the building are provided in Appendix B. The building layout is illustrated in Figure 1.1.

Table 1.2 Building Description

Building Address	431 Pacific Blvd. and 1331 Homer St., Vancouver, BC
Legal Description	N/A
Owner	The Owners, Strata Corporation VR 2540
Property Manager	Crosby Property Management Ltd.- c/o Brian Carleton
Building Type	2 medium rise apartment buildings and 1 low rise connector apartment building, concrete structural frame
Principal Occupancy	Residential
Other Occupancy	Commercial
Date of Construction	1988-1989
Applicable Building Code	Vancouver Building By-law, Part 3
Number of Suites	153
Type of Construction	Non-combustible – concrete frame
Site Area	NA
Floor Area	N/A
Number of Storeys	Tower A, 8 storeys Tower B, 16 storeys Connector building, multi-level (stepped)
Adjoining properties	North: residential building West: lane South: Pacific St. East: Homer St.
Parking	Underground parking – 6 split levels

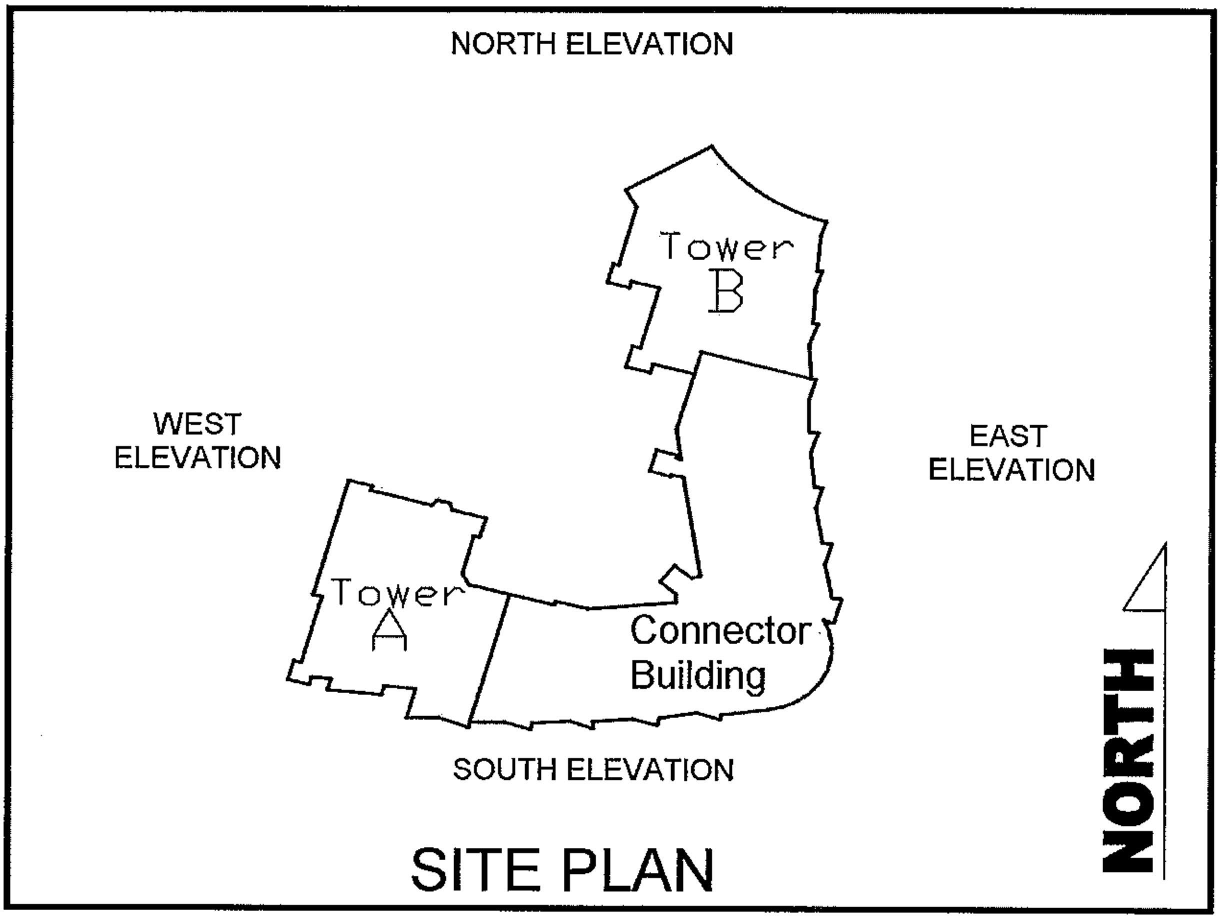


Figure 1.1: Building Layout

1.6 Building History

Table 1.3 provides a brief history of activities and events relating to the building envelope assemblies as reported to us or as described in the documents reviewed.

Table 1.3 Building Activities Relevant to Envelope Performance

DATE	ACTIVITY
2002	• 1331 Homer Street, Installation of new curtain wall
Since construction	• Various exterior painting • Various restoration of exhaust duct terminations • Remediation of various horizontal cap flashings • Various sealant remediation at walls, windows, etc. • Various roof membrane repairs / replacement

1.7 Occupant Questionnaire

A standard questionnaire was distributed to all building occupants (dated October 28, 2002). Seventy-four suite surveys were returned to RDH of the 153 that were originally distributed to the occupants. This response rate provides an adequate representation of common building envelope concerns.

To effectively manage the survey data the suites were divided into the three distinct building types that are present at Pacific Point: Tower A, Tower B and the Connector Building.

- Tower A (south tower): 431 Pacific Street (2nd floor: A201, A202, A203; 3rd through 8th floors: All 01, 02, 03, 04, 05 suites.)
- Tower B (north tower): 1331 Homer Street (All 01, 02, 03, 04, 05, 06 suites)
- Connector Building: 431 Pacific Street (2nd floor: A204, A205, A206, A207, A208; 3rd floor: A306, A307, A308, A309, A310) and 1331 Homer Street (All suites 07 and up)

The results of the survey by building are summarized in Table 1.4. Percentages higher than 30% have been highlighted. A sample occupant questionnaire is included in Appendix C.

Table 1.4 Response to Suite Survey Questions

SURVEY QUESTION	SUITES REPORTING PROBLEMS (See Figure 1.1)			
	TOWER A	TOWER B	CONNECTOR BUILDING	TOTAL
Number of units	29	91	33	153
Number of responses	19	36	19	74
Percentage of responses	66%	40%	58%	48%
Does your suite have current leaks (within the last year)?	9/19 **47%**	16/36 **44%**	7/19 **37%**	32/74 **43%**
Has your suite experienced leaks in the past which have now been corrected (no leaks within the last year)?	8/19 **42%**	19/36 **53%**	12/19 **63%**	39/74 **53%**
Do you have problems with condensation?	15/19 **79%**	24/36 **67%**	13/19 **68%**	52/74 **70%**
Do you have problems with mould?	12/19 **63%**	16/36 **44%**	8/19 **42%**	35/74 **47%**
Does cold air penetrate your suite?	3/19 **16%**	7/36 **19%**	4/19 **21%**	14/74 **19%**
Are there any walls or floors that are unusually cold during periods of cold weather?	3/19 **16%**	9/36 **25%**	4/19 **21%**	16/74 **22%**

Several observations can be made based on the responses to the questionnaires:

- Forty-three percent of the respondents reported current moisture related problems.
- A high percentage of problems related to condensation (70%). A significant number the occupants indicated condensation problems at windows and sliding doors.
- Half of the respondents (47%) reported a high incidence of mould, fungi and mildew.
- Various respondents expressed concerns regarding mould growth and their health.
- Various respondents commented on the poor air quality within the building.

TABLE OF CONTENTS

2 FIELD ASSESSMENT OF CURRENT CONDITIONS

Documented in the following sections are conditions found during our field investigation of the reported moisture problems.

Layers and materials for various assembly types have been confirmed only at locations where exploratory openings have been made. Otherwise determination of assembly type and layers within the assemblies is based on visual evidence in combination with our review of the original architectural drawings. The details shown in the architectural drawings may vary from the as-built construction at some of the locations reviewed.

Our field investigation included visual observations of the exterior from a boatswain chair, from balconies, from roofs, and from ground level. Exploratory openings into the exterior wall assemblies were also made from the interior of the suites.

2.1 Moisture Probe Survey

The condition of the wall assembly is best determined using exploratory openings. Therefore, our investigation focused on exploratory openings, rather than localized moisture probe readings. However, moisture content readings were taken within the exploratory openings of both the gypsum sheathing materials and the wood liners at the window perimeter. The moisture content readings provide some indication of the extent of current moisture levels to complement the visual observations of damage. Note that our field review was performed in a relatively dry fall and, therefore, the values obtained are probably lower than those that would be obtained during more typical fall weather.

Gypsum Moisture Readings

Moisture probe readings were taken in the exterior sheathing at various exploratory openings. A Delmhorst Model BD-10 analog moisture meter was used, which provides a range from 0 to 100 relative moisture content for gypsum products. This instrument uses electrical resistance between two points, a known distance apart, to determine the relative moisture of the material. Water lowers the resistance and is indicated by a higher reading. When used on gypsum-based products, readings obtained from the instrument are relative (does not provide an actual % moisture content) and are intended for comparison to other areas and to known results. Because the readings are relative and not true moisture contents, they are referred to as "RM%" (relative moisture). Based on preliminary testing conducted by RDH, mould and mildew growth may occur on the surface of gypsum sheathing when an RM% of approximately 80 or higher is obtained. RM% values of less than 60% will be obtained when the relative humidity adjacent to the exterior gypsum is 75% or less. Typically, the relative humidity in the wall cavity of an exterior wall under normal operating conditions should remain below 75%.

2.2 Interior Operating Conditions

Interior air is exhausted through fans located in the bathrooms and kitchens. The air is carried through ducts in the concrete floor slabs and discharged at exhaust vent hoods on the exterior walls. The effectiveness of the fans was not reviewed. The typical windows are not thermally broken and various windows did appear to have water staining present on the windowsills, potentially as a result of condensation forming on the interior of the windows during the winter months.

The quantity and frequency of condensation that forms on windows will increase with an increase in interior relative humidity. High interior relative humidity can be the result of occupant use (showers, cooking, laundry, vegetation, etc.). However, interior relative humidity can also increase if water is penetrating the exterior walls.

Rather than including comprehensive changes to the suite exhaust system, we recommend that the performance be assessed following completion of the building envelope rehabilitation plan. In our experience, the exhaust ventilation system needs to be evaluated in the context of the actual envelope performance. Improvements to the walls and windows may dictate that only targeted repairs and replacement is required to achieve acceptable performance from the exhaust system. Any obvious deficiencies can be addressed during the building envelope rehabilitation project through allowances carried within the budget.

Tropical Room

An indoor tropical room is located on the north side of Tower A. It incorporates elements that are commonly found in a tropical environment including an extensive planting area, a pond with a falling water feature and increased air temperature with a high relative humidity. There are significant differences in the temperatures and relative humidity levels between the tropical room and the adjacent interior space. It was not confirmed that there is an effective vapour barrier or air barrier within the wall assemblies at this location. Tropical rooms such as this generate higher indoor moisture in the form of water vapour. Hence, it is extremely important to ensure that a suitable environmental separation contains the conditions within that space.

At the interior entrance to the tropical room, there is a set of double doors that were propped open on all occasions that RDH was on site. These may originally have been intended to separate the conditions within the tropical room from the rest of the building. Adjacent to the double doors are the elevator and stairwell that lead to the upper floors. If not isolated, these may act as passageways through which moisture-laden air may travel. (The occupant in the suite directly above the tropical room (301A) indicated a concern of excessive mould growth within the suite.) The mechanical air exchange system within this area was not reviewed. It is important that the mechanical units be reviewed at these areas so that indoor relative humidity will be controlled to an acceptable level. Non-thermally broken strip windows enclose the perimeter of the tropical room that faces the courtyard. Some evidence of interior condensation was found at various locations.

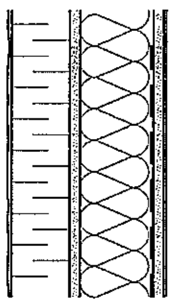
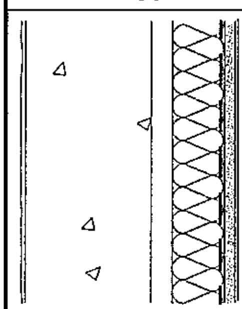
1	**Review suite ventilation system after completion of the building envelope rehabilitation program and undertake targeted replacement or improvements.**
2	**Review the environmental separation and air exchange system at the tropical room and the adjacent lobby and amenity areas.**

2.3 Walls

General Arrangement and Types

The exterior walls consist primarily of Exterior Insulation Finish System (EIFS) clad walls between sections of an aluminum window wall system. Metal spandrel panels are incorporated into the window assemblies at various slab bypass locations. The metal panels are also located vertically along the window wall to EIFS interface. Mass concrete walls and columns are also present at various locations. The relevant wall assemblies are described in Table 2.1.

Table 2.1 Wall Assemblies

	Exterior EIFS external gypsum board 3 5/8 inch metal studs glass fiber insulation batts polyethylene sheet gypsum wall-board Interior
1: Wall Type 1 – 'Face Seal' Exterior Insulation Finish System	
	Exterior EIFS external gypsum board metal track reinforced concrete wall or column metal track (insulation unconfirmed) polyethylene sheet gypsum wall-board Interior
2: Wall Type 2 – 'Face Seal' EIFS over Mass Concrete (unconfirmed assembly)	
	Exterior Mass concrete metal studs Glass fiber insulation batts Polyethylene sheet gypsum wall-board Interior
3: Wall Type 3 – Mass Concrete (unconfirmed assembly)	

	Exterior metal panel insulation external gypsum board metal studs Glass fiber insulation batts Polyethylene sheet gypsum wall-board Interior
4: Wall Type 4 – Insulated Metal Panel (Spandrel Panels) (unconfirmed assembly)	

Visual Appearance

Our visual examination of the exterior walls from a boatswain chair revealed the following. Complete details of the individual drops can be found in Appendix D:

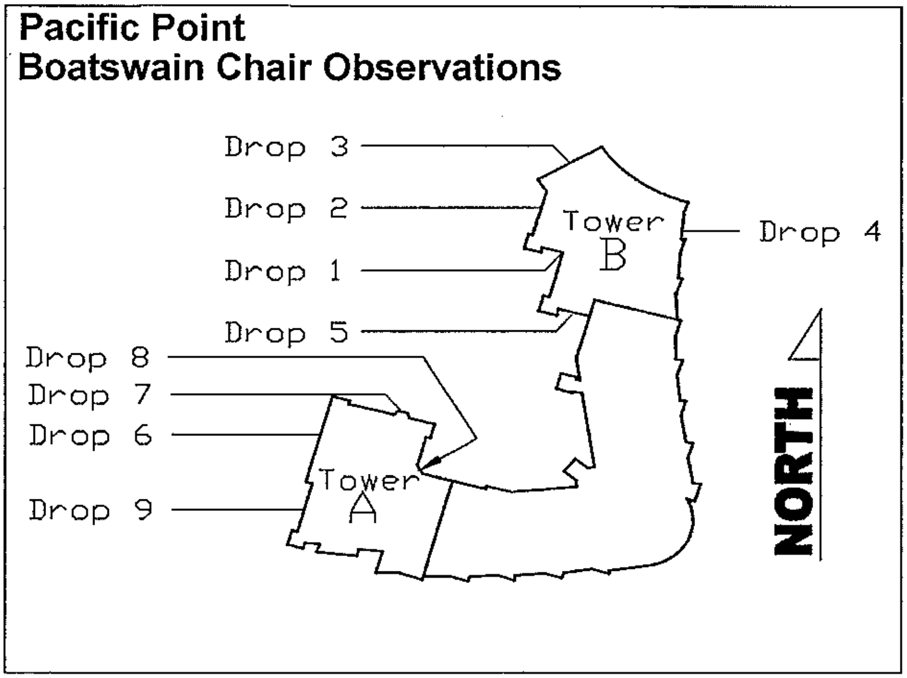


Figure 2.1: Building Layout

- It appeared that there is a paint coating over the EIFS panels. (Photo A03-01)
- There is failed joint sealant at several locations between the window frames and the adjacent EIFS. Some sealant beads have failed cohesively and some have failed adhesively. (A7-01 to A7-06)
- EIFS trims are situated at most window perimeters (not at enclosed balcony windows). (A8-01)
- At numerous locations reviewed, there is not adequate surface area on the window frame to allow adequate bond or "bite" of the sealant bead to be installed between

the window and the EIFS. Typically sealant should have a minimum of ¼" "bite". Typically, the sealant joints observed on drop #1 have less than ⅛" "bite" onto the frames. (Photos A12-01 to A12-02)

- Exhaust vents are located directly above the EIFS window trim at various locations. Condensation is dripping from the EIFS trim at a few of these locations. (Photo A13-01)
- There is no sealant around the attachment of the guardrail fastening plate to the exterior wall at several locations. A gap between the plate and the wall is common at this interface. (Photo B11-01
- In locations where the EIFS has been recessed to accommodate the attachment of the guardrail fastening plates, the lower horizontal surface of the recess does not have outward slope. (Photo B09-01)
- The EIFS cladding at the perimeter of the balconies is sealed to the tiles with caulking. Ponding water stains adjacent to the exterior walls are on several of the balconies. (Photo B08-01)
- Several of the sealed window units have visible moisture between the glass panes. (Photo C01-01)
- Concentrated run-off is present at the EIFS trim around the windows at various locations. There is also increased staining at these locations directly below exhaust vents (Photos C04-01 to C04-02)
- Cracking is common near the outer corners of the EIFS panels. (Photo D01-01)
- The windows are framed by an EIFS trim projection. The horizontal surfaces of the trim are sloped outwards. Cracking in the trim and in the adjacent EIFS cladding is typical. (Photos D02-01 to D02-02)
- There are several types of face mounted exhaust vent hoods. Weathered and discontinuous sealant is present at several vents. Some have secondary vent covers over top of the exhaust vent hoods. It is probable that these secondary vent hoods were installed as part of a maintenance program. Some have large quantities of additional sealant applied in a trowel-like manner at the perimeter-fastening flange. (Photos D04-01, D04-02, D04-03)
- Cracking through the face of the EIFS cladding occurs in a rectangular pattern around several of the vent hoods. An additional layer of coating has been applied over these areas, however, the coating is discontinuous where cracking has occurred. Remedial caulking across the top of these vents is common. (Photos D06-01 to D06-02)
- Several small penetrations and tears in the EIFS cladding are present above a lower level deck. A canopy frame was previously installed at this location. The penetrations have been topically patched, however, there are holes through the patched areas. (Photos D07-01 to D07-02)

Exploratory Openings

Thirty-three exploratory openings were made into the wall assemblies at various interior and exterior locations throughout Pacific Point to confirm the conditions of concealed components. Information obtained from the openings has been utilized throughout the report in the various subsections. The complete details of the openings and the photos can be found in Appendix E.

The exploratory openings that relate specifically to interior wall assemblies have been included in the table and discussion below.

Nineteen exploratory openings were made into the exterior wall assemblies through the interior drywall to confirm conditions of concealed components and materials within the wall assemblies.

Summarized in Table 2.2 is the current level of damage observed in the interior exploratory openings through wall assemblies.

Table 2.2: Condition of Components at Wall Exploratory Openings (summary)

Condition	Observed	Percentage *
Staining on interior finish	10/19	53%
Damage of interior drywall (gypsum board)	9/19	47%
Corrosion of steel studs	14/19	74%
Corrosion of fasteners	14/19	74%
Moisture staining on exterior gypsum	12/19	63%
Visible mould growth on exterior gypsum	14/19	74%

* A total of 19 openings were included.

Discussion and Recommendations

Wall Type 1 – 'Face-Seal' Exterior Insulation Finish System

Wall Type 2 – 'Face-Seal' EIFS over Mass Concrete

The exterior walls at Pacific Point are clad with EIFS and can be categorized as "face-seal" wall assemblies. Face-seal assemblies must shed all exterior moisture at the outermost surface of the assembly. Face-seal assemblies do not have any capacity to drain or discharge water that penetrates the outermost surface.

The EIFS clad walls at Pacific Point are not designed to accommodate significant quantities of moisture behind the exterior face of the EIFS cladding. If wetting of the walls is relatively rare and drying of rain-wetted materials does occur, the wall can function acceptably. However, the Pacific Northwest has one of the wettest climates in North America and during the rainy season, from October to March, wetting periods are long and drying periods are short. Pacific Point is located on a very exposed site resulting in the exterior walls being exposed to a significant quantity of wind driven rain.

The EIFS clad wall areas on the Towers A and B are situated in high exposure locations not protected by any form of overhang. On the connector building between Tower A and B, the EIFS wall areas facing the courtyard are protected from rainfall by overhanging canopies and elevated walkways. However, most of the EIFS wall areas on the south and east elevations of the Connector building are not protected.

The use of "face-seal" EIFS at exposed locations is not appropriate construction practice in our coastal climate. Water may penetrate at cracks and joints occurring between panels and at terminations of the panels. A considerable amount of cracking was observed throughout all buildings at Pacific Point. An exploratory opening was cut through the EIFS cladding at an area protected by the glass canopy structure. Water was observed passing behind the lamina in the internal structure of the EIFS. In addition to performance concerns, water and dirt retention occurs in the rough textured acrylic finish, resulting in staining of the EIFS and the growth of algae.

Based on past performance, the major disadvantage to the system is that it requires that the exterior face or skin of the cladding be perfectly sealed to repel the water from the exterior. Once rainwater penetrates the exterior seal, there is no continuous provision within the system to manage the water or to shed the water back to the exterior. This lack of drainage combined with water sensitive substrates can cause significant problems to occur within the system if it allows water past the exterior plane of the cladding. Based on observations made at the test cut openings, it is apparent that water is penetrating the EIFS assembly in a significant number of locations. Water penetration into the wall assembly has resulted in deterioration of the exterior gypsum and corrosion of the steel stud assembly.

A coating has been applied to the outer surface of the EIFS as part of a previous maintenance program. It was not confirmed which type of coating was applied. Coatings such as this are intended to provide weather protection and increased durability to the cladding. Some types of coatings reduce the drying potential of the wall assembly.

One of the most sensitive components of the system to moisture penetration is the sheathing. In the case of Pacific Point, exterior gypsum sheathing was used. The sheathing is screwed to the steel stud framework and the EIFS panel is bonded to the exterior face of the sheathing with adhesive. The drawback to the exterior sheathing is its sensitivity to water. When the exterior sheathing is exposed to water, EIFS cracking, moisture intrusion and system detachment can result. In addition, with saturation of the exterior sheathing, strength of the material is reduced to the point where the ability of the fasteners to secure the sheathing to the studs is compromised.

Typically, "face-seal" EIFS wall assemblies will not provide acceptable performance in high exposure conditions. Rain typically penetrates an EIFS wall assembly at interfaces with other components or through the material itself. The exterior walls of Pacific Point contain a number of details and deficiencies that are prone to water penetration. These details include discontinuous or failed sealant joints at window frames and flashings.

In our opinion, it is not possible to adequately maintain the EIFS wall assemblies, given the details and exposure conditions at Pacific Point. There are many mid-rise and high-rise "face-seal" EIFS clad buildings that will require re-cladding in the near future. The failure of the EIFS cladding assemblies on mid-rise and high-rise buildings is similar to the "leaky condo" problems on low-rise wood frame buildings. The main difference between the problems faced by an owner of a wood frame "leaky condo" and the owner of a leaking mid/high-rise building is the time frame available to resolve the problem.

Low-rise wood frame structures have a short time frame available to repair the exterior cladding, before significant wood rot and structural decay occurs. In many cases, repairs are undertaken soon after the problems are identified to avoid expensive repairs resulting from replacement of deteriorated wood framing. The replacement cost of deteriorated wood framing is affected by the extent of structural support provided by the framing. Replacement typically requires staged removal and shoring.

Pacific Point is constructed of cast in place concrete with conventional and post tensioned steel reinforcement. The steel stud framing of the exterior walls is not vertical load bearing but is relied upon to resist lateral loads due to wind on the exterior cladding. Unlike deteriorated wood repairs, repairs to corroded steel studs can often be completed without the removal of the damaged studs, but instead by installing new framing adjacent to affected members.

The time frame available for the repairs to a mid/high rise building is dependant on the existing condition of the walls, the extent of corrosion to the steel studs, the extent of deterioration to the sheathing, and the presence of mould. The exploratory openings conducted at Pacific Point revealed conditions that indicate water penetration into the wall assembly with significant damage to steel stud components at various locations. Advanced corrosion of the steel studs and fasteners could ultimately result in detachment of the EIFS cladding. Deterioration of the wall sheathing will also increase the risk of this failure.

The following sections address each typical condition observed and describe the relevance of the existing condition with respect to the building envelope performance, impact of future performance, and need for rehabilitation.

Steel Stud Corrosion

The steel studs support the exterior sheathing to which the EIFS is adhered. The exterior sheathing is attached to the steel studs with screws. Corrosion of the flanges on the steel studs reduces the material thickness and thereby reduces the pull out capacity of the exterior sheathing fastener screws.

Where the flange of the steel stud is corroded, rehabilitation efforts should be accelerated to avoid fastener failure and unnecessary stress on adjacent fasteners. The failure of only a few fasteners will not result in imminent collapse or failure of the EIFS cladding. Failure of the EIFS in this instance means detachment from the building. With each fastener failure however, redistribution of support loads will occur and the significance of continued corrosion and future fastener failures increases. Unlike more ductile structures, such as wood framing, it is not necessarily the case that fair warning will precede failure. Due to the progressive nature of the EIFS support system, failure may involve more than one floor level.

Fastener Corrosion

Fastener corrosion within the wall assembly was noted at 74% of the 19 wall exploratory openings at Pacific Point. The fasteners do not appear to be adequately corrosion resistant and increased corrosion can be anticipated if wetting continues to occur within the wall cavity. Corrosion of fasteners is an initial indicator of potential problems. Typically, if the fastening screw is corrosion resistant, corrosion and loss of strength in the steel stud flange material will result in failure before corrosion of the fastener. It is important to note that non-corrosion resistant fasteners, or corrosion resistant fasteners, continually exposed to wet conditions, will eventually corrode and fail at the shank/head interface. Failure of the fastening screws results in loss of anchorage for the exterior sheathing.

Sheathing Deterioration

The role and importance of the exterior sheathing is complex. The sheathing can provide lateral bracing for the steel stud framing, support for the batt insulation and support for the EIFS cladding. The sheathing is also a barrier for fire protection purposes.

The water resistance of exterior gypsum sheathing is relatively poor. Exposing exterior gypsum sheathing to wet conditions results in deterioration of the gypsum materials within the sheathing. The exterior gypsum sheathing is not intended for use in wet applications. Water damaged exterior sheathing loses flexural, compressive and bearing strength. Moisture staining on the interior face of the exterior gypsum was observed at 63% of the interior openings through walls.

Mould Growth

Mould growth, as a health concern, was not assessed by RDH. Mould was observed within a majority of the interior openings. Additionally 49% of the occupant questionnaires indicated problems with mould. At the present time, the polyethylene vapour barrier may be reducing the quantity of any mould spores or growth that may be present from infiltrating the wall assembly to the interior of the building.

Although the ramifications of mould growth in exterior walls are not well established at the present time, it is generally accepted that removal is the most effective remedy. Therefore, remediation should proceed at a time when the affected materials can be easily removed during the natural course of the repair work. Repairs to interior finishes exposed to mould growth are more difficult to contain and costly to undertake. The interior finishes have already been damaged by moisture at some locations.

Based on the sensitivity of this wall type and the evidence of significant deterioration of the materials within this wall assembly, damage to the materials underlying the EIFS cladding at the exposed areas will continue to worsen until rehabilitation is undertaken.

Due to the current corrosion of the steel stud framing we recommend that the EIFS cladding be replaced with a rainscreen wall assembly as part of a rehabilitation program.

It is apparent that the east and south elevations have a more frequent exposure to wind driven rain, and thus, more damage has occurred within wall assemblies on these elevations. However, similar details at window and balcony interfaces are present on other, less exposed elevations.

We recommend complete wall rehabilitation with exception to the curtain wall that was recently rehabilitated. Phasing the full wall rehabilitation of Pacific Point may be an option for some of the less damaged areas. Further investigation should be performed prior to confirming deferral of remediation at any locations.

3	**Replace all exposed EIFS wall areas with new rainscreen wall cladding assembly.**

Wall Type 3 – Mass Concrete Walls

This wall type is located at various columns and walls throughout Pacific Point. Small areas of this wall type were observed on the balconies on the west elevation of Tower B. At one location reviewed, the sealant at the interface with the adjoining EIFS cladding was missing. The addition of a coating applied over the entire concrete surface should be incorporated as part of the rehabilitation plan. The selected paint coating should have a high resistance to water penetration and a high vapour permeance.

The interior condition of this wall type is unconfirmed, however at this time there does not appear to be a need to disassemble the interior portion (steel studs, Insulation, and interior gypsum board). However, the acceptable condition of the elements behind the mass concrete walls should be verified during construction while the adjacent areas are rehabilitated.

4	**Apply paint coating to exposed concrete walls.**

Wall Type 4 – Insulated Metal Panel

This "face sealed" wall type is located at the perimeter of the window wall assemblies that are found throughout Pacific Point. Metal spandrel panels are incorporated into the window assemblies at the slab bypass locations. They are also located vertically along the window wall to EIFS interface.

The detailing beneath the metal panels was not confirmed. It is not known if a protective membrane layer covers the assembly beneath. The panels are constructed out of metal segments, which are butted together. Sealant has been applied topically over the joints, which can be described as a "bandage joint", however, at various locations the sealant has failed and is discontinuous. The wall assembly behind the vertical panels is the same as found behind the adjacent EIFS walls with the exception that the perimeter of the window opening is lined with plywood onto which the window unit is fastened. Maintaining the structural integrity of the plywood liner is paramount to ensuring that the window units remain secured. It should be noted that no holes to accommodate internal water drainage were noted in the bottom edge of the horizontal panels. If the metal panels are to remain as an aesthetic feature at Pacific Point, they should be replaced with improved detailing at the time of wall and window rehabilitation.

5	**Replace the metal panels with improved detailing.**

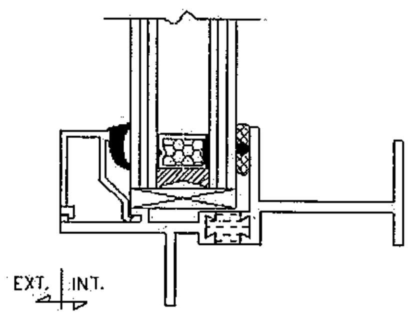
2.4 Windows, Doors and Skylights

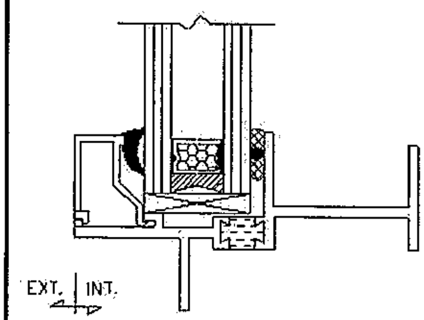
General Arrangement and Types

The glazed assemblies consist primarily of exterior glazed aluminum frame windows including both punch windows and window wall assemblies. Punch windows are single window units contained within the wall framing. Window walls span from the underside of one floor to the underside of the floor above. They typically consist of multiple windows (strip windows) joined by coupling bars. Most of the operable vents at Pacific Point are sliding however, some awning vents have been incorporated into the smaller punch window units. Sliding glass doors and swing doors provide access to balconies and roof decks. The newly installed curtain wall at the north end of Tower B was not included in the scope of this review.

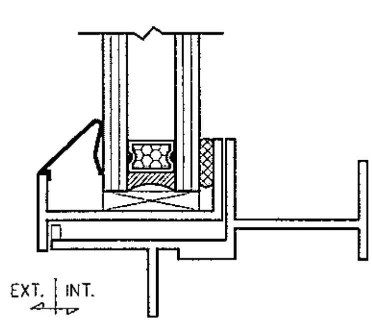
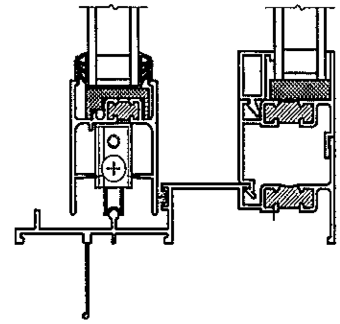
The relevant glazed assemblies and doors are described in Table 2.3.:

Table 2.3 Glazed assemblies and doors





	1: Improved Concealed Barrier	2: Improved Concealed Barrier
Manufacturer	Westcraft	Westcraft
I.G. Date	N/A	N/A
Drainage	Weep holes	Weep holes
Thermal Break	No	No
Opener Type	Slider	Awning
Flashing	At sill	At sill
Glazing stops	Glazing spline	Glazing spline
Perimeter Trim	Wood interior sill	Wood interior sill
Perimeter Sealant	Exterior	Exterior
Glazing Type	Double	Double
I.G. Unit Seals	Aluminum	Aluminum

	 	
	1: Concealed Barrier	2: Sliding Glass Door
Manufacturer	Westcraft	N/A
I.G. Date	N/A	N/A
Drainage	Weep holes	Weep holes
Thermal Break	No	No
Opener Type	Slider	Slider
Flashing	At head	N/A
Glazing stops	Rolled in aluminum stops	N/A
Perimeter Trim	Ceramic interior sill	Wood stool
Perimeter Sealant	Yes	Yes
Glazing Type	Double	Double
I.G. Unit Seals	Aluminum	Aluminum

Visual Appearance

Our visual examination of the glazed assemblies revealed the following:

- The glass areas observed consist of full height window wall sections, coupled strip windows, and punched windows.
- All windows observed are a concealed barrier type. The exterior glazed lites are held in place with vinyl spline gaskets on the majority of the windows and aluminum roll beads on some of the windows.
- The window frames appear to be non-thermally broken.
- Weepholes are typically present from the glazing pockets to the exterior.
- Operable types are predominantly sliding vents, however, some smaller punched windows are awning vents. Typically, sliding type vents have a much lower resistance to water penetration than awning type vents;.
- Glazing tape pump-out is common.

- Plywood liners are located around the perimeter of the window rough openings reviewed.
- The windows are fastened to the rough openings with screws through the condensation track profile at the sill and jambs.
- There is no sub-sill level drainage membrane beneath the windows.
- There is a metal slab band panel located over the slab edges between the window wall sections.
- The undersides of the metal panels do not have weepholes. Therefore, there is no means of draining for water that penetrates joints in the panels.
- Failed sealed units are common throughout all window types. Sealed units that have failed have condensation between the panes of glass.
- The balcony sliding doors that were reviewed do not contain a sub-sill drainage membrane beneath the threshold. The majority of the balcony sliding doors are protected from direct exposure to rainfall.

Exploratory Openings

Ten exploratory openings were made beneath windows and doors located in exterior walls to confirm conditions of concealed components and materials within the assemblies. The details and photos of the exploratory openings can be found in Appendix E.

Summarized in Table 2.4 is the current level of damage observed in the interior exploratory openings at window / door assemblies.

Table 2.4: Condition of Components (Window / Door Exploratory Openings)

Condition	Observed	Percentage *
Corroded hardware fasteners	7/10	70%
No waterproof subsill drainage layer beneath frame	10/10	100%
Significant staining of components beneath frame	10/10	100%
Mould present beneath frame	6/10	60%
Corroded fasteners in wood liner	9/10	90%
Deterioration of wood liner	7/10	70%

* A total of 10 openings were included.

Water Penetration Testing

On November 19, 2002, water penetration testing was conducted on one of the existing windows on the connector building. The window was an existing non-thermally broken, rebate frame, punched window. The testing was preformed specifically in Suite 208A, 431 Pacific Street, on the south end of the east elevation. The complete results of the test can be found in Appendix F.

Typically, water penetration testing is performed on exterior window configurations to determine the existing performance level of the typical installed windows and to determine paths of possible water leakage.

The water penetration testing exposes the exterior of the window and adjacent wall area to water by spraying water from rain racks. During the test, a door fan is used to exhaust interior air from the test location suite to create a negative air pressure across the window and wall area. The intent of the test is to simulate the conditions of wind driven rain. The test is carried out in general conformance with the ASTM E1105 standard for field-testing window assemblies for water penetration. Water penetration tests contribute to establishing the performance level of the existing windows. The use of standard protocol also makes the results meaningful to others who may review the results of our condition assessment work.

Based on the CAN/CSA A440-M90 standard for windows, a water penetration resistance rating of B5 (500 Pa pressure differential) is recommended for many of the windows at Pacific Point. However, due to the significant water leakage, testing was preformed to a maximum air pressure differential of approximately 150 Pa.

Water ingress occurred at multiple locations prior to application of any pressure differential. The leakage that occurred into the wall assembly and onto the interior surfaces indicates that the window tested could not withstand any pressure differential with regards to water penetration. Some of the tests were terminated prior to completion due to excessive water leakage through the window to the interior of the suite.

Discussion and Recommendations

Windows

From information obtained from the questionnaires and our review of documentation relevant to moisture related problems, we are aware that complaints have been made in the past regarding rainwater leakage and condensation associated with the windows. The windows and the manner in which they are installed make the assemblies vulnerable to visible water leakage into the suites and concealed water leakage into the wall assembly. A discussion of several problematic aspects of the windows follows:

Water Leakage Through Mitred Frame Joint

The glazing spline and glazing stop was often observed to be discontinuous at the corner interface of the window frames. This condition typically results in water entry into the glazing cavity. The glazing cavity is a pocket at the bottom of the window frame beneath the insulating glass (IG) Unit. Although the glazing cavity is provided with drainage slots to redirect this water to the outside, the glazing cavity is seldom level and water accumulating in the corners typically exposes the mitred aluminum frame joints to standing water and hence an increased probability of leakage. Water leakage through the mitre joints can result in corrosion of steel, liner decay, gypsum sheathing deterioration, and mould growth. These conditions were found beneath most of the windows reviewed at Pacific Point.

The mitred window frame joints are difficult to seal properly during assembly and even more difficult to maintain during the anticipated service life of the window. Small joint sealant is used to seal the aluminum-to-aluminum joint. Leakage at the mitred joints can occur as a result of misalignment of the frame components, improper cutting of frame material, improper placement of sealant at the joint and screw attachments, racking during installation, movement during use, deterioration of the sealant, abrasive damage during cleaning, etc.

Interface of Windows with Wall Assemblies

Water can also penetrate through discontinuities between the window frame and the adjacent wall assemblies. There is perimeter sealant at the window openings however, the current effectiveness of the sealant is questionable. The sealant was commonly observed to not have enough "bite" onto the window frame. Significant discontinuities were discovered during our exploratory opening work. There is no sub-sill drainage membrane beneath the windows. Water that bypasses the window frame is likely to be directed into the wall where it can damage various adjacent materials. Drainage holes are provided in the exterior face of the window frame of the windows installed at Pacific Point. The drainage holes are intended to drain away incidental water ingress past the exterior glazing stop and glazing spline.

Performance of IG Units

Observations were made of numerous failed insulating glass units during both the exterior review and the interior review. Although we have not investigated the extent of failed IG Units in-detail, it is common for a few units to start to fail after ten years and the remainder continuing to fail gradually over the following ten to fifteen years. Many IG Units require replacement.

Condensation Performance

The typical windows at Pacific Point were observed to be non-thermally broken. As such, the interior surfaces of the frame are much cooler than the same surface would be in a thermally broken window frame. It is likely that these poor thermal performance conditions in conjunction with high relative humidity within the suites has, and will continue to result in the formation of condensation.

Due to the design of the existing windows it is almost impossible to improve their thermal performance. Therefore, if the windows are not replaced, then reducing condensation potential must focus on the elimination of the moisture sources both from the interior and the exterior.

It is apparent that the windows and the manner in which they are installed contribute to water damage and the concealed deterioration of the adjacent wall construction. In addition, observations at exploratory openings revealed stains and deterioration on plywood window liners that are consistent with patterns typically caused by leakage directly through the window (in addition to through the window to wall interface).

We recommend the replacement of all windows to be included in the rehabilitation plan.

6	**Replace non-thermally broken exposed windows with thermally broken rainscreen windows at the time of wall rehabilitation.**

Skylights

The skylight on the main roof of the connector building was not thoroughly reviewed. Modifications and or replacement should be further investigated during roof rehabilitation.

There are bay windows on the west elevation of both towers. The sides of the bay windows are basic punch windows with coupling bars at the outside corners. The top of the bay windows are constructed of sloped glazing. Typically, sloped glazing should be constructed using a skylight frame that is specifically designed and constructed for this purpose. The sloped glazing above the bay windows at Pacific Point is simply constructed of a conventional window tipped on its side.

Sloped glazing has also been utilized at the perimeter of the tropical room. One of the failed units was partially filled with water. This is a safety hazard that should be addressed as soon as possible.

Glass canopies

Glass canopies cover the exterior walkways that face the courtyard (located below the various roof levels of the connector building). The canopies consist of sloped glazing that is supported by HSS (hollow steel section) frames. Rainwater leaders drain the gutters positioned along the lower edge of the glazing. The upper portion of the sloped glazing interfaces with the EIFS cladding on the roof parapet.

The glass canopies are in poor condition and are contributing to the wetting of the soffits, walkways and wall surfaces below. Significant corrosion was observed on several of the HSS frames. Typically this was observed at the exposed ends of the canopy sections where water management is very poor. Corrosion was also observed at various weepholes and open ends of the HSS members. Concentrated water runoff was observed at the canopy interface with the exterior wall (Tower B) during periods of rain. In some areas the HSS members at the end of the frames protrude into the EIFS cladding of the exterior walls. Wetting at this interface was observed.

Corrosion and water was observed on the steel spacers that shim the frames away from the slab support. An exploratory opening was made through the EIFS cladding at the lower frame attachment to expose the hidden components. Water from above the canopy was passing within the EIFS cladding and entering into the exterior wall of Suite 306A. The cause of the water ingress was not confirmed, however it was noted that there was no waterproof membrane beneath the cap flashing. (Exterior Opening #2)

In addition, the canopies have not been adequately maintained. Excessive organic growth and staining was observed on the frame components beneath the glazing and on adjacent wall surfaces. Water runoff on the outer surface of the rainwater leaders was commonly noted.

7	**Replace glass canopies at time of wall rehabilitation.**

Balcony Sliding Glass Doors and Swing Doors

Many doors at Pacific Point are in high exposure locations and are usually not protected from wind driven rain. Damage and water leakage through and around these doors was observed during condition assessment work. Generally, typical detailing at these doors decks and balconies would incorporate a waterproof membrane at the sill of the openings joining into to a main field membrane to provide a continuous barrier to water ingress. However, no waterproof membrane was observed at the perimeter of the door openings at Pacific Point. Perimeter sealant was typically installed at the door openings however, the installation and current condition of the sealant was often inadequate. The sealant was commonly observed to not have enough "bite" onto the frame of the doors. Additionally, the threshold of the doors was commonly located at the level of the exterior surface (concrete pavers, ceramic tiles), further exposing the penetration to wet conditions.

If the doors are removed, the openings can be made waterproof, perimeter details can be improved, and a sub-threshold flashing can be installed beneath the door to drain away any penetrating rainwater. At this time the threshold could be raised above the level of the exterior surface. The membrane installation would be performed in conjunction with the addition of a waterproofing membrane in the main field of the deck or balcony.

In some locations, such as the balconies on the west elevation of Tower B, the exterior swing doors are covered by a significant overhang and would unlikely be subject to wind driven rain. Similarly on the connector building, the suite access doors that face the courtyard are also under a significant overhang and would not likely be exposed to water.

8	**Improve the perimeter waterproofing details at the balcony sliding and swing doors. Co-ordinate membrane tie-ins with the addition of a balcony membrane. Install new thermally broken sliding doors.**

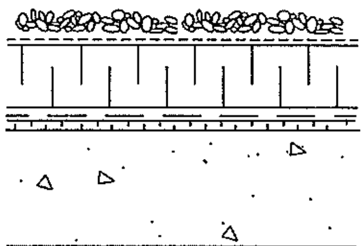
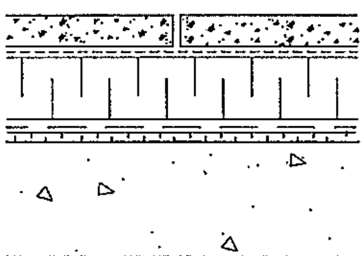
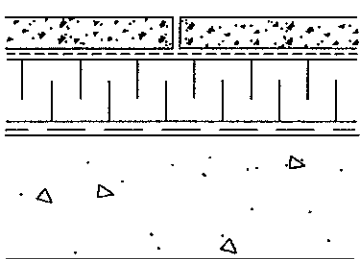
2.5 Roofs and Decks

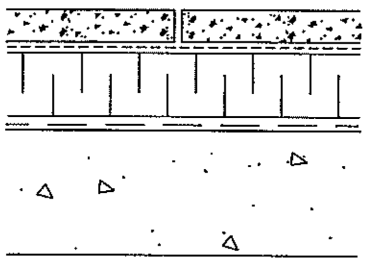
General Arrangement and Types

There is an inverted roof assembly on the primary roof areas. This type of roof assembly has the insulation on top of the waterproof membrane as opposed to having the insulation below the waterproof membrane. (Table 2.5) Inverted roof membrane assemblies can be very effective if a good quality membrane is properly installed. With this type of assembly, the membrane is protected from thermal extremes and mechanical damage by the insulation. At Pacific Point, a 45 mil EPDM (rubber sheet) membrane has been used. In our experience, 60 mil membranes are more typical for this application.

Decks over living space (roof surface that is regularly occupied) are present throughout Pacific Point. These are predominantly EPDM assemblies, however some roof decks have been replaced with SBS modified asphalt torch-on membrane. RDH was informed that some of the decks on the east elevation, above the ground floor residential units, have had the original membrane replaced with a liquid applied membrane. Additionally, various balconies and decks at Pacific Point are enclosed by structures with sloped metal roofs. An EPDM membrane was noted at the floor level within some of these interior spaces.

Table 2.5 Roof and Deck Assemblies

	Exterior Gravel Ballast on Filter Fabric on Rigid insulation on EPDM on Thin layer of insulation Concrete Interior
1: Main Roof, EPDM system	
	Exterior Concrete Pavers on Filter Fabric on Rigid insulation on SBS Membrane on Thin layer of insulation Concrete Interior
Various Decks, EPDM system	(Confirmed by resident caretaker, A. Charneski)
	Exterior Concrete Pavers on Filter Fabric on Rigid insulation on SBS Membrane on Concrete Interior
Various Decks, SBS system	

	Exterior Concrete Pavers on Filter Fabric on Rigid insulation on Liquid applied membrane on Concrete Interior
Various Decks, liquid applied	(Assembly unconfirmed)
	Exterior Metal roofing Interior
Sloped metal roofs	(Assembly unconfirmed)

Visual Appearance

Our visual examination of the roofs revealed the following. Complete details of the individual drops can be found in Appendix G:

- The EPDM roof assembly is currently leaking at various locations. RDH was advised of previous leaks through EPDM assemblies.
- There are several Lap-Seam failures in the EPDM membrane.
- Parapets without protective membrane beneath the segmented metal cap flashings are common.
- Failed caulking at the segmented metal cap flashings and base flashings and at flashing interfaces with exterior walls is common.
- The cap flashings have little-to-no slope, hence, increasing the probability of leakage through the joints.
- At various locations, the parapets terminate in close proximity to the window glazing. This close proximity makes it difficult to install a properly configured cap flashing termination.
- Saddle flashings and crickets have not been incorporated at the cap-flashing interfaces with exterior walls.
- Pooling water is common within the EPDM gutters at the perimeter of the sloped metal roofs. At various locations this occurs above living space.
- Inadequate details at drain scuppers and overflow scuppers through parapets.

- Fastener corrosion was present on all of the sloped metal roofs that were reviewed.
- Peel-and-stick membrane, that has been installed below the cap flashings in some locations, is part of a rehabilitation program.

There are sloped metal roofs at select locations throughout the complex. In some locations, the sloped metal roofs are not over occupied space so leakage does not have a significant consequence; in other locations, the roofs are over occupied space. All of the roofs are constructed with "exposed fastener" assemblies. Any water that leaks through the fasteners is inside the roof assembly and will not be drained back to the exterior. Leakage around the fasteners on this type of assembly is common because the washers below the screw heads deteriorate and because the roof sheets move enlarging the penetrations. The fasteners are corroding on a significant number of the roofs.

It is currently considered poor practice to use exposed fastener roofs over occupied space.

Discussion and Recommendations

The waterproof membrane assemblies and corresponding parapets at the roof areas are not performing adequately and will require full rehabilitation in the near future. Various deficiencies have been noted including some that may be causing the current leaks and ongoing roof related water ingress at Pacific Point.

The detailing of the parapet cap flashings is inadequate. Failed and discontinuous caulking sealant was commonly observed on the seams and at interfaces with exterior walls. The absence of a consistent membrane layer beneath the cap flashings has resulted in internal wall and roof components to be exposed to moisture. The presence of a membrane below the cap flashings is a minimum safeguard against possible discontinuities of the shedding surface at seams and penetrations.

It will be necessary to monitor and repair the roof membrane as leaks appear. Diligent and proactive roof maintenance is required until the roof and parapets can be fully rehabilitated.

The condition of the roof decks that have been upgraded with the installation of an SBS modified bitumen system was not confirmed. Further investigation of these assemblies should be performed prior to rehabilitation.

The sloped metal roofs that are found throughout Pacific Point should be redesigned at the time of roof rehabilitation. Ponding water was commonly observed within the EPDM gutter. The configuration of this assembly has it located along exterior walls and above living areas. Additionally, corrosion was commonly observed on the metal panels and fasteners. In some locations these structures are separated from the living area and are partially open to the exterior. These too are attached to adjacent walls, which again is not ideal for water management at the perimeter of the roof. Replacing these with a freestanding gazebo structure should be considered.

9	**Replace all roof and deck membranes with improved details at the time of wall rehabilitation.**

2.6 Walkways and Balconies

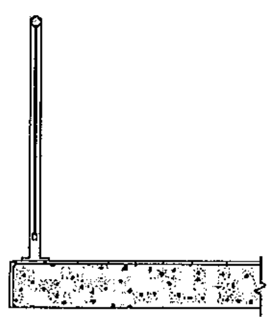
General Arrangement and Types

Exterior walkways are located on the courtyard side of the connector building, extending between Tower A and Tower B. The primary purpose of the walkways is to access the suites in the Connector building. An elevator and two exterior stair structures extend between the various walkway levels. It was unconfirmed whether the balconies and walkways contain a waterproof membrane beneath the ceramic tile floor covering. Additionally it was unconfirmed whether a membrane has been installed at the balcony to exterior wall interface. The exposure of the walkways is varied. Floor to ceiling glazing has been incorporated along the outer edge at some locations. This is typically aligned with the suite access doors. The glazing acts as the guardwall and provides significant protection from wind and rain. Aluminum picket guardwalls extend between the glazed assemblies and interface with the towers. Water is drained over the front edge of the walkway.

The balconies at Pacific Point are located on the west elevation of Tower B and extend up to the 15^{th} floor. Glazed guardwalls help protect the exterior face of each balcony. Water is drained over the front edge. The presence of a waterproof membrane was not confirmed. The balconies are covered with ceramic tile flooring. Photos of the walkways and balconies can be found in Appendix B.

The relevant balcony and walkway assemblies are illustrated in Table 2.7.:

Table 2.7 Balcony and Walkway Assemblies

	Above Ceramic tile flooring Reinforced concrete slab Cement skim coat Below
1: Balcony / Walkway (similar)	Confirmed by visual observation
	Above Ceramic tile flooring Concrete Metal Q-deck Metal hat track Gypsum board Cement skim coat Below
1: Stair landings (similar)	

Visual Appearance

Our visual examination of the exterior balconies and walkways revealed the following:

- The balconies and walkways have very low slope.
- A ceramic tile covers the surface of the balconies and walkways.
- The ceramic tile on the exposed front edge of the balconies and walkways extends below the bottom surface of the soffit.
- Joint sealant is present at the interface between the wall cladding and the tile surface. At various locations the sealant is deteriorated and discontinuous. (Photo M-01)
- Ponding water is common on the tiled surface of the walkways. Ponding is common beneath areas with overhang.
- Stains from previous ponding water are present on some of the balconies. In some areas the stains are against the exterior wall. (Photo M-02)
- Water stains are present on the soffit of the walkway. The stains are typically positioned along the outer edge of the walkway, however some are located in interior areas. The pattern of the staining suggests that there may be moisture passing directly through the walkway. (Photo M-03)
- Significant staining occurs beneath the vent hoods located in the edge of the walkway. (Photo M-03)
- The threshold of the swing doors that accesses the balconies is level with the tiled surface. The interior floor level is below the level of the walkway. (Photos M-04 and M-05)
- Significant organic growth was observed on the grout between the tiles of various balconies. (Photo M-06)
- During periods of rain excessive water ponding occurs on the tiled surfaces of the stairs and landings. Corrosion is present on the steel stair structures.

Discussion and Recommendations

A significant amount of water was observed on the exterior walkways and stairs that access the connector building. Water ponding during periods of rain is common due to limited protection and to the limited slope of the tiled surfaces. This can result in corrosion of the steel reinforcing and exhaust ducts within the walkway assembly. Additionally, the balconies on the west elevation of Tower B have inadequate slope and poor detailing at the interface with exterior walls.

We recommend that a continuous waterproof membrane be installed on the surface of the walkway and interface with membrane at the exterior walls. The slopes of these locations should be corrected prior to the installation of the new membrane. Replacement of the ceramic tile on the balconies after installation of the new membrane will be difficult and expensive.

10	Re-slope balconies and walkways and install continuous waterproof membrane.

2.7 At-Grade Assemblies

General Arrangement and Types

A non-destructive review was performed of the at grade assemblies located at Pacific Point. The outdoor garden pool was not reviewed.

Visual Appearance

Our visual examination of the at-grade assemblies revealed the following:

- Concrete planters are located adjacent to the exterior walls of the tropical room. Efflorescence staining is present on the interior side of the wall. This wall does not appear to have provisions for thermal separation.
- Others had exposed the waterproof membrane within one of the planters above the underground parking area. The self-adhered membrane appears to be in poor condition.
- In several areas, the bottom of the EIFS cladding is touching the surface of the finished grade. A joint sealant is present at this interface. Typically, the EIFS should be elevated above hardscape and landscaping.
- A significant overhang covers the commercial space on the east and south elevations of the Pacific Point.
- The at-grade drainage is poor in several areas. Ponding on the tiled surface of the courtyard is typical during periods of rain.
- When pressure is applied vertically to the exposed aggregate landing at the front entrance (431 Pacific Street) water leaches out of the joints.
- Ponding water occurs adjacent to various entranceways. The door thresholds are typically level with the tile surface.

Discussion and Recommendations

Significant ponding water in the courtyard area was observed during periods of rain. We recommend that the surface drainage be improved in the courtyard and at all entranceways.

During exterior wall remediation, better access to review the condition of the at-grade assemblies and waterproof membrane will be possible. A contingency amount should be budgeted to improve or repair any observed deficiencies in the existing waterproofing.

Isolated water leakage into the parkade does not normally present a serious problem for the building envelope above grade level. A brief visual review of the parkade did not reveal any signs of extensive water leakage that would be indicative of systemic failure of the waterproof membrane above the parking slab.

11	**Undertake targeted repairs to at-grade waterproofing as required. Improve or repair observed deficiencies and interfaces during rehabilitation program.**

3 REHABILITATION PLAN

3.1 The Need for Rehabilitation

Our recommendations are based on a combination of observations and test results collected at Pacific Point as well as experience and knowledge gained from investigations of many other buildings with similar assemblies and details. Assessment techniques included a review of design drawings, review of available documentation, visual observations, and exploratory openings. Evidence found during our current investigation in addition to reports of water ingress into the suites indicates that significant moisture problems exist within the building envelope of Pacific Point.

If no action is taken, concealed water penetration damage will likely continue and the extent of the problem will become progressively more evident as the incidence of visual water damage to interior finishes increases. Currently, various materials within the wall assemblies are deteriorated and require replacement. The primary cause of this damage is water infiltration from the exterior.

Water penetration generally impacts a building in two ways; leakage may occur to the interior of the building and damage interior finishes, or water may penetrate into the wall assemblies and cause deterioration of building materials and components within the wall. Reports by owners indicate that water penetration into suites has occurred in the past and continues to occur. Water penetration into exterior walls has also occurred, although this is not always apparent from a visual inspection of the interior of the suites.

The existing EIFS wall assemblies are not appropriate for the exposure conditions that exist at Pacific Point. Evidence of damage to concealed wall components provide confirmation that the building envelope is not performing. It is not possible to repair the existing wall assemblies to provide acceptable performance, and it is therefore recommended that the rehabilitation program include complete replacement of the existing EIFS wall areas with rainscreen wall assemblies. It may be feasible to retain and monitor the existing walls in selective, less exposed locations, such as on balconies. However these areas also require remediation of the balcony surface.

In order to provide adequate protection for the steel reinforcing and the in-slab exhaust ducts, we recommend that the balcony slabs and elevated walkways be resloped and waterproofed as part of the rehabilitation program.

The windows and doors are not providing acceptable performance and have contributed to moisture damage within the walls. They should be replaced as part of the wall rehabilitation work. While it may be possible to retain some of the existing windows in protected areas of the building, their poor thermal performance suggests that they should also be considered for replacement.

The waterproof membrane assemblies on the roof areas and parapets are not performing adequately and will require full rehabilitation. There is a high probability of damage to the EPDM membrane on the roof parapet walls when the exterior walls are rehabilitated.

The at-grade hardscape has potential for problems. It is recommended that an amount be budgeted to re-slope hardscape surfaces and repair any observed deficiencies in the existing waterproofing during the rehabilitation program.

Rather than including comprehensive changes to the suite exhaust system, we recommend that the performance be assessed following completion of general rehabilitation of the building envelope. Our experience has been that exhaust ventilation systems need to be evaluated in the context of the actual envelope performance. Improvements to the walls and windows may dictate that only targeted repairs and replacement is required to achieve acceptable performance from the exhaust system. Any obvious deficiencies can be addressed during the building envelope rehabilitation project through allowances carried within the budget.

A summary of all rehabilitation and renewal recommendations for the work identified in Chapter 2 is presented in the following Table 3.1 – Rehabilitation and Renewals Summary:

Table 3.1 – Rehabilitation and Renewals Summary

1	Review suite ventilation system after completion of the building envelope rehabilitation program and undertake targeted replacement or improvements.
2	Review the environmental separation and air exchange system at the tropical room and the adjacent lobby and amenity areas.
3	Replace all exposed EIFS wall areas with new rainscreen wall cladding assembly.
4	Apply paint coating to exposed concrete walls.
5	Replace the metal panels with improved detailing.
6	Replace non-thermally broken exposed windows with thermally broken rainscreen windows at the time of wall rehabilitation.
7	Replace glass canopies at time of wall rehabilitation.
8	Improve the perimeter waterproofing details at the balcony sliding and swing doors. Co-ordinate membrane tie-ins with the addition of a balcony membrane. Install new thermally broken sliding doors and new swing doors.
9	Replace all roof and deck membranes with improved details at the time of wall rehabilitation.
10	Re-slope balconies and walkways and install continuous waterproof membrane.
11	Undertake targeted repairs to at-grade waterproofing as required. Improve or repair observed deficiencies and interfaces during rehabilitation program.

3.2 Rehabilitation Costs

Based on the previous recommendations, preliminary order of magnitude estimates have been prepared for the rehabilitation and renewals work. Due the complexities of the building form a rough budget has been prepared for undertaking comprehensive rehabilitation. It is important to remember that the rehabilitation work program and costs are refined during the design phase. Refer to Table 3.2 - Estimated Budget Cost Summary below:

Table 3.2: Preliminary Order of Magnitude Costs

Description	Complete Rehabilitation
Exterior Walls – 100,00 ft^2	$6,000,000.
Low Slope Roofs – 23,000 ft^2	$460,000.
Sloped metal Roofs -	$36,000.
Construction Sub-Total	$6,500,000.
Engineering Design, Administration and Field Review Fees	$600,000.
Sub Total	$7,100,000.
GST (on Construction & Engineering)	$500,000.
PST Refund	($195,000.)
Warranty (2-10 Willis Warranty)	$183,000.
Total Project Budget (rounded)	$7.5 – 8.5M

In reviewing preliminary order of magnitude costs, it is important to understand that although they are based on our experience with similar projects, they are presented as probable costs, and are based on approximate unit rates without a complete design developed. A more precise overall figure can only be obtained as the design is undertaken and when contractors actually bid on the project. The construction industry-pricing environment can vary significantly, and is dependent to a certain extent on factors external to the actual project. Many decisions regarding the rehabilitation design and implementation are yet to be made which may **significantly** influence these amounts.

3.3 Next Steps

The condition assessment report presents conceptual level recommendations with respect to rehabilitation and 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 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 the owners in making decisions with respect to specifics of the rehabilitation 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 phase. During this phase, the remedial work program that has been designed by the consultant is implemented, and repair and reconstruction takes place on-site. The consultant administers the construction contract and undertakes field review of construction as the work proceeds. It is usual for the consultant to provide a maintenance and renewals plan (or update an existing plan) for the rehabilitated envelope assemblies upon completion of the construction.

4 SUMMARY

The current condition of the building envelope assemblies was assessed for the purpose of planning for rehabilitation and longer-term renewal activities.

Assessment techniques included a review of design drawings, review of available documentation, visual observations, exploratory openings, and water penetration testing.

Pacific Point has experienced damage due to water penetration most notably in the EIFS wall assembly and in the window wall assembly at the interface of these walls with the adjacent window and balcony assemblies. Damage to wall components and materials includes corrosion of steel studs / fasteners and damage to interior finishes. Significant leakage at the window to wall interface was observed. The performance of the windows themselves was determined by water penetration testing as part of the scope of work in this condition assessment. The roof assemblies are currently leaking and require full remediation. The at-grade waterproofing requires further review at the time of full wall rehabilitation.

There is a need to address current building envelope performance problems through a comprehensive rehabilitation program. The primary features of the recommended program will include complete wall, window and roof rehabilitation as well as improved detailing of the balcony and walkway areas.

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GLOSSARY

A number of the terms which are used in this report have specific meaning in the context of this report and are, therefore, defined below:

Air Barrier refers to materials and components that together control the flow of air through an assembly and, thus. limit the potential for heat loss and condensation due to air movement.

Assembly refers to the collective layers of components and materials which together comprise the complete cross section of the wall or roof.

Balcony refers to a horizontal surface exposed to outdoors, and intended for pedestrian use, but projected from the building so that it is not located over a living space or acting as a roof.

Base Flashing refers to the part of the roofing that is turned up at the intersection of a roof with a wall or another roof penetration. It may be made of the same material as the main roofing membrane or of a compatible material.

Building Envelope, now called an environmental separator in Building Codes, refers to those parts of the building which separate inside conditioned space from unconditioned or outside space, and includes windows, doors, walls, roofs, and foundations.

Cap Flashing sheds water from the tops of walls. It is difficult to make metal cap flashing waterproof at joints and intersections, and it, therefore, requires a secondary, continuous and waterproof membrane below it.

Cladding refers to a material or component of the wall assembly which forms the outer surface of the wall and is exposed to the full force of the environment.

Concealed Barrier refers to a strategy for rain penetration control that relies on the elimination of holes through a combination of the cladding as well as a secondary plane further into the assembly.

Counter Flashing prevents water from penetrating behind the top edge of base flashing, and consists of a separate piece of flashing placed over the top of the base flashing. It is usually made of sheet metal.

Cross Cavity Flashing intercepts and directs any water flowing down the cavity of a wall assembly to the exterior.

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.

Deflection refers to a water management principle that utilizes features of the building and assembly geometry to limit the exposure of the assemblies to rain.

Drainage refers to a water management principle that utilizes surfaces of the assemblies to drain water away from the assembly.

Drip Flashing directs water flowing down the face of vertical elements, such as walls or windows, away from the surface so that it does not continue to run down the surface below the element.

Drying refers to a water management principle that incorporates features and materials that speed diffusion and evaporation of materials that get wet.

Durability refers to a water management principle that utilizes materials that are tolerant of moisture.

Element refers to a material or component within the assembly intended to perform a function(s).

Face-Seal refers to a strategy for rain penetration control that relies on the elimination of holes through the cladding.

Flashing refers to materials used to deflect water and make waterproof connections at interfaces and joints within and between wall and roof assemblies.

Horizontal Movement Joint refers to a horizontal joint on a wall which provides capability for differential movement of portions of the building structure (expansion joint) or prevents or localizes cracking of brittle materials such as stucco (control joint).

Housewrap refers to a sheet plastic material which is used as a breather type sheathing membrane, generally between the wall sheathing material and the exterior cladding. Although at one time used as a proprietary term, housewrap is now used to represent a generic group of materials. One common type of housewrap consists of Spun-Bonded Polyolefin (SBPO), another is made of perforated polyethylene.

Maintenance refers to a regular process of inspection and minor repairs to the building envelope.

Moisture Barrier is generally considered to be the surface farthest into the assembly from the exterior which can accommodate moisture without causing damage to the assembly.

Moisture Content of wood refers to the weight of water contained in wood expressed as a percentage of the weight of oven dry wood.

Operation of the building or envelope refers to normal occupancy of the building where the envelope is affected by interior space conditioning, changes to light fixtures, signs, vegetation and planters, and accidental damage or vandalism.

Penetration refers to a intentional opening through an assembly in which ducts, electrical wires, pipes, and fasteners are run from inside to outside.

Pressure Treatment refers to a variety of processes for treatment of wood to provide greater durability.

Rainscreen refers to a strategy for rain penetration control that relies on deflection of the majority of water at the cladding but also incorporates a cavity which provides a drainage path for water that penetrates past the cladding.

Saddle refers to the junction of small horizontal surfaces, such as the top of a balcony guardrail or parapet wall, with a vertical surface, such as a wall.

Sheathing refers to a material (generally OSB or plywood) used to provide structural stiffness to the wall framing and to provide structural backing for the cladding and sheathing paper.

Sheathing Membrane refers to a material in an exterior wall assembly whose purpose is to retard penetration of water further into the structure once past the cladding. Waterproof type sheathing membranes can also perform the function of the air barrier and the vapour barrier. These materials include both breather type sheathing membranes such as sheathing paper and housewraps, and waterproof sheathing membranes.

Sheathing Paper refers to asphalt impregnated organic sheet material (breather type sheathing membrane) which creates a water shedding surface behind the cladding.

Stepped Flashing is installed at the junction between a sloping roof and a wall running parallel to the slope. Both base and counter flashing are overlapped and installed in pieces following the slope to form the complete stepped flashing.

System describes a combination of materials and components that perform a particular function such as an air barrier system, or moisture barrier system.

Through-wall Flashing refers to a waterproof membrane or metal flashing placed under segmented precast concrete, stone masonry or brick units known as copings close to the tops of masonry walls to prevent water from entering the wall at joints in the coping. Through-wall flashing is also used to prevent capillary transfer of moisture through porous materials such as concrete or masonry if they extend from high moisture locations such as below grade.

Valley Flashing is installed in the valleys of sloping shingle roofs to give continuity to the roofing system.

Vapour Barrier refers to a material with low vapour permeability which is located within the assembly to control the flow of vapour and limit the potential for condensation due to diffusion.

Walkway refers to a corridor exposed to outdoors which provides pedestrian access between suites and stairwells or elevators. It may or may not also be a roof.