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REPORT

Building Envelope Condition Assessment – VR 329- Purcell Woods

1804-2088 Purcell Way
North Vancouver, British Columbia

Presented to:

The Owners, Strata Corporation VR 329

C/O Mr. George Alexandru
Vancouver Condominium Services Ltd.
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1. INTRODUCTION

1.1 Terms of Reference

Morrison Hershfield (MH) was retained by the owners of Purcell Woods (Strata Corp. VR 329) to undertake an assessment of the current condition of the building envelope systems of their buildings located at 1804-2088 Purcell Way, District of North Vancouver. Authorization for the study was provided in writing March 5, 2004, by George Alexandru of Vancouver Condominium Services Ltd.

The objective of this investigation was to assess the current condition of the building envelope of the property and to provide our recommendations with respect to any required remedial work or further investigations.

1.2 Scope of Work

The scope of our services was outlined in our proposal letter to George Alexandru of Vancouver Condominium Services Ltd., dated February 5, 2004 and is attached in Appendix E for reference purposes:

During the course of work we varied from the proposed scope of work in the following way:

- We focused on two townhouses (Buildings F and R) and the two maisonettes (Buildings D and P). Our proposal had indicated that we would focus on five blocks, however our visual review indicated that the townhouses were in relatively good condition and the maisonettes appeared to be more problematic. We therefore concentrated our probing and test openings at the two maisonettes and did some representative sampling at the two townhouses.

1.3 Limitations

This assessment is based on a review of available documents and visual inspection, selective moisture content measurements and test openings taken at a sample of building envelope elements.

It is a basic assumption that any correspondence, material, data, evaluations and reports furnished by others are free of latent deficiencies or inaccuracies except for apparent variances discovered during the completion of this report.

The sheathing moisture content measurements and test openings were done at typical building details believed to be possible locations of water penetration. They do not represent a total listing of all locations with deficiencies nor do they imply all similar locations or items to be deficient.

This report documents the current condition of elements of the building envelope and may identity factors or mechanisms that lead to the current condition. The report is not intended to provide an opinion regarding responsibility of any party in causing or contributing to the found condition.

Any comments or conclusions within this report represent our opinion, which is based upon the documents provided to us, our field review of physical conditions, specifically identified testing and our past experience.

In issuing this report, MH does not assume any of the duties or liabilities of the designers, builders or owners of the subject property. Owners, prospective purchasers, tenants or others who use or rely on the contents of this report do so with the understanding as to the limitations of the documents reviewed, the general visual inspection undertaken and understand that MH cannot be held liable for damages which may be suffered with respect to the purchase, ownership, or use of the subject property.

1.4 Documents Reviewed

MH reviewed the following documents to assist in our assessment of the condition of the building envelope systems:

Document Description	Prepared By	Date
Architectural Drawings A1, A12 to A18, A24 to A27	Dunhill Development Corporation Ltd.	June 6, 1975

These documents were obtained from the city and will be provided to the owners.

1.5 Details and History of Building

Purcell Woods is a 3-storey, 143 unit complex constructed in 1976. The complex is comprised of 16 townhouses and 2 maisonettes. The buildings are wood framed. The primary cladding is cedar siding with some stucco cladding at townhouse chimneys and maisonettes. Windows are a combination of fixed and operable units. The operable units are mainly sliders with some awning. There are sliding patio doors at balconies.

The following table provides general information about the buildings. Refer to Photos 1 to 5, Appendix C for general views of the buildings. Figure 1, Appendix D provides a key plan of the arrangement of the site and buildings.

Building Address/Name	VR 329- Purcell Woods, 1804-2088 Purcell Way, District of North Vancouver
Owner	VR 329

Property Manager	Mr. George Alexandru, Vancouver Condominium Services Ltd.
Building Type	Townhouses (16) and Maisonettes (2)
Type of Construction	Wood Framed
Occupancy	Residential
Date of Construction	1976
Applicable Building Code	1975 National Building Code
Sprinklered?	No
Number of Suites	143
Number of Storeys	Townhouses-2-storey Maisonettes- 3-storey
Parking	Surface and Underground
Adjoining Properties/ Exposure Condition	North: Residences South: Purcell Way East: Residences West: Lillooet Road

The buildings have architectural features that proved to be important in understanding the significance of our findings. These include:

- The gable end walls of the three storey maisonnettes are more exposed to the elements because they do not have overhangs.
- Other walls are protected by overhangs.
- Townhouses are two storeys and are generally protected by overhangs.

No documentation of repairs was available and no widespread replacement or renewal programs were reported with the exception of asphalt shingles. It is our understanding that some individual owners have replaced their windows for better performing double-glazed windows over the years. In addition, several balcony membranes have been replaced in recent years. It was reported that all asphalt shingles were replaced in 1997-1998.

2. ASSESSMENT METHODS

The assessment approach adopted by MH can be considered as a series of sequential steps, which focus the investigation and sample areas addressed..

The initial steps are a review of drawings, occupant input and a visual review of a broad sampling of building elements. From this a focused sample of locations of concern is identified for closer review and moisture measurement. The result of the above steps is then used to identify a limited number of locations for intrusive test openings.

2.1 Site Work

Site inspections were made on March 19, 2004. During site visits we carried out an exterior visual inspection of the buildings, including walls, roofs, balconies and windows.

We were provided access to and reviewed the exterior / interior of suites 1888 (Building D), 2082 (Building R), 2050 (Building P), 1986 (Building L), 1976 (Building K) and 1912 (Building F).

This was followed with a moisture probe survey, carried out by Patrick Roppel, MASc. and Jacquelyn White, P.Eng., on March 26, 2004, focusing on construction features highlighted in the visual examination. Test openings were made by Patrick Roppel and Jacquelyn White on April 14, 2004 and reviewed by Richard Taylor, MRAIC.

The weather at the time of the fieldwork included scattered showers with periods of sun, with temperatures ranging from 7°C to 15°C. Periods of wet weather preceded each day of fieldwork.

2.2 Moisture Probe Survey

As part of the scope of work, the moisture content (MC) of wood at selected locations was assessed using a Delmhorst Model BD-9 moisture meter. Moisture probing is performed by drilling two 4mm diameter holes approximately 20mm apart through the exterior cladding and into the sheathing. After recording the MC reading of the sheathing, the holes were cleaned and filled with clear sealant.

There are limitations to this method that must be considered while interpreting results.

The Delmhorst moisture meter measures the electrical resistance of materials (the presence of water lowers the electrical resistance). There is a fairly well researched relationship between resistance and moisture content of wood but it is not exact. Readings can be affected by several factors including:

- wood species

- temperature
- characteristics of the piece of wood
- preservative treatment

Errors can also be introduced by poor contact of the pins with the material being measured or by contact of the pins with metal flashing or lath.

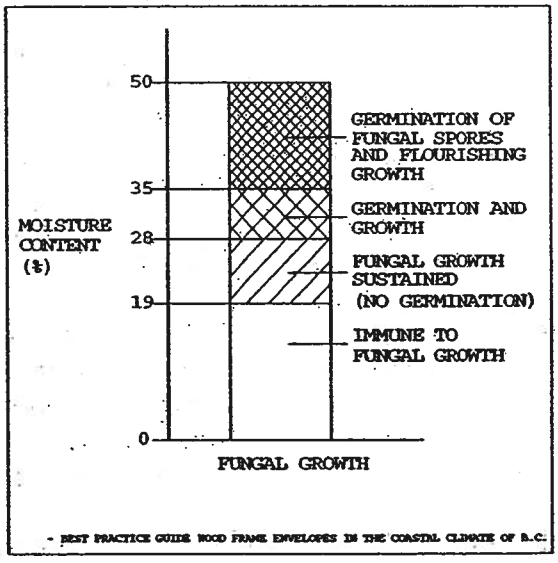
Furthermore readings are only indicative of moisture present at the probed location at the time of sampling. MC depends on relative humidity and the history of exposure to wetting drying cycles. Since, most of Vancouver's annual rainfall occurs during the winter months, measurements taken in late summer may not identify the average state of the sheathing condition.

The BD-9 moisture meter has a scale for wood moisture content (with a range from 10% to 50% MC). It also has a reference scale (labeled 0-100 units) generally used for plaster and concrete. In this report MC readings are recorded as read from the meter. Temperature and species correction data is available but have not been applied because the impact is small in relation to other uncertainties.

Interpretation of MC Readings in Wood

The following guidelines were used to interpret MC measurements in wood:

MC less than 20% indicate that the wood has not been recently exposed to liquid water and the MC is below that required for wood decay fungi to propagate.



- MC between 20% to 30% indicate probable exposure to liquid water, and represent a MC at which fungal growth can be sustained. We interpret such readings as a "Caution" where the condition of the wood should be assessed by visual review.
- MC greater than 30% indicate exposure to liquid water and are conditions under which decay fungi can grow. We interpret this as a "Danger" reading which should be verified through visual review using exploratory openings.

2.3 Exploratory Openings

Exploratory openings were made at locations where deterioration of the wall components was either expected based on results of visual examination and MC measurements, or at locations where construction assemblies were unknown and suspect. After examination, the openings were provided with a temporary seal to prevent further entry of water into the wall assembly.

3. ASSEMENT OF CURRENT CONDITIONS

3.1 Environmental Conditions

We would classify the site as having a medium exposure to wind driven rain because the complex is predominately low rise buildings in a rural, moderately treed site.

3.2 Walls

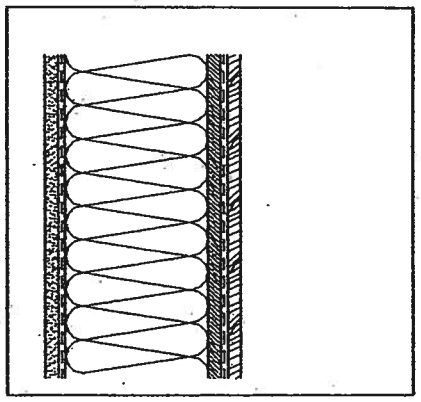
3.2.1 Assemblies Used

There are fundamentally two different exterior wall assemblies constructed at this project. No openings were made behind the sheathing to confirm the interior construction.

Cedar Clad Walls

The typical wall construction as detailed on the architectural drawings is:

- 1 x 6 vertical cedar siding
- 1 x 2 strapping at 24 inches on centre
- Building paper
- 1/4" plywood sheathing
- 2 x 4 studs at 16 inches on centre
- 2.5 inches batt insulation
- 5/8" type 'X' gypsum wall board



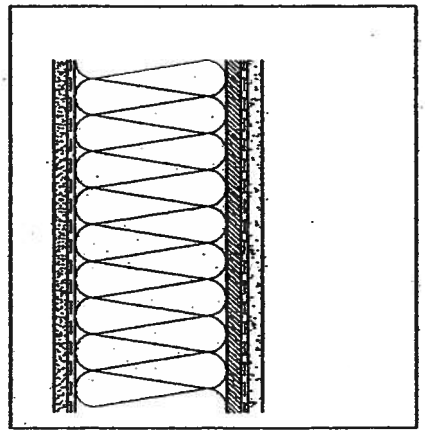
We noted the following deviations from the architectural drawings:

- No strapping is provided behind the cedar siding.
- The cedar siding is a T & G channel siding.

Stucco Walls (Exterior Extension of Party Walls)

The typical wall construction at stucco walls as detailed on the architectural drawings is:

- Stucco and metal lath
- 5/8" type 'X' gypsum wall board
- ½ inch soundboard
- 2 x 4 studs at 8 inches on centre
- 2.5 inches batt insulation
- ½ inch soundboard
- 5/8" type 'X' gypsum wall board



We noted the following deviation from the architectural drawings:

- Building paper was provided below the stucco and metal lath.
- Plywood sheathing was used instead of gypsum wall board.

3.2.2 Visual Review

The extension of party walls to the exterior is clad in stucco on the two maisonettes. Concrete block chimneys on the townhouses are also clad in stucco. The following observations of the stucco walls were made during our visual review of the complex:

- Staining of the stucco, particularly below balcony saddles.
- Damaged areas of stucco at balcony saddles. Refer to photograph 6.
- Buckling of the stucco at floor joists and at-grade at both maisonettes. Refer to photograph 7.
- Openings in the stucco at the top of balcony saddles at several locations. Refer to photograph 13.
- Some patching of the stucco below the balcony saddle of unit 1868 where balcony alterations have been undertaken.
- Step cracking in the stucco finish over concrete block of townhouse chimneys. Refer to photograph 8.
- Algae staining in the stucco finish over concrete block of townhouse chimneys.
- Failed sealant at stucco/wood transitions at townhouse chimneys.
- Exposed top edge of concrete foundation wall at townhouse chimneys.

The remainder of the walls on the maisonettes and townhouses are clad in T & G cedar channel wood siding with localized areas of glass block at townhouse entrances. The following observations of the remaining walls were made during our visual review of the complex:

- Peeling paint, particularly on the north elevations. Refer to photograph 9.
- Brittle and deteriorated areas of cladding, particularly at the north elevations.
- Popping of board ends. Refer to photographs 8 and 9.
- Algae staining. Refer to photograph 5.
- Wood cladding applied at-grade or with concrete patio finishes poured directly against cladding.
- Damaged/deteriorated wood cladding noted at-grade.
- Unsealed penetrations such as vent hoods. Refer to photograph 10.
- Some localized areas of split wood panels. Refer to photograph 10.
- Localized damage of cladding from climbing vines.

- Wall vents are located at the same level as balcony soffits at some locations. Refer to photograph 11.
- An area of repair adjacent to the chimney of unit 2080, presumably due to the addition of flashing at horizontal stucco/vertical wood transition.
- Failed mortar and sealant joints in glass block at unit 1984. Refer to photograph 12.

3.2.3 Moisture Probe Survey

Probes made in the exterior sheathing to measure the moisture content (MC) were performed at 44 locations. The probe locations and results are shown on the elevation drawings in Figures 2 through 5, Appendix D.

The following table summarizes the results. We have classified results by building and wall type.

TABLE 1: Moisture Probe Survey

Moisture Content Range	Building D 1844-1998		Building P 2058-2040		Building R 2080-2088	Building F 1912-1922	Total No. of Probes	Percentage per Moisture Content Range
	Stucco	Wood	Stucco	Wood				
Less than 20%	2	12	1	11	5	5	36	82%
20% - 30%	2	1	0	3	1	0	7	16%
30% - 50%+	0	0	1	0	0	0	1	2%
TOTAL	**4**	**13**	**2**	**14**	**6**	**5**	**44**	**100%**

In general, MC readings in the sheathing below wood cladding were low. MC readings in the stucco were varied, however, when openings were performed in the stucco it was found that either the sheathing had deteriorated so badly that MC readings were not reading from the plywood sheathing itself or readings were low, as the deteriorated sheathing had dried out.

3.2.4 Exploratory Openings

The results of the moisture probe survey were inconclusive. Low moisture readings were taken at areas which appeared suspect from a staining or detail viewpoint. Therefore, 14 exploratory openings were made in the wall assemblies to confirm the

construction and condition of the building envelope components. Locations of exploratory openings are indicated on Figures 2 through 5, Appendix D. Detailed observations recorded at each opening are included in Appendix B, complete with an identifying photograph.

We concentrated our openings on the two maisonettes. The maisonettes are more exposed than the townhouses because they are three levels and have fewer overhangs. Also, details were more suspect such as at balcony saddles. In addition, owner concerns about the condition of the wood cladding had been raised. A select number of openings were made at the townhouses to confirm their condition.

The table below summarizes the results.

TABLE 2: Exploratory Openings

Extent of Damage Found	Openings in Stucco Walls	Openings in Wood Walls	% of Openings
No damage	0	6	43%
Evidence of moisture but materials intact (staining)	1	4	36%
Deteriorated sheathing but framing intact	3	0	21%
Framing deteriorated	0	0	0%
Total Openings	**4**	**10**	**100%**

Similar to the moisture probe survey, there was a pattern of damage associated with the exposed stucco walls, particularly at balcony saddle locations. At the wood clad walls, we found numerous areas of deteriorated cladding however minimal water damage was observed on the building paper and sheathing.

3.2.5 Discussion

The stucco walls are clad in what is often referred to as *face-sealed stucco*, in which no specific provision is made for the drainage of water that gets past the face of the cladding. In a face-seal system, durability of the wall is dependent on the ability of the exterior surface of the cladding and associated sealant to shed water and to dry out before water penetrates the sheathing membrane (building paper). Water that penetrates past the face, via leakage paths through the stucco itself (e.g., cracks, ineffective or deteriorated sealants), at interface with adjacent elements or by absorption through the stucco, can provide the moisture needed for decay of the sheathing and framing materials.

Recent history has shown that the use of these systems in moderate or high exposure environments incurs a high risk of deterioration due to water entry. A number of contributing factors have been identified as leading to this.[1,2] Major factors in governing the prevalence of problems are degree of exposure and the number of details prone to water penetration. The performance history of face-sealed stucco systems in the Lower Mainland is such that in 1996, The City of Vancouver amended its Building Bylaws to enforce systems that incorporate a drained cavity behind the stucco. These drained cavity "rainscreen" systems are now considered good practice except in the most sheltered locations.[3] Most municipalities in the Lower Mainland and warranty providers will not accept the use of face-sealed systems where major repairs are undertaken.

The wood clad walls have a two-stage moisture management strategy. The cladding sheds the majority of water impacting the wall and there is a secondary moisture barrier (typically asphalt impregnated sheathing paper or sheathing membrane) and flashing to manage the relatively small amount of moisture that penetrates the cladding and drains it back to the outside.

The success of these siding systems depends on:

- Controlling the volume of water that penetrates the cladding (typically higher at corners, windows and, penetrations),
- The correct lapping of sheathing membranes and flashing to direct water down and out of the wall assembly, and
- To a lessor extent, maintaining spaces behind the siding that allow some drainage, provide a capillary break and enhance drying by air movement. Furring out the cladding with strapping creates a clear cavity that improves all three effects.

Our experience with these systems in the Lower Mainland[3] is that they generally have the ability to manage the moisture load when well detailed. In many cases, we find localized problems that can be traced back to specific failures, as opposed to systemic failures requiring full rehabilitation of the wall system.

At Purcell Woods, we found:

- areas of deterioration of sheathing requiring major repair.

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[1] *Survey of Building Envelope Failures in the Coastal Climate of British Columbia*, Morrison Hershfield Limited for CMHC, 1996

[2] Preliminary report of Part II of the Barrett *Commission of Enquiry into the Quality of Condominium Construction in British Columbia*, March, 2000

[3] *Best Practice Guide; Wood Frame Envelopes in The Coastal Climate of British Columbia*, Morrison Hershfield Limited in joint venture with RDH Building Engineering published by CMHC, 1999

- areas where decay is not yet significant, but there was evidence of water penetration that could lead to deterioration of the sheathing and framing elements.

The extent of problems was location dependent. Major deterioration of sheathing has been documented at the stucco walls of the maisonettes. Deterioration of the cedar cladding has been documented at the north walls of the maisonettes and select areas of north facing walls of the townhouses. These areas require full rehabilitation as a minimum remedial repair. Areas associated with deteriorated cedar cladding are, in our opinion, at high risk of future failure.

- At other locations, the prevalence of damage and the risk of future damage has been reduced because the maisonette walls are protected by the eave overhangs and townhouse walls are only two storeys high and not subjected to direct rainfall.

With this situation, the option of undertaking targeted repairs (as opposed to a complete re-cladding) is worth considering but only under certain conditions:

- The Strata recognizes that retaining the existing cladding system implies more risk of future repair requirements.
- Immediate action is taken to address the significant water entry paths identified to date and in the future.
- Maintenance plans include detailed review of water protection elements such as gutters and sealant on an annual basis and immediate correction of deficiencies.
- A plan of periodic inspection and moisture probing be undertaken to reduce the probability of undetected deterioration.

Although the majority of the wood cladding is still performing adequately, it is nearing the end of its service life and will likely become more problematic in the future. The Strata is considering re-cladding alternatives. Based on the age of the cladding and the future risk of damage from water infiltration, we recommend that necessary remedial action to the wall assemblies include:

- Replacement of the stucco clad walls with a rainscreen wall system including improved detailing at balcony saddles (will be further discussed in Section 3.6 Balconies).
- Phased replacement of the wood clad walls with a rainscreen wall system starting with the maisonettes. Alternative cladding materials are further discussed in Section 4.5 Remedial Options.

3.3 Windows and Doors

3.3.1 Assemblies Used

The original windows on the building are single glazed non-thermally broken aluminum famed. The majority of windows are horizontal sliders with some awning units. The frames are flange mounted with mitred corners sealed with caulking. Head flashings are provided but no sill flashings were observed. Drainage is provided from weepholes at condensation track.

Entrance doors are predominately wood doors in wood frames. Sliding patio doors are provided at balcony/patio accesses. Sliding doors and wood entrance doors at both the maisonettes and the townhouses are well protected by overhangs.

3.3.2 Visual Review

The following observations were made during our visual review of the windows:

- Many of the owners have replaced the standard single glazed units with double glazed units resulting in numerous different styles and quality of windows on site. Head and sill flashings were not provided at some areas of observed window replacement.
- At one test opening, the sheathing paper was found to lap over the nailing flange at the sill, resulting in a reverse lap. This means that if the window leaks through the frame or if moisture penetrates past the cladding surface then the wood framing elements will be exposed to moisture.
- Condensation was noted at several units.
- Sealant and glazing tape are in poor condition on the majority of windows reviewed. Refer to photograph 10.
- Signs of water infiltration at unit interiors observed include corroded fasteners and stained finishes.

3.3.3 Window Testing

Window testing was not carried out as part of this assessment. It should be carried out if retention of the windows is to be considered as part of remedial action.

3.3.4 Discussion

When exposed to wind driven rain, windows can allow leakage to the inside. This can create significant damage and nuisance depending on how often it happens. Of more concern, windows have proven to be a common source of water penetration in to wall systems[1,2]. Typical leakage points include:

- poorly sealed joints at the window to wall junction

- joints within window frames particularly at bottom corners, or
- joints where sectional window are coupled together.

The original windows installed at Purcell Woods are of a type that has proven to be prone to failures of the sealant in the mitred joints at the corners of the frames. However, based on information provided by occupants, and the results of our inspections and test openings, limited water penetration into the walls has occurred. This is likely a result of well-protected windows and the drainage, although limited, provided by the wood cladding. No windows are located in stucco clad areas.

The thermal performance of the original windows is poor and numerous occupants complained of drafts and condensation. As previously mentioned, many occupants had upgraded the thermal performance of the windows although some installation was noted to be suspect.

In new construction or during major renovation MH has found it necessary to assume that all windows will eventually leak through the frames. Our standard practice is to incorporate a sub-sill flashing to protect the wall and drain the incidental water out of the wall system. Such waterproofing measures protect the wall but do not improve the performance of the windows themselves. In locations where major remedial action requiring window removal is necessary, consideration should be given to upgrading to improved windows.

Reasons to consider replacement rather than reuse of windows include:

- The incremental cost of replacement, over a refurbish and reuse strategy, is less than the purchase cost of new windows (installation costs cancel out; and repair costs for the existing windows are similar to the cost of new windows).
- The use of better windows reduces the risk of water damage to sills and material below the windows and nuisance of rain penetration.
- The disruption to and handling of windows during the removal and reinstallation process may increase leakage in some windows.
- Windows with a more appropriate condensation resistance can be purchased.
- Replacing the Insulated Glazing Units in a window costs about the same as buying new windows, especially if one considers that the IGU's at the project have served for a significant part of their expected life. The life cycle cost of replacement is reduced relative to a refurbish and reuse strategy.

Considering the performance history and level of damage found at Purcell Woods, we suggest that necessary remedial action includes:

- Ongoing replacement of single glazed units with double glazed units in conjunction with any wall rehabilitation program.

3.4 Roofs and Decks

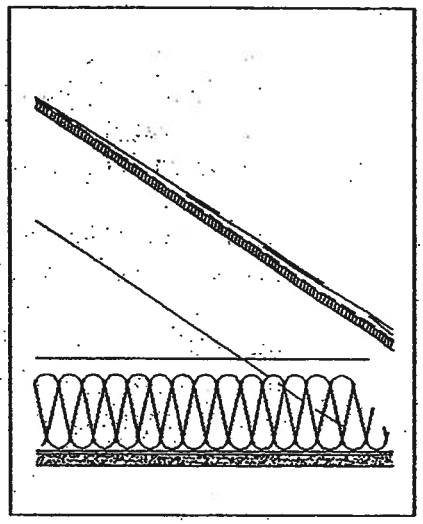
3.4.1 Assemblies Used

There is fundamentally one roof construction assembly and one deck (balcony over living space) used on the project. No exploratory openings were made in the roof assemblies to confirm construction and condition of materials in the assemblies.

Sloped Roof Assembly

The construction as indicated on the architectural drawings:

- Asphalt shingles
- 3/8 inch plywood sheathing
- 2 x 8 rafters at 16 inches o/c or 2 x 4 trusses at 24 inches o/c
- roof eave protection,
- Batt insulation
- ½ inch drywall



We noted the following deviations from the architectural drawings:

- The drawings indicate a flat roof over maisonette breezeways, however a sloped asphalt shingle roof is provided.

Some decks over living space are provided on the rear elevations of townhouses. The flat deck assembly is not legible on the drawings but appears to be comprised of deck boards over a built up roofing membrane on sheathing and joists. The decks are sloped to drain.

3.4.2 Visual Review

The following observations were made during our visual review of the roof assemblies:

- Good overhangs at eaves are provided at both the maisonettes and the townhouses.
- Minimal overhang is provided at gable ends.
- Asphalt shingles are in fair condition with areas of moss noted.
- Valley transitions are not provided with flashings at some locations.
- Shingled mansards are provided at the maisonettes.

The following observations were made during our visual review of the deck assemblies:

- Drainage appeared to be impeded by gravel stops at the end of the flat roof. Owners reported poor drainage.
- Wood picket railings are provided at decks.
- At Unit 2072, an enclosure had been build on top of the rear entrance deck. The enclosure is comprised of glazing and an entrance door. The roof appears to be problematic indicative of the tarp covering at the time of our inspection. Refer to photograph 20.

3.4.3 Discussion

It was reported that asphalt shingled roofs were replaced in 1987 and 1988 although no documentation was available for confirmation. This is in keeping with the appearance of the shingled roofs, which are in fair condition. No substantial curling or missing shingles were noted on the roof areas. There are several roofs that are heavily covered in moss due to orientation. Roof shingles typically have a life expectancy of 15-25 years depending on quality. Based on the condition of the existing shingles, they will likely maintain functional for another 5-7 years with some minor repairs as required.

Locations of missing valley flashings were noted. Improvements at these locations should be considered as part of a regular maintenance plan.

The decks are in various conditions with evidence of newer deck boards and railings at some units. The built up roof assemblies below the deck boards typically have a service life of approximately 20-25 years. It is likely that the majority of built up roofs are nearing the end of their useful service life and should be budgeted for replacement as required.

The railings on the decks are constructed of 1 x 8 vertical boards at 6 inches on centre. We were not able to observe the nailing/screw pattern of the railings however, it is our experience that residential railings are typically not designed to accommodate the required horizontal forces imposed by the British Columbia Building Code (BCBC). Upgrades to railings would likely be required in conjunction with the roof membrane replacement.

We are unaware of what procedure, if any, was followed during the construction of the enclosure at unit 2072. Specifically, if the Strata approved such installations by individual unit owners which are deemed to be part of the common elements?

Considering the performance history and level of damage found at Purcell Woods, we suggest that necessary remedial action to roof assemblies include:

- Replacement of flat roof membranes as required.
- Localized repairs at sloped shingle roofs, particularly at valleys.

3.5 Balconies and Patios

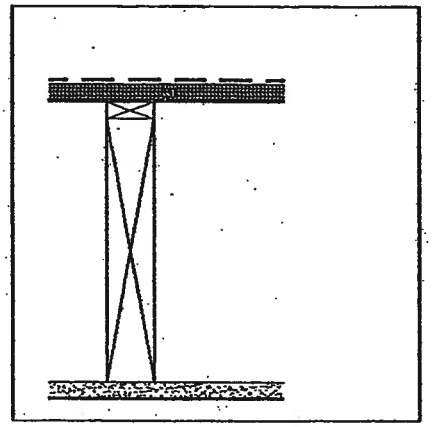
3.5.1 Assemblies Used

There is fundamentally one assembly used for balconies on the project. No exploratory openings were made through balconies membranes to confirm construction and condition of materials in the assemblies.

Cantilevered Balconies

The construction illustrated on the architectural drawings is:

- Liquid applied waterproof membrane
- 5/8" T&G plywood to slope away from building
- Perimeter wood cant strip
- 2 x 10 joists at 16 inches o/c



Balconies over Carport

As above but sloped to roof drain.

We noted the following deviations from the architectural drawings:

- A number of balconies do not have soffits.

3.5.2 Visual Review

The following observations were made during our visual review of the complex:

- Drainage of water off the surfaces is achieved by a slope on cantilevered balconies and by a roof drain on balconies over carports.
- Railings consist of wood pickets at cantilevered balconies and wood framed upstand walls at carport balconies. The upstand walls are clad in wood siding.
- The majority of wood clad upstand walls did not have a metal cap flashing along the top. Similarly, sloped divider walls were not provided with metal cap flashings. Refer to photograph 3.
- Balconies are framed into return walls at the maisonettes. It was noted that no saddle flashing or seal is provided between the balcony and the wall cladding. Refer to photograph 13.
- A large number of balconies did not have soffits. Some rot was noted at joists, particularly adjacent to stucco walls. Refer to photograph 14.
- Various conditions of membrane were observed. Several owners reported replacing their membrane over the past few years.
- Some of the balconies at townhouses without carports have installed new balconies in recent years (Units 1974-1984). A continuous wood railing has been provided in lieu of the picket railings common to the original construction. As a

result, drainage is impeded. The owner of unit 1976 reported drilling holes through the outer wall for drainage. Refer to photograph 15.

- At unit 1986, the owner reported that the membrane was not returned up the vertical at the carport balcony.
- Some tenting of the membrane was observed at unit 1976.
- At one unit reviewed (Unit 2082), no reinforcement of waterproofing membrane at sheathing seams was provided. Membrane appeared stressed at these locations.
- At patios, concrete topping is commonly poured directly against the wood cladding. Refer to photograph 19.
- At patios, the door threshold is often flush with the concrete topping or pavers.

3.5.3 Discussion

The design of the balconies on the maisonettes is causing water infiltration into the stucco wall system. The balcony edge is built against the stucco wall. The stucco terminates at the balcony deck and commences again below the deck. No seal or flashing is provided between the edge of the deck and the stucco cladding. At all exploratory openings in stucco below balcony saddles, severe deterioration was observed. Typically the sheathing is completely deteriorated and framing is wet. Some mold was observed on the exterior face of the interior drywall at opening No. 1.

Minimal damage at balcony saddles at wood cladding was observed.

Similar to the deck railings, the structural capacity of the railings was not determined, however, based on our experience, they would likely require upgrading with any retrofit work.

Considering the performance history and level of damage found at Purcell Woods, we suggest that necessary remedial action to balcony assemblies include:

- Redesign of maisonette balconies adjacent to stucco walls in conjunction with stucco wall remediation.
- Continued membrane renewals as required.
- Waterproofing and provision of cap flashing at upstand walls.

4. RECOMMENDATIONS FOR REPAIRS

It is clear that there are areas of Purcell Woods where either the existing wall systems do not provide the performance to deal with their weather exposure or the cladding materials have reached the end of their service life. Since these areas are clearly associated with local details rather than a systematic problem with the wall system, it is appropriate to improve the water management capability of the problematic details. In these areas, the existing cladding must be removed to affect repairs. Although not mandated in the District of North Vancouver, we would recommend replacement with a drained cladding system. In addition, third party warranties often mandate the use of a drained cladding system.

While the application of alternate cladding materials can be considered, we are assuming, for this assessment report, that a drained stucco system would be used at current stucco walls and a drained wood cladding system would be used at existing wood clad walls. The owners had expressed some interest in vinyl cladding. Vinyl cladding has a more maintenance free advantage over wood cladding, however it is not as aesthetically pleasing and is not in keeping with the original architectural design intent. Both products have a similar life span. Alternatives should be considered in the design stage. They may have either performance or cost benefits.

4.1 Prioritization of Repair Items

To assist with the process of planning for correcting the problems identified in this report, we have assigned a priority reference for each recommended repair item. This serves as a guideline for the strata to ensure that the more critical repairs items are addressed first. The priorities are as follows (Refer to Table 4 below for priority reference to each repair item):

1. **Immediate** (as soon as practical), because of legislative requirements, safety issues, or the risk of loss of function or acceleration in the rate of degradation. These items should be repaired within the next year.
2. **Medium-term** (within 2-5 years) it may be possible to defer repairing these items to a more convenient time without major consequences.
3. **Long-term** (exceeding 5 years).

We note that it is sometimes cost effective to schedule tasks earlier than necessary on technical grounds when there are efficiencies gained by including the task with other scheduled work. We also note that there can sometimes be a cost saving gained by deferring rehabilitation of assemblies with known problems to extend the functional life of the existing components. This may incur a risk of additional damage occurring to the assembly, which could lead to increased repair costs in the future.

4.2 Issues Related to Mold

Currently, there are no regulations requiring application of specific procedures to address the presence of mold in buildings. However, worker and occupant health

concerns and the potential liability they engender are leading to acceptance of the hazard control principles. It is likely that specific guidelines will be adopted by authorities in the future. Until then, decisions on what protective measures to take are left to owners and their consultants.

In our opinion, the best summary of the issues related to mold contamination in buildings, and what to do about it, is a publication entitled *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* issued by the New York Department of Health in April 2000.[4]

4.3 Remedial Package for Purcell Woods

Our assessment found evidence that Purcell Woods is suffering from some significant moisture induced degradation in its stucco wall systems as well as exceeding the life expectancy of some of the wood clad walls. In our opinion, immediate repairs are required to some walls. The remaining walls are in surprisingly good condition considering their age and do not require immediate repair but their replacement should be planned for in the long term.

Based on the general discussion above, we have developed a repair strategy for the problematic wall areas at Purcell Woods. The strategy has been developed to address the problems identified in this assessment report.

We have also presented an option for continued replacement of the cladding as part of a renewal program to address the aging cedar cladding.

In addition to the recommended wall repairs, continued replacement of balcony and flat roof membranes including the necessary railing upgrades should be undertaken as required.

4.3.1 Repair Strategy – Correction of Known Problems

This assessment found no major problems in the walls protected by overhangs or in the south facing wood clad walls of the maisonettes or the majority of townhouse wood clad endwalls. There is no reason to expect walls that have performed adequately for 30 years will suddenly stop performing. However, it is necessary to recognize that the wood cladding is nearing the end of its service life and that they have a higher risk of future failure, and associated future costs, than the drained cavity walls we propose for the exposed walls rehabilitation. Budgeting for a future repair is discussed further in 4.3.2.

In our opinion, immediate repair is required at the exterior stucco walls and the north cedar siding walls on the two maisonettes. This will include:

[4] This document is available on the web at http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html.

- conversion to a drained cavity wall system,
- replacement of decayed sheathing and framing components,
- improvement to detailing at penetrations and transition details (e.g., windows, doors, vents, base and through wall flashings).
- redesign of balcony to wall transitions.
- windows will need to be removed and reinstalled in the waterproofed rough opening. We recommend replacing the windows in the area of rehabilitation as discussed in Section 3.3.4.

In walls protected by overhangs and townhouse gable end walls, only local repairs at split wood cladding, cracked stucco at chimneys, balcony and roof saddles and penetrations would be made. Windows would be left in place.

To control the risk of major costs for future repairs in the walls that are not fully rehabilitated, we recommend that a plan of annual inspection and rigorous maintenance be applied.

4.3.2 Renewal Phasing

The remaining walls are performing adequately at this time, however they are nearing the end of their expected service life. Full replacement of all wood clad walls with a drained cavity system would reduce the risk of water leakage and moisture damage in the future. It would be prudent to plan for a phased replacement of the remaining wood clad walls over the next 5-10 years, which would entail applying the same repair procedure proposed for the exposed maisonette walls discussed in 4.3.1 above, to the remaining walls of the complex.

We would recommend that the phased renewal of the wood clad walls also include window replacement. The merits of window replacement are discussed in Section 3.3.4.

4.4 Summary Opinion of Probable Costs

Table 4.1 presents a summary of MH opinions of probable cost for remedial work recommendations.

It is important to recognize that these are offered as **probable costs**, expressed in 2004 dollars. They are based on quantities estimated from available elevation drawings, prior to development of the design and scope, and unit costs based on our experience with similar projects. We have assumed the use of specific systems and components (such as replacement of claddings with like). Alternatives, which may have either performance or cost implications, should be considered in the design stage, and will affect costing.

Since MH has no control over the costs of construction labour, materials, or equipment, or over the Contractor's method of determining prices, or over

competitive bidding or market conditions, the opinions of probable cost provided are made solely on the basis of past experience with similar conditions and proposed scopes of work.

For some repair elements we have indicated annual cost budgets only. The estimates of tasks and probable costs are based on our current knowledge of the condition of the envelope. However, the presence of mold or hazardous materials can impact repair procedures and thus add supplementary costs.

With any wall cladding rehabilitation, there may remain some potentially significant unknown costs. For example, the extent of deterioration of the structural elements and thus the magnitude of structural repairs required cannot be determined precisely until the cladding and sheathing is removed.

These opinions of probable costs are "orders of magnitude" and are for initial budgeting purposes only. More accurate cost estimates for the rehabilitation plan can only be obtained for work of this nature once the design, specifications and detailed tender documents are completed.

Sidebar: Comparative Cost Estimates

It is Morrison Hershfield's practice to provide conservative opinions of probable construction costs, based on the limits of available knowledge. These estimates of construction cost are intended solely for the establishment of parameters for discussion within the Strata on the future directions for rehabilitation. These are not "quotations for construction".

We caution that these opinions are based upon MH's assumptions of the design and construction elements which would get accomplished as part of an eventual rehabilitation program. Before the final construction cost estimates can be developed with any actual representation of the final work to be accomplished, the Owners must identify the final scope of the work to be completed. This is your building and your money. Therefore, the Owners direct the final extent, and limits, of the work to be done, with professional assistance from MH.

There are always other companies willing to provide lower opinions of cost estimates, either by assuming the use of alternate systems and components, or by using "optimistic" unit cost figures. Nevertheless, the actual real costs are established by the design decisions agreed to by the Owners in consultation with MH, and the subsequent contractor bid prices on the actual design documents. It is important for the Owners to keep in mind that the only cost that ultimately matters is the actual construction cost.

Table 4.1: Remedial Work Recommendations
Summary Opinions of Probable Costs (See Notes)

DESCRIPTION	Repair Budgets	Priority (see section 4.1)	Renewal Budgets
Wall Cladding Repairs			
Stucco wall remedial work on maisonette walls – based on $40/ sq. ft. x 6,000 sq. ft.	$240,000	1	N/A
Wood Cladding remedial work on north facing maisonette walls – based on $35/ sq. ft. x 8,100 sq. ft.	$284,000	1	N/A
Structural Contingency Allowance – for replacing rotten structural framing members. Allowance based on 30% of stucco wall repair cost and 20% of cedar wall repair cost.	$130,000	1	N/A
Balcony Re-Design			
Redesign of balconies to separate structure from stucco walls includes new balcony membrane and railings – based on $5,000 per balcony.	$60,000	1	N/A
Window Replacement			
Replacement of windows in area of rehabilitation. Vinyl windows based on $300/window.	$8,000	1	N/A
Interim Wall Contingency (for deferred work of wood clad walls)			
Replacement of failed sealant at penetrations, windows and cracks, localized replacement of split or deteriorated cladding, repair of stucco at chimneys.	$50,000	2	N/A
Sub-Total	**$772,000**		
GST (7%)	$54,000		
Grand Total	**$826,000**		
Wall Cladding Renewals			
Renewals of wood clad walls- unit price: $35/sq.ft.	N/A	2	Unit Price: $35/sq.ft.

DESCRIPTION	Repair Budgets	Priority (see section 4.1)	Renewal Budgets
Re-Roofing			
Annual budget for re-roofing of flat roof areas including rebuilding deck above, based on 2 decks a year.	N/A	3	$8,000/yr
Balcony Membrane Renewals			
Annual budget for replacement of balcony membranes including new railings – based on 2-3 balconies a year, depending on size.	N/A	3	$10,000/yr
Maintenance and Monitoring Contingency			
Annual inspection and maintenance of walls, which are not fully rehabilitated.	N/A	3	$3,000/yr

Notes:

1. These order of magnitude opinions of probable costs are for initial budgeting purposes only. Estimates are initial figures only.
2. Drawings available were limited. Quantity take-offs are estimated as best possible from small scale drawings with no measurements.
3. These estimates were developed using assumptions for unit costs and the scope of work for each item. These estimates should not be used to raise Special Assessments without discussing the implications with Morrison Hershfield before hand.
4. For work of this nature, more accurate cost estimate figures can only be calculated once the design, specifications and detailed tender documents are underway. The Strata must be involved in decisions affecting the scope and extent of work in order to develop more accurate construction cost estimates.
5. The above budget costs exclude specific estimates for unseen conditions and permit fees. These estimates also exclude estimates related to any architectural changes desired by the Strata as part of the rehabilitation program.
6. The contingency allowances for replacement of rotted and damaged structural members are preliminary estimates. The final cost of this component cannot be established until the wall sheathing is fully removed.
7. General contingency figures are an allowance for items that occur outside of the assumed scope of work. MH recommends Strata's maintain a general contingency fund within the overall budget to allow for unexpected items. Examples of this type of item include required code improvements to electrical and mechanical components, sprinkler systems, fire safety components, etc., which are discovered once the project is underway.
8. Engineering Fees are estimated excluded and can be prepared once the Strata's selection for rehabilitation has been made.

5. SUMMARY

Our review found evidence of areas of water penetration and decay in the envelope of Purcell Woods. The extent and severity of problems appears to be strongly associated with specific elements of the construction. Specifically, we noted deterioration of sheathing below balcony saddles at stucco walls of the maisonettes. The observed deterioration of sheathing appears to be a result of a failure of the balcony saddles at stucco wall transitions. We have recommended that stucco walls be rehabilitated with improved balcony saddle details.

The remainder of the walls appear to be in good condition considering their age. Limited signs of water ingress at wood clad walls were noted despite areas of deteriorated wood cladding. We have recommended that the two north walls of the maisonettes be rehabilitated as they demonstrated the worst wear and the most risk for future water ingress.

Other elements of the building are reaching the end of their service life and require replacement. A phased replacement program for the following elements should be planned for in the future:

- Single glazed window units
- Balcony membranes
- Flat roof membranes
- Cedar cladding

The phased renewal of the cedar cladding is in response to our understanding that the Strata wishes to explore the possibility of replacing the wood cladding as it is nearing the end of its service life. It is our opinion that a phased replacement plan should be budgeted for in the future.

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