BUILDING ENVELOPE CONDITION ASSESSMENT

The Ivys

STRATA CORPORATION LMS 2379
652- 689 WEST 7TH AVENUE
VANCOUVER, BC

August 16, 2004

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1.0 INTRODUCTION

.1 TERMS OF REFERENCE

.1 JRS Engineering Ltd. (JRS) was retained by Strata Corporation LMS – 2379 "The Ivys", to perform a condition assessment of the building envelope assemblies and systems at their residential complex located at 652 - 689 West 7th Avenue, Vancouver, B.C.

.2 The scope of services provided by JRS Engineering Ltd. is outlined in our proposal P03727 dated November 12, 2003. A copy of this proposal is attached to this report as Appendix G.

.3 The assessment consisted of reviewing the original drawings, a previous building envelope condition assessment report, discussing the performance history with an Owner's representative and the property agent and conducting an overall visual review of the building envelope systems. The investigation then focussed on sample locations for a more in-depth review including moisture probing and exploratory openings.

.2 BASIC INFORMATION

.1 The complex consists of four three-storey, wood frame residential townhouse buildings constructed over one single-level below grade reinforced concrete parking garage. The complex contains 59 residential units and was constructed in or about 1995. The complex is situated in Vancouver, British Columbia. Refer to photographs 1 and 2 for general views of the complex. Plan drawings are reproduced as Appendix B.

.2 The complex is surrounded by a similar four-storey building to the east, a single storey commercial building to the west, an arterial road to the south and a lane to the north.

.3 The wood framed building would be classified as medium to high exposure to wind-driven rain according to the CMHC Wood-frame Envelopes in the Coastal Climate of British Columbia, Best Practice Guide[1]. Exposure is influenced by the height of the building, size of the roof overhang and local wind characteristics. Wind loading is influenced by the size and proximity of adjacent buildings, hills or trees.

[1] Wood-frame Envelopes in the Coastal Climate of British Columbia, Best Practice Guide, Building Technology, published by the Canada Mortgage and Housing Corporation, 1999, 2001.

.4 The majority of the exterior walls are clad with wood shingle siding with some wall areas clad with wood board and battens. Units on the upper floors include sunken roof decks that are accessed by dome skylight hatches. Walls adjacent to roof decks are clad with wood siding. First floor units include exterior patios. The windows are vinyl framed and roof level skylights are aluminum frame. The roofing consists of low slope roofs covered by modified bituminous roof membrane complete with a granular cap sheet.

.5 The primary building envelope related architectural features that formed part of this assessment include:

.1 Wood shingle siding;

.2 Board and batten cladding;

.3 Vinyl frame, double glazed, windows;

.4 Aluminum frame acrylic dome skylights and aluminum frame double glazed T-bar skylights;

.5 Low-slope roofing;

.6 Roof decks and their waterproofing; and

.7 Waterproofing systems over the underground parking garage.

.3 HISTORY

.1 In order to become more familiar with the history of the building envelope of the complex , JRS spoke with the Owner's property agent, Nizam Dossa, of Century 21 Prudential Estates (RMD) Ltd. Property Management to discuss the building. The following information regarding the building envelope was obtained through these conversations:

.1 The building was constructed in or around 1995.

.2 In 2001 some cladding was repaired due to bulging.

.3 Up until 2003, the strata had quarterly roof inspections and maintenance as required. This included roof patching of ridges and torn seams, etc.

.4 In 2003 a number of board and batten wall areas were retrofitted with a rainscreen system.

.4 DOCUMENTS REVIEWED

.1 The Owners provided JRS with the original drawings and a previous building envelope assessment report for review by JRS as part of this assessment. These documents are listed below as follows:

.1 Report re "Building Envelope Investigations, The Ivys" by MHP Building Consultants Ltd. dated April 16, 2001.

.2 Mechanical, Electrical, and Structural drawings received for building permit June 25, 1995. These drawings were provided but not reviewed by JRS, as they do not pertain to the building envelope.

.3 Architectural drawings were not included in the drawing package provided to JRS.

.5 OCCUPANTS QUESTIONNAIRE

.1 In June, 2004, JRS distributed a questionnaire to the residents of The Ivys. The intent of the Questionnaire was to gather information on the nature and extent of any moisture related problems that may be occurring at the complex. JRS received a response from 29 of the 59 suites.

.2 The results of the questionnaire identified some moisture related issues of reported problems with water leakage and staining at the ceiling. Some occupants reported ceiling staining. Occupants attributed some of these issues to pipe leaks. Many units reported stud or nail shadowing through the gypsum board, and many reported condensation of the aluminum frame roof skylights. Refer to Appendix D for a summary of the results.

.6 SITE VISITS

.1 JRS attended the site on May 5, May 12, and July 8, 2004, and undertook visual observations, exploratory openings, and window testing. The fieldwork was performed by Cory Legge, AScT, Kevin So, Dipl.Tech, Josh Jensen, Dipl.Tech, and Darren Sauer, Dipl.Tech.

2.0 REVIEW OF EXISTING CONDITIONS

.1 GENERAL

.1 There are five types of exterior wall assemblies noted at The Ivys. Three of the wall assemblies, as originally constructed, are cedar shingle siding, cedar lap

siding, and plywood board and batten cladding applied over building paper and plywood sheathed wood framed walls. The fourth wall assembly (some board and batten walls that have been retrofitted) is fibre-cement board and batten cladding applied to the wood framed walls with a drained cavity between. The fifth wall assembly can be found on the east elevation of the eastern most building and the west elevation of the western most building.

.2 While cedar shingle siding covers the majority of the walls, board and batten cladding also forms a large portion of the exterior wall cladding. Cedar lap siding has been applied to the walls surrounding the roof decks and the concrete block assemblies, which are non-combustible and are used adjacent to other buildings.

.3 A wood band board at the second floor level around the perimeter of the buildings consists of 2 x 6 on 2 x 12 lumber with a sheet metal cap flashing. A similar feature has been included above the entry doors to upper units (refer to photo #2). It was observed that these cap flashings are typically back-sloped toward the building and do not include end dams to prevent water from cascading over the edges.

.4 Small roof overhangs provide some shelter to the walls below. The roof projects past the walls by approximately 6 to 8 inches.

.5 Upper floor units include sunken roof decks covered with PVC (vinyl) membranes that are utilized as both the primary roofing membrane and traffic surface. The roof decks are approximately three feet below the level of the main roof with adjacent wood framed walls clad with cedar lap siding. These units also include dome and T-bar skylights at the roof decks.

.6 Windows are vinyl framed, double glazed, and swing doors are wood framed. Wood trim has been installed around all windows and doors.

.7 Low sloped roofing covered with a modified bituminous roof membrane and sheet metal flashings transitions protect the buildings.

.2 WALL ASSEMBLIES

.1 VISUAL OBSERVATIONS

.1 At exploratory openings in the cedar shingle siding we observed the as-built assembly as follows:

Cedar shingle siding

Two layers of building paper

½" Plywood sheathing

.2 The cedar shingle siding has been installed so as to provide three layers of shingles at any location. Each shingle is offset from the one below to prevent water on the surface from transferring to the wall framing.

.3 Cracked, missing, or warped shingles were generally not observed at the complex. A couple of exterior fasteners were noted in concentrated areas in some locations. This is typical due to a repair.

.4 Wood trim boards are installed around windows and doors. The trim is installed directly over building paper with the shingle siding butt jointed to the trim at the jambs. Sealant was not used at the butt joint. Properly designed and installed sealant joints can reduce the risk of water penetration and is a prescriptive requirement of Part 9 of the Vancouver Building By-law. The trim at the sill was notched at the bottom edge to provide an overlap onto the shingles. The top horizontal surface of the wood trim has been protected with a sheet metal cap flashing. At inside and outside corners, shingles were simply butt jointed without trim or sealant.

.5 Similar to the windows and doors, electrical outlets and light fixtures also have wood trim installed directly over the building paper with the shingle siding butt jointed to the trim. At other penetrations, such as gas and hood vents, the shingle siding had been sealed with fillet caulking beads directly to the penetration. The sealant at these locations was brittle.

.6 At patio locations, shingle siding is within 5" of the wearing surface. It was noted during our review that the shingles were wet near the base of wall, likely due to rainwater backsplash.

.7 At exploratory openings in the board and batten assemblies we observed the as-built assembly as follows:

Wood trim battens

Painted plywood boards

Two layers of building paper

½" Plywood sheathing

.8 The board and batten cladding system has been installed over two layers of building paper. The boards consist of painted plywood sheets spaced approximately ¼" apart. The joints and fasteners of the boards are concealed and protected by wood trim boards. The trim is sealed with a fillet caulk joint along its edge.

.9 We noted the caulk sealant in some locations was old and brittle. We also observed sealant that has lost adhesion with the substrate.

.10 As noted above some board and batten clad walls have been retrofitted using a fibre-cement material installed on strapping to provide a drainage cavity behind. JRS did not perform destructive testing in these areas.

.11 Fire rated wall assemblies have been constructed using split-face concrete blocks and concave mortar joints. They are required by the building code when adjacent buildings are in such close proximity.

.12 The concrete block walls appear to be in good condition. No signs of efflorescence staining or cracking were noted.

.3 MOISTURE PROBE TESTING

.1 As part of our scope of work, moisture probe testing was performed on the exterior walls of the building in order to help determine the moisture content, the extent of any moisture ingress and the potential for deterioration of wood sheathing and framing.

.2 During our visual review of the cladding, we identified common construction details which, in our experience, are considered higher risk of permitting water to travel behind the exterior surface of the cladding. Water penetration of this nature could ultimately saturate the sheathing paper and expose the framing and sheathing to excessive moisture. These locations were typically selected for moisture content testing.

.3 The moisture probe procedure consists of the following:

- .1 Drilling two holes through the wall cladding, using a 1/4" drill bit.
- .2 Insertion of a remote testing probe (2 metal prongs) from an electrical resistance-type moisture meter into the holes to contact the sheathing. These devices calculate or interpret the moisture content levels by measuring electrical resistance as an electrical current is passed through the materials in contact with the tip of the probes. The moisture meter used by JRS is a Delmhorst Model BD-2100 measuring a range of 0% - 40% moisture content.
- .3 Clearing the holes with compressed air and applying caulk sealant to test holes once complete.
- .4 Plotting the location of moisture content readings on plan drawings of the building.

.4 JRS performed 92 moisture probe tests on the walls at the complex. Individual test locations and corresponding results have been plotted on plan drawings. Plan drawings depicting test locations and results are

attached as Appendix B to this report. The results of each moisture probe have been coded to indicate moisture content range. The following is a list of moisture content values and their significance to the relative condition of the wood:

- ● Moisture content less than 20%. This is the general equilibrium moisture content of wood.
- ▲ Moisture content between 20% & 28%. Infrequent contact with external moisture with varying drying potential. Moisture content sufficient to sustain fungal growth.
- ■ Moisture content greater than 28%. Constant contact with external moisture. Moisture content will initiate fungal growth and cause significant decay. Deterioration likely exists.

.5 We wish to note that the moisture probe testing performed by JRS is not capable of nor is it intended to identify all locations of wetting and / or decay currently hidden from view. This procedure constitutes a statistical sampling. The test data has been extrapolated to approximate the extent of any problems and the locations where they may occur.

.6 The interpretation of the data generated from moisture content testing must consider the climatic conditions preceding the testing and also the results obtained at the exploratory openings. Moisture probe testing is ideally performed after a long period of rainfall. Please refer to Appendix E for environmental information related to the conditions surrounding the time of testing.

.7 The moisture probe testing performed by JRS was completed in May, 2004. The climatic data indicates below average amount of rainfall for the period of our testing. Please refer to Appendix E.

.8 WOOD / MOISTURE ISSUES

.1 Wood rotting fungi and decay occurs due to the growth of specific fungi that feed on cellulose fibres. Fungal spores are found throughout the environment and will grow on wood in the presence of:

.1 Oxygen.

.2 Moisture.

.3 Warm temperatures.

.2 Air is found throughout the cellular structure of wood, so oxygen is nearly always available. Spores of decay fungi will germinate in wood at 25 to 28 percent moisture content and flourish when the moisture content of the wood exceeds 33 percent. The spores will not germinate on wood that has low moisture content. Once decay fungi have taken hold, they may continue to grow at moisture content as low as 20 percent. At or below 19 percent moisture content, wood is considered immune to fungal growth.

.3 Drying wood below 20 percent will stop the decay process but will not necessarily kill the decay fungus unless a sufficiently high temperature has been used in the drying process. Decay fungus can survive for up to 9 years in wood at moisture contents around 12 percent.

.4 The temperature range for optimal fungal growth is 18°C to 35°C. Above this range, the growth decreases and will cease at about 38°C. As the temperature falls the growth slows. In cold temperatures fungi become dormant but will be activated again when it becomes warmer.

.5 The rate of decay depends on design, wood species, temperature and moisture content. It is estimated that under conditions ideal for rot, strength loss in the wood is in the range of 15 percent to 25 percent per week.

.6 Moulds and staining fungi will grow on a wide variety of organic materials including drywall and natural fabrics. These fungi, while unsightly, generally cause very little damage other than the disfigurement of the appearance of wood products. Typically, if moulds and staining fungi are permitted to flourish, they will normally be replaced by wood rotting fungi. Some moulds are known to cause respiratory problems and other adverse health effects in some individuals.

.4 SUMMARY OF MOISTURE CONTENT READINGS

	Total Number of Probes	Less than 20% ●	Between 20% & 28% ▲	Greater than 28% ■
North Elevations	20	14	6	0
South Elevations	14	14	0	0
East Elevations	32	29	2	1
West Elevations	26	26	0	0
Totals	92	83	8	1
Percentage	100%	90%	9%	1%

.1 EXPLORATORY OPENINGS

.1 Fourteen exploratory openings were made in the wall assemblies to assess the condition of the underlying components and confirm the construction. Locations of the exploratory openings are shown on the plan drawings included in Appendix B. Detailed observations made at each opening are included as Appendix C.

.2 The exploratory openings made through the exterior were conducted using the following procedure:

.1 The siding or trim detached to expose the underlying building paper and sheathing.

.2 Examine the assembly, wall sheathing and in some locations the secondary components such as wood framing, insulation, polyethylene vapour barrier and backside of the interior gypsum.

.3 In most exterior locations moisture probes were taken in the sheathing.

.4 Reinstall sheathing paper and cladding that was removed.

.3 Openings through the cladding may require permanent repairs. Openings performed by JRS are temporarily sealed with caulking. The Owners should permanently repair all of these openings.

.4 The results of our exploratory openings made in the walls are summarized by the following table:

Condition of wall assembly	North Elev.	East Elev.	South Elev.	West Elev.	Roof Deck	% of Openings
No Damage	0	4	4	3	1	86%
Evidence of moisture but no damage	0	1	0	0	0	7%
Damage including deteriorated sheathing and / or framing	0	1	0	0	0	7%
Total Openings	0	6	4	3	1	100%

.5 Test openings made at windows revealed that the building paper was improperly lapped (not shingled to the exterior) at the sill at the locations reviewed. The field building paper has been lapped onto and sealed with Tuck tape to the window's nailing flange. At two locations we noted damp building paper at the sill. At one of those locations deteriorated plywood sheathing was observed.

.6 Test openings made at grade revealed that a self-adhered membrane has been installed up the wall framing 10" and building paper correctly laps onto the membrane and base of wall flashing. We did not note any signs of moisture ingress.

.7 At test openings made at cap flashings over wood trim details, we observed correct lapping of building paper. We did not note any signs of moisture ingress.

.2 DISCUSSION

.1 The board and batten (as-built) and cedar siding walls are cladding assemblies which are commonly referred to as concealed barrier or face-

sealed cladding systems where the surface of the siding deflects the majority of the rainwater. The building paper installed between the siding and exterior plywood sheathing is intended to intercept small amounts of moisture that penetrate past the siding. Due to the small and sometimes nonexistent cavity, this type of wall assembly is limited in the amount of moisture it can manage that penetrates past the face of the cladding, more so in the case of the board and batten cladding than the cedar siding, as the boards have large areas that are directly applied to the building paper. These types of claddings have poor performance histories with respect to managing exterior rainwater due to their limited drainage characteristics.

.2 The cedar shingle siding walls are also known as a concealed barrier cladding system, however the inherent nature of shingles provides multiple layers of drainage. The effect is similar to that of a rainscreen system.

.3 Our visual observations revealed a number of details such as windows, flashing over trims, vent penetrations, etc. that could allow moisture to penetrate past the face of the cladding. However, our moisture probing and exploratory openings did not reveal extensive signs of moisture damage. The exploratory openings conducted by MHP did reveal wet conditions with some early signs of deterioration at the board and batten clad walls.

.4 In the two locations that we did note signs of moisture damage it is not clear where the water is entering the wall assembly. Both were below windows within the shingle clad walls. We observed reverse lapping of the building paper onto the windowsill nailing flange which creates a path for water that is running down the window jamb to enter behind the building paper. There are a number of possible entry points that include the integration of the band board trim at the concrete stair, the integration of the trim over the entry door at the shingle siding, the integration of the window trim head flashing, or the window frame itself.

.5 We noted that a number of board and batten wall areas have been retrofitted with a fibre-cement rainscreen assembly. This was recommended by MHP based on their findings as noted above. JRS did not perform moisture probe testing or exploratory openings on these walls as they are relatively new repairs. Rainscreen cladding systems deflect a majority of rainwater at the cladding surface but anticipate water ingress beyond the exterior surface. The assembly is constructed with a vented

air space behind the cladding and integrated flashings at each floor level to drain water that penetrates past the outer cladding.

.6 We also noted that a soft joint or sealant joint was not provided between the cladding and the trim around the windows. The intent of this sealant is to provide a continuous water shedding surface where cracking or movement is expected. Sealant is a prescriptive requirement of Part 9 of the building code and generally considered good practice.

.5 VINYL FRAME WINDOWS

.1 VISUAL OBSERVATIONS

.1 The windows installed at the complex are conventional residential, double glazed, nail-on-flange extruded polyvinyl chloride (PVC) frame. The windows are a combination of fixed windows and fixed windows with vertical slider style operation.

.2 Assembly joints in PVC framing are mitred and heat welded. The windows include a PVC exterior glazing stop. At the windows reviewed the joints appeared continuously welded. Windows are drained via weep holes to the exterior.

.3 Sealant has been applied at the interface between the window frame to the wood trim.

.4 Head flashings have been installed directly over all window openings with an additional head flashing installed over the wood head trim. We noted that some of these head flashings slope towards the building and others are either flat or have little slope to the exterior. Head flashings do not include end dams.

.5 At the exploratory openings made under the windows we observed that the sheathing paper was not properly shingled at the sill. Therefore, any moisture penetrating through or around the window would be shed into the wall assembly. Tuck tape was installed around the window over the window flange and building paper thus restricting the drainage at the windowsill from behind the nailing flange.

.2 WATER TESTING

.1 GENERAL

.1 Water testing of the windows provides an insight into status and performance of the window assembly joints which are designed to

remain permanently closed. Assembly seals can be evaluated, as leakage (or no leakage) through assembly joints can reveal any concealed deficiencies that may allow water through the frame.

.2 Two separate water tests were conducted. The living room window of units 105-685 and 102-675 were tested. Windows included two vertical sliding vents.

.3 The water test protocol has been performed in accordance with AAMA 501.2-94 "Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage".

.4 The test protocol consists of the following:

.1 For a period of five minutes, apply a water spray to five-linear feet portion of the window, at a distance of one foot from the framing. A Type B-25, #6.030 brass nozzle as manufactured by Monarch Manufacturing Works was used at a water pressure of 30 psi,

.2 Monitoring the joints from the interior for moisture ingress in exposed areas,

.3 Repeat the procedure on the next five-foot portion of window.

.5 The two windows had no visible moisture passing through the window assembly joints, however, water did enter through the weep holes at the condensation trough.

.3 DISCUSSION

.1 PVC windows of this type are fabricated, assembled and glazed under controlled factory conditions. The complete window units are generally delivered to the construction site ready for installation with flashings and all interfacing components.

.2 Rainwater penetration resistance of windows is influenced by continuity of the seals at window frame mitre joints, and the interfacing (glass-metal) seals within the system, the allowance for drainage, and the integration of the window perimeters with the wall system.

.3 The results of our exploratory openings revealed secondary moisture barriers were not properly installed, and at two locations moisture ingress was evident. We also noted that some of the head flashings installed over the windows are improperly sloped towards the building which could result in unnecessarily diverting moisture towards the cladding and secondary moisture barrier.

.4 The results of our limited water testing indicated that the window assembly seals are performing adequately. Water ingress at the condensation trough weep holes as noted during testing is typical of this window design. For the tested windows, it is appropriate to conclude that the standard prescribed testing would most likely result in a relatively low rating of water tightness.

.5 The exploratory openings also confirmed that the sheathing membrane was installed improperly at the windowsills. The building paper applied to the main field of the walls was lapped over the windowsill nailing flange ensuring that moisture collected on the window liner would be directed into the wall assembly, not outward as intended.

.6 MAIN LEVEL MEMBRANE ROOFING

.1 VISUAL OBSERVATIONS

.1 The roof system used over the main level roofs at the complex is visually consistent with a 2-ply modified bituminous roof membrane consisting of multiple pre-manufactured asphaltic sheets. A small parapet curb along the perimeter of each building is flashed with sheet metal.

.2 A roof test cut was performed to verify the composition of the roof assembly. The roof assembly consists of the following:

2-ply SBS roof membrane c/w
granular cap sheet and
base sheet fully bonded to substrate
Plywood roof deck sheathing

.3 Perimeter membrane stripping has been completed with modified bituminous membrane sheets that extend on top of the parapet curb in accordance with good roofing practice.

.4 All roofs appeared to be adequately sloped to drain. We did not note any signs of excessive ponding such as areas of heavy organic deposits.

.5 We noted a number of galvanized sheet metal vent housings integrated into the roof membrane, which likely serve to ventilate the roof joist space. The vent housings were overall in good condition. Strip vents were also noted at the underside of the roof overhang, which also likely serve to ventilate the roof joist space. JRS did not confirm the ventilation paths of the roof.

.6 The sheet metal cap flashings on parapet walls are well-sloped to drain water and jointed with upstand or S-lock seams in accordance with good roofing practice.

.7 Blisters approximately 2' x 1' and ridging perpendicular to the seams of the SBS membrane sheets were noted in various areas. We also noted numerous repair patches (small sections of membrane cap sheet) throughout the field of the roof. MHP also noted ridging of the SBS membrane cap sheet.

.8 Painted steel stacks have been integrated into the roof membrane, which appear to be plumbing vent stacks. One stack, with a membrane patch below, is shorter than the rest and should likely be extended as the rest are.

.2 DISCUSSION

.1 The main level low slope roofing system is referred to as a 2-ply SBS roof. This type of roof system is known as a newer technology modified bituminous membrane, which is superior to conventional paper reinforced bituminous systems. Conventional systems have used bitumens successfully as a waterproofing agent for many years. Newer systems use bitumens modified with a synthetic polymer that provides increased strength and elasticity compared to conventional systems.

.2 The patches in the roof membrane are indicative of previous water leakage or maintenance of membrane deficiencies. Many residents reported leakage and / or staining at the ceiling that stopped and did not reoccur after a repair to the roof membrane.

.3 Blistering of the nature observed can be caused by trapped inner ply moisture or a water vapour from the interior. This is considered a form of deterioration that is harmful to the overall performance of the roof membrane. Repeated expansion and contraction of the ridges and blisters in the membrane could eventually tear the reinforcing plies of the membrane. Proper ventilation and vapour control at the roof cavity is critical to eliminate the water vapour source from the interior. JRS did not confirm the presence and / or continuity of the vapour barrier or the adequacy of the roof ventilation.

.4 Building movement, irregularities in the substrates, and / or deficiencies during installation can cause ridging of the nature observed. As built, the membrane has been fully bonded to the substrate making the membrane more susceptible to building movement.

.5 Typically, a roof assembly of this nature has an anticipated life expectancy of between 20 and 25 years or longer. The actual service life will depend on the quality of the application and materials used and design. It is important to note that the actual replacement date of the roof will depend on its performance.

.7 ROOF DECKS

.1 VISUAL OBSERVATIONS

.1 Upper floor units include sunken roof decks that are 3' below the level of the main roof. Roof decks are waterproofed with a sheet applied PVC (vinyl) membrane that is utilized as both the primary roofing membrane and traffic surface.

.2 The perimeter walls are clad with cedar lap siding. An exploratory opening at the cedar siding revealed that the vinyl membrane correctly extends up the wall 8" and is positively lapped by the building paper and cladding. No damage or evidence of water ingress on the plywood wall sheathing was noted.

.3 The roof decks are accessed through large acrylic dome skylight hatches. The vinyl membrane extends onto a curb and appears to continue below the dome skylight.

.4 Tenting and / or delaminated membrane was observed where the roof deck membrane transitions up the wall.

.5 Glass and aluminum T-bar skylights have been incorporated into the roof deck areas. The glass units are double-glazed and some were noted with condensation between the glass panes. Condensation issues on skylights were noted in many of the occupant questionnaires. A diverter flashing was not observed at the sill of the skylights where integrated with the wall cladding assembly. This may allow large volumes of water, running along the jamb of the skylight, to discharge behind the cladding.

.2 DISCUSSION

.1 The PVC membrane is considered a trafficable membrane because it serves as the primary waterproofing and as the pedestrian surface. Therefore the membrane is vulnerable to punctures due to sharp heavy objects. Owners should ensure that objects stored on the balconies, such as BBQ's and furniture are free of sharp edges that could damage the membrane.

.2 Where damage to the membrane has occurred, repairs should be undertaken immediately. Reviewing and repairing of the PVC membrane should be ongoing and form part of the Owners' regular maintenance program.

.3 An unprotected single ply membrane is not recommended over habitable space, as they are vulnerable to damage as noted above. We would typically recommend a more durable two-ply SBS roof membrane with at protective wearing surface installed over it.

.4 As noted above, the jamb flashing for the T-bar skylights are currently installed in a way that directs water behind the cladding. Rainwater that flows down the skylight and jamb flashing may flow behind the siding. These areas should be monitored to identify leakage if or when it occurs.

.5 At test openings made at cedar lap siding, we observed correct lapping of building paper over the membrane. We did not note any signs of moisture ingress.

.8 WATERPROOFING OVER CONCRETE SLAB

.1 VISUAL OBSERVATIONS

.1 The waterproofing membrane over the suspended concrete slab above the parking garage structures, for the most part, was not visible due to the landscaping, concrete and other covering layers. Small sections of the membrane are visible on the concrete curbs at the building perimeters and patios. The membrane appears to be a liquid applied asphaltic product such as a hot applied rubberized asphalt. Embedded fabric reinforcing was not observed in the exposed portions of the membrane.

.2 Details of the integration between the ground level waterproofing and wall cladding vary throughout the complex. In most areas a sheet metal flashing protects a self-adhered sheet membrane that extends onto the waterproofing and up the wall. In a few other areas the waterproofing terminates at the top of the patio pavers or just above landscaping and a portion of the concrete curb is left exposed.

.3 We completed a visual review of the underground parking garage. We noted only a few areas where efflorescence staining had occurred indicating that some minor leakage is occurring. These areas are at the foundation wall to suspended slab transition.

.2 DISCUSSION

.1 Prolonged active water leakage through cracks in the suspended concrete structural slab and foundation walls could adversely affect the structural integrity of the steel reinforcing within the concrete.

.2 We did not note significant signs of water present in the concrete or structural distress as indicated by rust staining and spalling of the concrete. Rust staining is an indication that the reinforcing steel is corroding and spalling can be a result of corroded reinforcing.

3.0 REVIEW OF PREVIOUS ASSESSMENT REPORT

.1 As part of our services we reviewed the previous assessment report by MHP Building Consultants Ltd dated April 16, 2001. The report, written by Thomas Morstead, MRAIC, is 14 pages including two appendices.

.2 The MHP report does not indicate when the investigations were conducted. The investigation included visual review, review of previous moisture probing data, and exploratory openings in accordance with accepted practice.

.3 MHP identified the reverse lapping of building paper and cellophane tape at the windowsill nailing flange. MHP however, consider water ingress at these locations unlikely as water would have to penetrate past the sealant at the sill and then past a defect in the tape. They recommend correcting the reverse lapped building paper as part of a maintenance program to prevent future problems.

.4 At the panel-clad walls, MHP noted some moisture-related damage to the wood framing. They indicate that the sealant at the windowsill details appeared to be in reasonable condition and therefore the sealant joints may not be sufficient to control rain entry. The report indicates the heavy reliance on exterior sealant to prevent moisture ingress and recommends retrofitting these areas with rainscreen fibre-cement panel walls.

.5 Main roofs were identified as generally free of problems indicative of premature failure and recommended they be inspected regularly and monitored as part of a maintenance program. Roof-patios were discussed and the risks of single ply roof membranes outlined. MHP recommends further inspections and repairs, which would include the installation of a wearing surface, as required.

.6 MHP indicated that at photographic record of the conditions exposed was compiled and moisture probe measurements were completed, however the data was not included with the documents reviewed by JRS. We did not review any of their moisture probe data, (how many probes and where were they taken) or photographs of the deterioration that was observed. In our opinion, MHP's recommendations and observations are consistent

with current building science principles and practice, however the data presented in the report to support the recommendations for significant repairs was not provided.

4.0 CONCLUSIONS AND RECOMMENDATIONS

.1 GENERAL

.1 The Ivys was constructed in or around 1995. The results of our investigation revealed some poor construction detailing but we found only two locations of moisture-related damage. The majority of moisture readings were found to be within acceptable limits.

.2 The following sections discuss the building envelope components and any required repairs at The Ivys.

.2 WALLS

.1 The wall cladding systems installed on the exterior walls (with the exception of the retrofit walls) are concealed barrier wall assemblies. This type of cladding system has a poor performance history in wet climates attributable to the lack of drainage behind the cladding. In particular, the board and batten siding has limited drainage and relies heavily on exterior caulking at joints. The board and batten walls are more susceptible to moisture-related damage than the cedar lap and shingle siding.

.2 Elevated moisture readings were generally not found behind the cladding and a majority of the exploratory openings revealed that the underlying sheathing and framing are in good condition.

.3 At two locations below windowsills signs of moisture and moisture related damage was noted. The plywood sheathing was water stained, damp to the touch, and spongy. As discussed above the entry point of the moisture was not clearly identified. There are a number of complex building envelope integrations above the noted damage, such as the concrete stair integration with the band board trim. It is recommended the owners complete further investigations at these locations to identify the source of the leakage and a scope of work for the repair. The investigations would involve a more in-depth and systematic approach to removing building envelope components in specific areas. Once a scope of work for repairs is determined a proper budget can be prepared. It should be noted that the details that allow water penetration repeat themselves throughout the complex. Although moisture-related damage was not observed in other similar locations at this time, the potential of future damage exists.

.4 We did note improper lapping of the building paper at windows which could lead to water ingress if moisture enters behind the cladding. The Owners may wish to correct these incorrect laps and improve detailing or regularly monitor the conditions behind the cladding to reduce the risk of water penetration and subsequent damage, as noted at two locations, going unnoticed. Considering the limited underlying damage a program of monitoring seems practical.

.5 Overall, the concealed barrier wall assemblies are performing adequately. Various details in the shingle siding walls are allowing water to penetrate past the cladding. These details should be further investigated to determine a proper repair solution and the walls should be monitored. The lap siding walls are fairly high exposure and should also be monitored. The board and batten siding, although they may be adequately preventing water ingress, are high-risk areas. It is imperative these walls be monitored and repaired as soon as a problem is noted.

.3 WINDOWS

.1 As discussed above, detailing at windows could be improved by correcting reverse laps. We recommend the Owners monitor the condition of the sheathing and framing below windows before undertaking a program of correcting these deficiencies.

.2 Sealant integration at windows should be monitored for failures and maintained on a regular basis to prevent water penetration.

.4 ROOFING

.1 The roofing system, with its various repairs, appears to be performing adequately. A modified bituminous membrane system is a durable roof membrane system that will provide a long leak-free life with proper maintenance.

.2 We recommend that the Owners continue to monitor and maintain their roofing system to obtain optimal performance and life expectancy.

.5 ROOF DECKS

.1 The roofing system, while not typically recommended for use as it is here, appears to be performing adequately along with the adjacent lap siding walls. Cuts or other damage to the PVC membranes must be repaired immediately. The Owners should implement a program of regular monitoring on the condition of these membranes so any damage can be addressed in a timely manner.

.2 At time of membrane renewals, the Owners should consider upgrading the roof deck membrane to include a more robust membrane and overlying wearing surface.

.3 The T-bar skylights at the roof decks are typically prone to air and water leakage. A number of occupants report they have replaced sealed glazing units due to condensation. It is recommended the T-bar skylights be monitored and regular maintenance be undertaken.

.6 SUSPENDED SLAB WATERPROOFING

.1 The slab waterproofing appears to be performing adequately as signs of distress or water leakage through the suspended concrete slab were generally not observed.

.7 PROJECT PLANNING

.1 When planning remedial repairs and renewals the Owners will need to consider the extent and timing of the work. As discussed above, it is often practical to undertake the repairs and replacements of elements consecutively. The Owners must also consider current building code requirements and warranty requirements when considering the scope and timing of the repairs.

.2 In considering phasing the repairs and renewals some work can be considered short-term, some medium-term and some work long-term. Short-term repairs are undertaken as soon as possible because of legislative requirements, safety issues or risk of further damage. Work can be considered medium-term if it is reasonable to undertake the work in the next 2 to 5 years without the risk of incurring major damage. Long-term repairs generally apply to the planned replacements of major components.

.8 MAINTENANCE & RENEWALS

.1 As part of the planning the Owners should also consider maintenance. Once the scope of repair work has been completed, the Owners should develop a comprehensive maintenance program including but not limited to:

.1 The development of a comprehensive written manual that adequately conveys and describes the ongoing maintenance requirements that are essential to the performance of the various components of the building envelope.

.2 Establish a scheduled program of maintenance reviews, inspections, and work.

.3 Establish a renewals plan to replace building envelope components when they near their life expectancy.

.2 It should be noted that a program of maintenance cannot address fundamental design and construction deficiencies. For example, although the application of sealant to the various openings and penetrations in wall areas may reduce water penetration it does not address the fundamental lack of drainage behind the wall cladding.

.3 The requirement for maintenance manual guidelines and inspections applies to existing or original systems as well as any new systems that are put in place through remedial work.

.9 MONITORING

.1 We recommend that the Owners implement a monitoring program focussed on the wall assemblies (especially board and batten walls), windows, T-bar skylights and roof deck membranes. This will establish an historical record or pattern of performance to aid in the planning of renewals and ensure problems do not go undetected.

5.0 OPINION OF COST

.1 GENERAL

.1 The budgets are provided by JRS for discussion purposes and are prepared as an opinion of the anticipated cost of the remedial or investigative work described above in this report.

.2 In order to determine the actual construction costs the Owners must obtain pricing from qualified contractors based on a defined scope of work.

Item	2004	2005	2006	2007
Further investigations at locations identified as damaged (allowance)	$6,000	N/A	N/A	N/A
Repair at locations identified as damaged (see above, allowance)	N/A	$ 30,000	N/A	N/A
Detailed Maintenance Manual and renewals plan	$6,000	N/A	N/A	N/A
Moisture probing / monitoring / reporting (includes roofs, roof decks, wall assemblies, caulking)	N/A	$ 4,000	$ 4,000	$ 4,000
Caulking and Miscellaneous maintenance.	N/A	N/A	$ 5,000	N/A
TOTAL	$12,000	$34,000	$9,000	$4,000

.2 LIMITATIONS

.1 Cost of work estimates are subject to change and are contingent upon factors over which JRS Engineering Ltd. has no control. Therefore, JRS Engineering Ltd. cannot guarantee the accuracy of such estimates. Exact cost and time will only be determined once the tenders for the work have been received and the work has been performed. The budgets provided by JRS are prepared as an opinion of the anticipated construction cost for the remedial work described in this report.

.2 The contingencies outlined in the budgets are based upon the assumption that wide scale replacement of the wall cladding and other components will not be required due to hidden or unknown damage or defects. In the event deterioration and damage is greater and wide scale replacement of the wall cladding is required to maintain compliance with the current laws of British Columbia pertaining to building envelope rehabilitation, the cost of the repair work may be dramatically increased.

6.0 CLOSURE

.1 This report was prepared by JRS Engineering Ltd. for Strata Corporation LMS 2379. Any use which a third party makes of this report, or any reliance or decisions to be made based on it, are the responsibility of such third parties.

.2 Some of the findings herein are based on a random sampling and others are based on a visual review of the surface conditions. Deficiencies that may exist, but were not recorded in this report, were not apparent given the level of study undertaken.

.3 The material in this report reflects the best judgment of JRS Engineering Ltd. in light of the information available at the time of preparation.

.4 Please contact the undersigned if you require any additional information.

Prepared by:

JRS ENGINEERING LTD.
Per:

Cory Legge, AScT
Building Science Technologist

Applied Science Technologists and Technicians of British Columbia
18649
CORY LEGGE
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AUG 16 2004

Reviewed:

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Principal

PROFESSIONAL ENGINEER
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AUG 16 2004

LMS-2379
Envelope

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August 16, 2004

The Owners, Strata Plan LMS 2379 – The Ivys
C/o Century 21 Prudential Estates (RMD) Ltd.
Sales & Property Management
7320 Westminster Highway
Richmond, B.C.
V6X 1A1 Fax: 604-273-9021

Attention: Mr. Nizam Dossa

Dear Sir:

Re: Strata Plan LMS 2379 – The Ivys
652 and 689 West 7th Avenue, Vancouver, B.C.
- Building Envelope Condition Assessment Report

Please find enclosed one bound colour copy and one unbound black and white copy of the Building Envelope Condition Assessment Report for the above noted project. The PDF format of the report will be compiled and sent to you via e-mail shortly.

Should you require any additional information or assistance, please do not hesitate to contact me.

Sincerely,

JRS ENGINEERING LTD.
Per:

Cory Legge, AscT
Building Science Technologist

Enc.