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REPORT

Building Envelope Condition Assessment – Ocean Vista

1279 Nicola Street
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Presented to:

The Owners, Strata Corporation VR 992

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PREFACE

Terminology & Glossary

A number of the terms used in this report have specific meaning in the context of this report and are therefore defined below. All of the terms and abbreviations used are standard in the industry. This glossary may be of some aid for those not familiar with construction terms:

Air Barrier refers to a combination of materials and components, including joints, that control the flow of air through an assembly, limiting the potential for heat loss and condensation due to air movement.

Balcony refers to a horizontal surface exposed to the outdoors, but projected from the building so that it is not located over a living space.

Base Coat refers to the initial wet state material, either factory or field-mixed, used to encapsulate the fibreglass reinforced mesh (EIFS applications).

Building Envelope refers to those elements of the building that separate inside conditioned space from outside unconditioned space, and includes walls, windows, doors, roofs, balcony decks (over occupied living space) and foundations. Sometimes referred to as "building enclosure" or an "environmental separator" in building codes.

Building Paper refers to a breather-type asphalt sheathing paper which is rated in minutes (15, 30 or 60), based on preventing water flow through it for number of minutes in accordance with a standard test.

Built-up Roof (BUR) refers to a waterproof system constructed of multiple felt layers mopped down with hot bitumen.

Capillary Break refers to the gap between parallel layers of material sufficient to break the surface tension of water, which is typically a minimum of 10 mm (3/8").

Cladding refers to a material or assembly that forms the exterior skin of the wall and is exposed to the full force of the environment. Typical cladding types include stucco, EIFS, metal panels, brick/stone veneer, wood siding, and vinyl siding.

Control Joint or **Movement Joint**, refers to a joint in the building envelope which allows differential movement of portions of the building structure (expansion joint), or prevents or localizes cracking of brittle materials such as stucco, where movement needs to be controlled (control joint).

Deck refers to a horizontal surface exposed to the outdoors, located over a living space, and intended for moderate use but not for access to other areas of the building.

Delamination refers to a separation along a plane parallel to the surface.

Drained Cavity (also **Rainscreen**) refers to a design strategy whereby a positive drainage plane is created immediately behind the exterior cladding material, sufficient in width to break the surface tension of water, and allowing incidental water entering the wall system to drain by gravity with the aid of flashings and membranes.

Drip Edge refers to a projection detailed to direct water run-off away from wall, window, balcony or roofing element.

Efflorescence refers to the dissolved salts in the material (such as concrete or brick) being transported by water, and redeposited on the surface after evaporation.

EIFS refers to *Exterior Insulated Finish System* and generally consists of layers of rigid insulation adhered or fastened to the substrate, and finished with thin coats (lamina) of reinforced cementitious material and a finish coat of acrylic stucco.

EPDM (Ethylene Propylene Diene Monomer) refers to a waterproofing sheet membrane made of vulcanized rubber. These membranes, usually single-ply applications, may be installed fully bonded to the substrate with an adhesive, or may be "loose-laid" with only the laps and terminations of the membranes adhered.

Face-seal refers to a building envelope strategy where the performance of the wall is dependent on the ability of the exterior surface of the cladding, windows, and associated sealant to shed water and prevent any water infiltration. This system can not easily accommodate water that penetrates past the exterior face since no positive drainage path or additional continuous barrier to water penetration are provided.

Finish Coat refers to the final wet state material, which provides colour and texture, applied over the reinforced base coat (EIFS applications).

Fishmouth refers to a deficiency in the installation of waterproofing membranes (roofing, self-adhering membranes, etc.) which results in a fold in the edge of the membrane, through which water can penetrate.

Flashing refers to sheet metal or other material used in roof or wall construction and designed to shed water (typically sloped outwards, with a drip edge to shed water). Used in conjunction with:

- *Cap* or *Parapet flashing:* top of wall, pier, column or chimney.

- *Saddle flashing:* an up-turn, sloping transition piece between a horizontal and vertical plane, eg. balcony cap and wall intersection.
- *Head/sill flashing:* at head or sill of window opening or other penetration.
- *Base flashing:* at bottom edge of wall surface.
- *Cross cavity* or *Through-wall flashing:* a flashing which sheds water from the weather barrier plane to the exterior, through the cladding plane.

Gum Lip refers to a method of sealing a flashing to a wall surface whereby the top edge of the flashing is bent outwards to form a caulk-filled cavity (typically at the termination of a waterproofing membrane).

Housewrap refers to a sheet plastic material which is used as a sheathing paper, generally between the wall sheathing material and the exterior cladding. Although recognized as a proprietary term, in this report *housewrap* is used to represent a generic group of materials. One common type of housewrap consists of spun-bonded Polyolefin (SBPO), another is made of perforated polyethylene. Their resistance to liquid water is high, but resistance to water vapour is lower than many common "vapour barrier" materials.

Maintenance refers to a regular process of inspection, cleaning and minor repairs of envelope elements and exterior systems such as roof, walls, windows, gutters, downspouts and drains. Cleaning is for normal activities for those items as required on a regular basis, such as leaves from gutters and drains in the fall, and cleaning lint from dryer vents. Minor repairs are for small projects for reinstating failed elements such as areas of cracked caulking or peeling paint.

Movement Joint or **Control Joint** refers to a joint in the building envelope which allows differential movement of portions of the building structure (expansion joint), or prevents or localizes cracking of brittle materials such as stucco, where movement needs to be controlled (control joint).

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

Penetration refers to a hole passing through the building envelope in which ducts, electrical wires, pipe and fasteners are run between inside and outside.

Punch Window refers to the architectural style of the window being expressed as a single "punched" opening surrounded by the cladding material, as opposed to being arranged in vertical or horizontal strips of several window units.

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

Scupper refers to a metal pipe or trough section creating a drainage overflow from a roof or balcony to a downpipe or to a surface below.

Sheathing refers to a material used to provide structural stiffness to the wall framing and to provide structural backing for the cladding and sheathing paper. Typical materials are OSB (oriented strand board), plywood, or gypsum board.

Sheathing Paper refers to a material or combination of materials in an exterior wall whose purpose is to retard penetration of incidental water further into the wall structure once past the cladding. Commonly used materials are building paper or housewrap.

Spall refers to a fragment of material, such as concrete or masonry, detached from a larger mass by a physical blow, weather action, internal pressure or efflorescence within the mass (sub-flourescence).

Strapping refers to the use of wood or metal material, typically 19mm (¾") nominal thickness, to form a drainage cavity and act as a capillary break behind the cladding.

Surfactant refers to an agent (e.g. detergent) that, when mixing with water, breaks the surface tension of water drops, thus enabling easier absorption of water through a material. Without surfactants, water would have a greater tendency to remain as drops on the surface of a given material.

Symptoms refers to visual evidence, such as staining or wetting of surfaces, loss of strength, material delamination or cracking, peeling paint, debonded coatings, etc., which suggests a performance problem within the exterior envelope of a building.

UV refers to ultra-violet radiation (from the sun), which has a degrading effect on many membrane and sealing materials (asphalt based) unless protected by an appropriate shielding layer.

Vapour Retarder refers to a material having a high resistance to water vapour diffusion that is located within the assembly to control the flow of vapour and limit the potential for condensation due to diffusion.

Weephole refers to an opening placed in a wall or window assembly to permit the escape of liquid water from within the assembly. Weepholes can also act as vents.

1. INTRODUCTION

1.1 Terms of Reference

Morrison Hershfield (MH) was retained by the owners of Ocean Vista (Strata Plan VR 992) to undertake an assessment of the current condition of the building envelope systems of their building located in Vancouver. Authorization for the study was provided by facsimile message dated August 24, 1999, by Mr. Peter Chan of Vancouver Condominium Services Ltd (VCS), on behalf of the Strata.

The objective of this investigation was to assess the overall condition of the building envelope at the Ocean Vista and to develop an implementation plan for any required remedial work or further investigations. Deficiencies reported herein are based on visual examination and selective sheathing moisture content measurements taken 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.

1.2 Scope of Services

The scope of our services was outlined in our proposal letter to Mr. Chan of VCS, dated June 24, 1999, and is summarized below for reference purposes:

1. *Review the original design documentation to become familiar with intent of the designer with respect to the exterior enclosure of your building.*

2. *Option: An Occupant Questionnaire Survey may be a useful tool to focus our exterior wall survey. We will issue a customized form for the Strata Council (or property manager) to copy, distribute and collect and MH will tabulate the results. We will conduct a walk through of five (5) sample suites based on the survey results during our visual examination described in 3.*

   In lieu of an Occupant Questionnaire Survey we will review the history and nature of the building envelope problems with suite owners, available records and your management company.

3. *Undertake a visual examination of the building cladding elements: stucco cladding, windows, caulking, balcony and roof areas.*

4. *Undertake a sample moisture content survey to identify the presence of moisture in the sheathing under the siding. The test probe locations (approx. 50) will be chosen in areas where other visual evidence suggests that water may have penetrated the stucco siding or at locations where the detailing suggests a potential problem (for example, under cap flashing locations). The results of the*

moisture survey will assist us in determining the extent of the moisture that may exist behind the stucco.

5. *Based on the results of the moisture survey, identify locations where larger exploratory openings may be warranted.*

6. *Develop conceptual remedial work and renewal recommendations with associated budget construction cost estimates for each element of the exterior building envelope which is likely to require action over the next few years.*

7. *Assess the priority of the various remedial work recommendations and develop an implementation plan for the next few years. We will meet with the Strata Council on one occasion to discuss the report and its implications in detail.*

8. *Prepare and submit a report that summarizes our assessment work and test results and presents our recommendations and prioritized budgets for remedial work over the next immediate few years.*

9. *Additional investigative work may be recommended to establish a realistic repair and renewals plan, if significant damage is discovered in the Initial Assessment.*

10. *The objective of this Initial Assessment is to evaluate the general condition of the building envelope and is intended to provide an opinion as to the level of risk that the building envelope represents to the owners.*

11. *Depending on the results of this Initial Assessment it may be recommended that a more detailed Supplementary Assessment be undertaken to develop a more defined budget and implementation plan for any required remedial work.*

12. *Alternatively, a maintenance strategy for the exterior cladding may be developed in conjunction with the proposed Assessment. This strategy may be only a measure to defer more significant repair requirements that may become evident during the course of the Assessment.*

In addition to the above scope of services, MH obtained copies of the architectural drawings of Ocean Vista from the City of Vancouver's microfilm storage facility. The drawings were obtained with permission from the Strata.

1.3 Basic Information

MH was provided with the following background information and documents to assist us in our assessment of the condition of the building envelope systems:

- Copies of architectural drawings A2 to A18 prepared by Raymond Letkeman Architect dated March to July 1981. Copies were obtained from the microfilm storage facility of Vancouver City Hall.

- Resident Survey, distributed by VCS to the owners of Ocean Vista in July 1999. The survey indicates units where water leaks to the interior have been reported.
- General Roofing Inspection Report dated October 3, 1990, by Gordon Spratt & Associates.
- Several reports between 1996 and 1999 by various contractors and consultants, regarding investigations and localized repairs to address locations of reported water leaks.
- Site Visit Report, dated October 5, 1999, by MH. The report indicates the results of a brief visual review of roofing components at Ocean Vista on October 1, 1999.

1.4 Moisture Probe Survey

As part of the scope of services, a selective moisture probe survey of the stucco clad exterior walls was intended to be performed to assess the general extent of the moisture ingress and the potential for deterioration of the sheathing and framing components. Moisture content (MC) readings are indicative of the amount of moisture present at the location at the time of sampling only, and are dependent upon local construction details, microclimate conditions, orientation, and material characteristics. The survey is intended as a guide only.

Probing is performed by drilling two 4mm holes approximately 20mm apart through the stucco and into the sheathing. A MC reading is then taken and recorded. After the reading, both holes are cleaned and filled with clear sealant.

However, when the probing was performed, it became evident that no continuous sheathing had been installed behind the stucco cladding. Therefore, MC measurement could not be performed and additional exploratory openings were carried out instead.

1.5 Exploratory Openings

As part of this assessment, exploratory openings were made to review the condition of the wall components behind the stucco cladding and to confirm the construction assemblies. Exploratory openings consist of cutting roughly 200 x 200 mm (8"x8") sections of the stucco cladding to view the condition of the wall components behind. The openings were made at locations where deterioration of the wall components was expected (based on results of visual examination and sheathing MC measurements) or at locations where construction assemblies were unknown and suspect. The openings allow better assessment of the severity of deterioration, and the extent of remedial work that may need to be performed. After examination, the openings were provided with a temporary seal to prevent further entry of water into the wall assembly.

1.6 Limitations

This review was based on visual inspection, exploratory openings and a review of available documents. 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. Unless specifically noted in this report, no testing, detailed analysis or design calculations were completed, nor were they within the scope of this review.

No samples of moldy materials were analyzed during this assessment. The presence of toxigenic mold species in water damaged materials has become a reasonably common finding in MH's experience with residential structures in B.C. and other temperate, marine climates.

Any comments or conclusions within this report represent our opinion, which is based on the documents provided to us, our field review of physical conditions, specifically identified testing and our past experience. This review is limited to technical, construction and performance items.

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.

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 of the limitations of the documents reviewed, the general visual inspection undertaken and understand that MH cannot be held liable for damages they may suffer with respect to the purchase, ownership or use of the subject property.

2. REVIEW OF EXISTING CONDITIONS

2.1 Details and History of Building Envelope

Ocean Vista consists of an 18-unit, five storey residential complex supported by a single storey below grade concrete parking garage. The building is approximately 18 years old and is constructed with a reinforced concrete structural frame and steel stud in-fill walls.

The exterior walls of Ocean Vista are clad with stucco and brick veneer. Most roof areas are low-sloped with a waterproofing membrane while the sloped roof areas are covered with sheet metal roofing. Several areas of sloped glazing also exist at Ocean Vista.

The occupants of several of the units have reported water leaks occurring to the building interior. Some of the leaks have been ongoing for five or more years. MH has reviewed various investigation and site visit reports and cost estimates for proposed repairs by 14 different contracting or consulting companies between 1996 to 1999, regarding the water leaks occurring at Ocean Vista. Several water penetration tests were performed to determine the sources of the leaks and, in a few cases, the leaks appear to have been arrested by subsequent repairs.

Based upon the occupant survey and various reports by contractors who have investigated and, in a few cases, repaired water leaks at Ocean Vista, the following is a list of the units which appear to be experiencing current, or have experienced recent, water leaks:

- Unit 102 – at east end of divider wall between units 102 and 103. Leak occurs at base of wall.
- Unit 103 - at east end of divider wall between units 102 and 103. Leak occurs at base of wall.
- Unit 104 – at front entry door.
- Unit 105 – leak at patio window and previous leak at skylight
- Unit 106 – previous leak at skylight
- Unit 109 – at base of exterior wall at north east corner of unit.
- Unit 302 – current leak in upper bedroom closet and previous leak in lower bedroom.
- Unit 303 – leaks into upper floor bedroom closet and also at base of wall beside fireplace.

- Unit 304 – previous leaks at third floor bedroom closet and at base of patio door.
- Unit 305 – leak into lower floor bedroom and water stains around living room skylight
- Unit 306 – stains on sloped living room ceiling
- Unit 307 – previous leak in living room
- Unit 308 – previous leaks above living room window and in stairwell below door to roof deck.
- Unit 309 – previous leak at bedroom wall and ceiling

The majority of the above reported leaks have been active within the past two years.

Some of the repairs recommended by the various contractors who have investigated the water leaks at Ocean Vista have included:

- Replacing metal cap flashing on chimneys.
- Cleaning the brick wall cladding and coating the bricks with a water repellant sealer.
- Replacing metal cap flashing on top of divider walls at the roof level.
- Installing metal cap flashing on exterior brick divider wall between unit 102 and 103.
- Reducing the number or size of weepholes at the base of the brick walls and replacing sealant between the brick and the metal base flashing.
- Localized stucco wall repairs, including installation of sheet membrane on exterior wall sheathing.

Several of the contractors had recommended further investigations into the various leaks that are occurring at Ocean Vista.

2.2 Review of Architectural Drawings

When it became evident during the moisture probe survey that no continuous wall sheathing existed behind the stucco cladding at Ocean Vista, MH requested permission from the Strata to obtain copies of the architectural drawings from Vancouver City Hall.

The following wall assemblies are listed on Sheet A9 of the architectural drawings.

Exterior wall assembly:
4" x 12" x 2" Brick or 3/4" Stucco (float finish) painted
8" Concrete block or concrete
2" Rigid insulation
1/2" Drywall on metal fastening channels

Exterior stud wall assembly (1):
3/4" Stucco (float finish) painted on wire mesh
3/4" hat channels
Building paper
5 5/8" Steel studs @ 16" o.c.
R 16 batt insulation
Poly vapour barrier
1/2" Drywall

On architectural drawing sheet A16 the following exterior stud wall assembly is indicated:

Exterior stud wall assembly (2):
3/4" Stucco (float finish) on wire mesh
Building paper
Fibreglass insulation board
R 12 batt insulation
3 5/8" Steel studs @ 16" o.c.
Poly vapour barrier
1/2" Drywall

During the course of the envelope assessment, it became apparent that the typical stud wall assembly was constructed as assembly 2.

The roof assembly indicated on the drawings is as follows:

Flat roof construction:
Gravel
Built-up roofing membrane
2" Rigid insulation
2 3/4" concrete slab on
Hambro steel joists

Roof decks are indicated to have pressure treated wood duck boards on sleepers, but the drawings do not indicate the underlying assembly.

Sloped metal roofs are indicated to consist of metal roofing on insulation board over the steel joists.

The majority of the details were not clear as to the intent of the designer with respect to providing a separation of interior and exterior spaces. This is predominately due to the poor quality of the reproduction of the drawings from microfilm.

2.3 Field Observations

Two site visits were made in October and November 1999. Andy Lang and Matthew Hircock carried out the initial day of fieldwork on October 21, 1999. At the time of the initial day of field review, MH had not been provided with the architectural drawings. During the review, it became apparent that no continuous exterior sheathing had been installed at the steel stud walls, and a moisture probe survey could not be performed. At that time, MH requested, and was provided, with permission from the Strata to obtain copies of the architectural drawings from the City of Vancouver microfilm storage facility.

The subsequent site visit was made by Andy Lang on November 26, 1999. EPS Westcoast was retained to perform the exploratory openings through the stucco wall cladding on November 26 in selected locations. The openings were performed under the direction of MH. On November 26, representatives of Coast Waterproofing were also present and provided MH with information regarding their investigation and remedial work to address a water leak into unit 109.

The weather at the time of the exploratory openings was a mix of sun and clouds, with cool temperatures.

2.3.1 Interior Water Leaks

On November 26, the interior of units 102, 103 and 303 were reviewed where water leaks have been reported.

The reported water leaks into units 102 and 103 occur at the east end of the dividing wall between the units. MH was informed that previous water leakage tests were performed and the source of the leak was believed to be at an exterior planter beyond the patio area of unit 103. Despite replacing the waterproofing membrane of the planter, the leaks have continued.

One reported leak into unit 303 occurs in the upper floor bedroom closet at the southeast corner of the building. A section of interior gypsum board had been removed to allow visual review of the interior wall framing and the interior of the fireplace shaft.

Corrosion of the metal wall framing was observed. Refer to Photo No. 1. The adjacent carpet was wet at the time of the field review. Inside the fireplace shaft, the south elevation concrete block wall was observed to be wet. It appeared that the moisture originated at the roof level where the fireplace is capped with sheet metal flashing.

An additional water leak at unit 303 was reported to occur at the base of the east wall beside the fireplace. At the exterior of this location, a vertical transition between brick and stucco wall cladding exists. This transition was not sealed, and openings were observed between the stucco and brick. The location of the leak is also directly interior to where the balcony guardwall connects to the building wall.

Although the interior of unit 109 was not reviewed during this assessment, the following information was obtained through discussion with Coast Waterproofing. The leak occurs at the northeast corner of the unit, near the main entry to the building and penetrates to the interior at the base of a brick clad, concrete block wall. Water penetration testing was previously performed by Coast Waterproofing at the base of the exterior wall and water leaks at this location were confirmed. An approximately 7" wide strip of concrete topping was removed from along the base of the exterior wall, and the waterproofing membrane was patched. Refer to Photo No. 2. Further water penetration testing of this area was performed and further leakage did not occur during the testing. MH understands, however, that despite the remedial work, water leaks still occur during periods of rainfall.

In addition to units 102, 103, 109 and 303 discussed above, the resident survey indicates current water leaks or mold/mildew problems also reported at units 104, 302, 304, and 306. During the field review, MH was also informed of a water leak into unit 105, which has been alleviated by temporary roofing repairs. Approximately half of the eighteen units at Ocean Vista appear to have current problems related to water penetration from the exterior.

2.3.2 Exterior Walls

The exterior walls of Ocean Vista are clad with stucco or brick veneer. The main north and west elevation walls have a stucco finish coat on concrete parging over a concrete structure.

The majority of the exterior walls are exposed to wind driven rain. Some areas within the courtyard, however, are recessed from the wall areas above and are thus provided with some shelter. Refer to Photo No. 3. A few wall areas are also protected by exterior walkways or sloped glazing above.

Many cracks were observed in the stucco cladding. The most significant and widespread cracking occurred on the south elevation in the courtyard. Refer to Photo No. 4. The cracks may, in part, be due to an inadequate number of control joints in the stucco cladding.

Some staining of the stucco cladding was also observed. The most significant staining typically occurred below metal cap flashing locations. Refer to Photo No. 5.

In most locations, the stucco wall cladding extends to within one or two inches from the floor or finished grade level. Sealant has been applied in some locations along the base of the wall between the stucco and the finished floor level. Refer to Photo No. 6. Around the central stairwell, the base of the stucco clad wall has been protected with a metal base flashing. The top edge of the flashing was terminated with a gum lip and a bead of sealant was applied between the flashing and the stucco cladding. Refer to Photo No. 7.

Significant corrosion of the metal stucco J-trim had occurred beside a west facing door in the courtyard. Refer to Photo No. 8. This is a fourth floor door to unit 303 at the bottom landing of an exterior stairwell.

At the south elevation in the courtyard, the lower floors are stepped back from the upper floors. The upper floors appear to be supported by stucco clad cantilevered beams, although no structural drawings were reviewed and the specific construction was not confirmed. In some of these locations, cracks in the stucco cladding were observed, in addition to staining of the cladding. At the east end of the elevation, the stucco appeared to have been patched at the base of the cantilever. Refer to Photo No. 9.

In some locations, a bead of sealant has been applied along the vertical intersections of the stucco and brick wall claddings. In some of these locations, failure of the sealant joint was observed. Many locations, however, lack any sealant, and the exposed intersection may allow water penetration past the cladding. Refer to Photo No. 10.

In general, the brick cladding extends the full four storey height of the main exterior walls. No control joints were observed in the brick, and no shelf angles had been installed to support the brick at floor levels. Therefore the full load of the bricks are supported by the concrete foundation, and it is likely that metal brick ties connect the brick cladding to the concrete wall behind, although this was not confirmed.

Some staining and efflorescence was observed on the brick cladding. The most significant staining occurred on the east elevation, below a location where a balcony guardwall connects to the brick clad exterior building wall. Refer to Photo No. 11.

Metal flashing has been installed along the base of the brick cladding, which separates the brick from the concrete curb below. Refer to Photo No. 12. A bead of sealant has been applied along the length of the flashing, between the brick and the metal. Weep holes in the brick cladding were observed at the base of the brick veneer walls and above the metal head flashing over window locations, although some locations appeared to lack weep holes at the base of the brick.

Several stucco clad partition walls have been installed at various locations around the complex. These walls are covered with metal cap flashing. Joints in the flashing were made with standing seams, which was found to be typical of the cap flashing at other locations throughout the building.

A section of metal cap flashing was removed from a partition wall at the upper roof deck. The opening revealed wood blocking under the metal flashing, without any additional moisture barrier over the wood. Refer to Photo No. 13. The wood was dry and appeared in reasonable condition. The opening also revealed that the partition wall did not have any sheathing behind the stucco cladding.

2.3.2.1 Moisture Probe Survey

A moisture probe survey was intended to be performed on the exterior walls of the building in order to assess the general extent of the moisture ingress and the potential for deterioration of the sheathing and framing.

During the initial day of field review, when the holes were made in the stucco cladding to insert the electrode pins of the moisture meter, it became evident that no continuous sheathing had been installed behind the stucco. Probe attempts were made at several locations with similar results. Therefore, the moisture probe survey was omitted and the assessment continued with an increased reliance upon the exploratory openings to determine the condition of the components behind the wall cladding.

2.3.2.2 Exploratory Openings

Ten exploratory openings were made in the stucco clad wall assembly at Ocean Vista. Locations of exploratory openings are shown on copies of the building drawings in Appendix C, Figures 1 to 6.

The exploratory openings revealed that the typical metal framed wall assembly consisted of:

- Three coat stucco cladding on wire mesh, with an elastomeric coating
- Building paper
- 1" Semi rigid glass fibre insulation
- 4" (nominal) steel stud framing with glass fibre batt insulation
- Polyethylene vapour barrier
- Interior gypsum wall board

The following specific observations were made at the ten exploratory openings through the stucco cladding:

Exploratory opening no. 1
West courtyard elevation, beside fourth floor door to unit 303.
Refer to Photo No. 14.

- The thickness of the stucco varied from approximately ½" - 1".
- The building paper had adhered to the back of the stucco cladding.
- The wall structure was concrete block with metal framing around the door.
- Corrosion of the stucco wire mesh and the fasteners securing the semi-rigid insulation was observed.
- The steel studs and bottom track appeared in reasonable condition.
- The insulation was dry at the time of the opening.

Exploratory opening no. 2
North elevation, upper floor roof deck, beside door to unit 305.
Refer to Photo No. 15.

- The stucco cladding was visibly wet at the time of the opening.
- Corrosion of the stucco wire mesh and deterioration of the building paper was observed.
- A small section of plywood sheathing was installed behind the stucco cladding at the base of the door. The plywood was wet at the time of the opening,

- The semi-rigid insulation at the door jamb was damp.
- The opening extended to within 3 1/2" of the concrete topping on the roof deck. No up-turn of the deck waterproofing membrane was observed at the exterior wall.

Exploratory opening no. 3
West elevation, at upper floor roof deck, at base of sloped glazing at unit 301.
Refer to Photo No. 16.

- Corrosion of the stucco wire mesh was observed.
- The insulation was dry at the time of the opening.
- Black staining of the insulation was observed at the base of the wall. This is likely a result of air leakage through the wall assembly at this location.
- The metal wall framing appeared in reasonable condition.
- No up-turn of the deck waterproofing membrane was observed at the wall behind the stucco cladding. Similarly, no membrane was observed to waterproof the intersection of the sloped glazing and the stucco clad wall.

Exploratory opening no. 4
East facing wall beside central stairwell door to upper floor roof deck.
Refer to Photo No. 17.

- The wall components were dry and appeared in reasonable condition.
- Because the stairwell is unheated, no insulation or polyethylene vapour barrier was installed within the wall assembly.
- The deck waterproofing membrane was observed to lap up the wall behind the stucco cladding. The membrane appeared to be a single ply bitumen sheet membrane with a thin metal foil backing.
- The membrane extended to a height of approximately 6" up from the top of the concrete topping of the deck. Because the membrane was lapped onto the metal framing, the up-turn of the membrane was not continuously supported.

Exploratory opening no. 5
West elevation, unit 103, at base of wall in courtyard below window and adjacent to intersection of stucco and brick clad walls.
Refer to Photo No. 18.

- Corrosion of the stucco wire mesh was observed.
- The opening extended to within approximately 6 1/2" of the top of the courtyard concrete topping. No up-turn of

waterproofing membrane was observed on the wall behind the stucco cladding.

- The building paper appeared in reasonable condition, although moisture was visible on the inside face of the paper.
- A strip of wood was installed along the base of the exterior wall behind the stucco cladding. The wood was wet at the time of the opening.
- Black staining was observed on the insulation. This is likely a result of air leakage at this location.
- The metal wall framing appeared in reasonable condition.

Exploratory opening no. 6

South elevation in courtyard, near base of third floor cantilevered wall area between unit 105 and 106.

- The wall between the units has been constructed with concrete.
- The semi-rigid insulation extended over the end of the concrete wall.
- The wall components at the time of the opening were dry and appeared in reasonable condition.

Exploratory opening no. 7

At chimney beside sloped glazing at roof of unit 105.

- No insulation was installed within the chimney wall assembly.
- Corrosion of the stucco wire mesh and the fasteners for the mesh was observed.
- The opening extended to within approximately 6" of the built-up roof membrane. No up-turn of the membrane was observed on the wall behind the stucco cladding.
- Condensation was observed on the metal wall framing.

Exploratory opening no. 8

South elevation in courtyard, below third floor window.

- Corrosion of the stucco wire mesh had occurred.
- Moisture was observed within the stucco and on the surface of the building paper.
- Two layers of building paper had been installed at this location. Some deterioration of the paper was observed.
- Corrosion of the fasteners for the semi-rigid insulation had occurred.
- The insulation and the steel studs appeared in reasonable condition.
- A vertical cut opening in the polyethylene vapour barrier was observed adjacent to a steel stud. Therefore, the polyethylene was not continuous.

Exploratory opening no. 9
East elevation, base of exterior wall at unit 102, where the water leak to the interior was reported.

- This location is in a somewhat sheltered area.
- The stucco was dry and the wire mesh was in reasonable condition.
- The building paper appeared in reasonable condition.
- The insulation was dry but had black staining, likely due to air leakage at this location.
- The polyethylene vapour barrier at the base of the wall was bunched up and was not continuous.
- The opening extended to within approximately 4 1/2" from the top of the concrete patio topping. No up-turn of waterproofing membrane was observed on the wall behind the stucco cladding.

Exploratory opening no. 10
East elevation, below corner of third floor bay window.

- Moisture was observed within the stucco cladding.
- Corrosion of the stucco wire mesh had occurred.
- Two layers of building paper had been installed at this location. Some deterioration of the building paper had occurred.
- The insulation had black staining, likely due to air leakage.
- The metal wall framing appeared in reasonable condition.

2.3.3 Windows, Doors and Other Wall Penetrations

The windows installed at the Ocean Vista are double glazed with non-thermally broken aluminum frames. They are exterior glazed units that drain to the exterior through weepholes in framing at the sill. The window units are a combination of fixed units, horizontal sliders and awning windows. In a few locations failure of the sealed window units had resulted in condensation occurring between the panes of glass.

The windows are not equipped with an interior condensation track, therefore, should condensation on the window units occur, this moisture would accumulate on the interior wood sill. During the interior review of unit 303, condensation was observed on the window frame.

Small metal flashing has been installed at the head of the window units. This head flashing does not have end dams and, in general, does not provide an adequate slope to shed water away from the building. Refer to Photo No. 19.

A stucco accent band has been installed around windows in stucco clad wall areas. The stucco cladding, in general, has been installed in direct contact with the aluminum window frames. Windows installed in stucco clad, metal framed walls are in the same plane as the face of the cladding. No metal flashing has been installed along the exterior of the window sills in stucco clad walls. The windows installed on the stucco clad concrete wall, such as along the main north elevation wall, have been recessed from the plane of the cladding. The head flashing over these windows has been installed over the cladding with a sealed gum lip at the top.

Windows in brick are recessed from the face of the wall cladding, and are provided with both a head and sill flashing. Refer to Photo No. 20. A bead of sealant has been applied between the window frames and the brick cladding around the window perimeters. The sill flashing extends behind the window frame at the sill and laps over the outer face of the brick cladding. The underlying waterproofing details could not be confirmed without removal of the windows or the adjacent brick cladding.

Several deficiencies or problem areas were observed with regard to the sloped glazing installed at various locations around the complex. These included condensation and water trapped between the panes of glass. At one location, above unit 105, the water between the panes of glass reached a depth of approximately 5". In some locations, plant growth was observed on the interior at the base of the skylights. Refer to Photo No. 21.

The skylights have T-bar framing, and the glazing has been sealed to the frames with exterior caulking on the surface. The top of the sloped glazing is generally covered with metal cap flashing. Sealant has been applied at the laps in the cap flashing. Poor sealant application was observed between metal flashing and the frames of the sloped glazing. Refer to Photo No. 22.

Balcony sliding doors, similar to windows, consist of dual glazed units in non-thermally broken aluminum frames. The installation of the sliding doors is similar to that of the windows. The waterproofing details at the door sills could not be confirmed without removal of the door framing.

Swing doors generally open to the interior. The intended seal of the operable unit is provided by weatherstripping around the perimeter of the door opening. Along the sill, a rubber gasket is installed to seal between the door and the metal threshold. Refer to Photo No. 23. In some locations, the metal flashing below the door threshold was sloped back towards the building. This can result in water penetration if an adequate interior seal is not provided below

the threshold. Water leaks have been reported at the entry door to unit 104 and interior water stains were observed at the swing door at the top of the central stairwell.

Other penetrations through the wall cladding that were observed, which are located in generally exposed wall areas, included vents, electrical outlets, light fixtures, and roof and balcony scuppers. The majority of these penetrations are in stucco clad walls. Many of the penetrations have the stucco applied in direct contact, with no sealant installed between the penetration and the cladding.

2.3.4 Roof Assembly

The main roof assembly (not including roof deck areas) is constructed with a built-up membrane with gravel cover. These membranes consist of multiple layers of roofing felt, with bitumen mopped down between the layers. A top "flood coat" of bitumen is then applied over the entire roof area.

A significant amount of gravel had been installed over many of the built-up roof areas, and a close review of the membrane was not performed. In addition, no cut tests of the membrane were performed to verify proper installation of the multiple layers.

Bleed out of the bitumen was observed at several locations. Refer to Photo No. 24. Bleed out occurs when the bitumen "bubbles" out of the membrane, generally during periods of high temperatures.

A section of roofing membrane above unit 105 had been patched. MH was informed that leaks to the interior had occurred and a temporary patch was performed to alleviate the water ingress until a more permanent repair could be completed.

A significant amount of plant growth was observed at several locations on the built-up roofs. Refer to Photo No. 25. The plant roots may potentially damage the roofing membrane.

The perimeters of the flat roofs have metal cap flashing over a small curb. A section of the metal flashing was removed from the roof above unit 105. The opening revealed that the roofing membrane did not extend to the outer face of the curb. The curb is constructed with wood blocking under the cap flashing. The membrane was observed to lap onto the wood blocking, but only covered about half of the width of the blocking. Where the section of

flashing was removed, the underlying wood blocking was wet at the time of the field review.

The upper roof level drains water onto the sloped metal roofing below, through scupper openings in the roof curb. The metal flashing at these locations was not removed to confirm the detailing of the waterproofing membrane at the scupper locations. In addition to scuppers, some roof drains have been installed. These drains are covered with a metal strainer to prevent debris from entering the drain pipe.

The sloped roofs are clad with sheet metal roofing. The assembly under the metal roofing was not confirmed during this assessment. The metal roofing is secured to the substrate with exposed fasteners. The fasteners were equipped with washers to provide a seal between the fasteners and the metal roofing. Over time and with thermal movements of the metal roof, the fasteners may loosen, thereby decreasing the effectiveness of the seal provided by the washer. A close review of the fasteners was not performed and the general condition of the seal provided by the washers was not confirmed.

Sloped roofs shed water into gutters at the base of the roofs. At the base of the sloped roof on the south elevation in the courtyard, debris was observed in the gutter. The downspout has been installed at the east end of the gutter. The gutter projects beyond the end of the sloped roof, and metal drip flashing has been installed to direct water from the sloped metal cap flashing above into the gutter. Refer to Photo No. 26. The top edge of the drip flashing was sealed to the stucco wall cladding. Due to difficulty in accessing this location, a close review could not be performed and the detailing at the bottom corner of the sloped roof could not be determined.

Metal cap flashing has been installed over the chimneys. Refer to Photo No. 27. Although not confirmed, it is unlikely that any waterproofing layer has been provided under this cap flashing. In general, staining on the flashing was observed, and in some cases, such as above the location of the water leak to unit 303, water was observed to pond on the metal cap flashing, which indicates an inadequate slope of the flashing to shed water.

2.3.5 Balconies and Roof Decks

Only a few balconies exist at Ocean Vista. Instead, most units are provided with ground floor patios or roof decks.

One balcony was reviewed, which revealed a concrete topping over the waterproofing membrane. Therefore, the condition and the detailing of the

membrane could not be determined. The guardwall was clad with stucco. It was not confirmed if the guardwall structure was concrete or metal framed, although the architectural drawings indicate both concrete and metal framed assemblies for balcony and roof deck guardwalls. The top of the walls are covered with metal cap flashing. Although the cap flashing was not removed to review the underlying wall components, based on the removal of cap flashing from other similar locations, it is unlikely that any moisture barrier had been installed under the cap flashing. The cap flashing was terminated at the adjacent brick clad wall, with sealant applied between the flashing and the face of the cladding. This detail was found to be typical of other locations where metal flashing terminated at exterior walls.

Balconies drain through circular scuppers which penetrate through the guardwalls.

Roof decks are covered with a concrete topping. Some localized repairs have been performed along the perimeter of some roof decks. The repairs appeared to consist of removal of sections of the concrete topping and the underlying rigid insulation and installing a liquid membrane patch. The concrete topping at these locations was not replaced. In several locations, deficiencies were observed in the membrane patch and water had penetrated underneath the membrane. Refer to Photo No. 28.

One flat roof deck area at the northeast corner of the building is waterproofed with a modified bitumen membrane. MH understands that the original membrane had been replaced in recent years. A visual review of the roofing membrane revealed some deficiencies. The deficiencies included ridges in the membrane and poor detailing where the membrane terminates at the base of a brick clad wall. Refer to Photo Nos. 29 and 30.

The exploratory openings through the stucco cladding at the base of walls above roof decks revealed that the waterproofing membrane of the roof decks was not adequately lapped up onto the exterior wall components behind the stucco.

Some mid-level walkways have clay tile flooring. The tiles generally appeared in reasonable condition. The method of waterproofing underneath the tiles could not be confirmed without exploratory openings.

2.3.6 Parking Garage and At-Grade Waterproofing

There was evidence of leakage problems within the parking garage, which included water stains and efflorescence on the underside of the concrete slab. Refer to Photo No. 31. These typically occurred along cracks in the slab. In one location a sheet metal channel had been installed, likely to control water penetration through the ceiling of the parkade. Refer to Photo No. 32.

The extent of the apparent water leaks into the parking garage appeared typical of many similar buildings. No spalling of the concrete was observed and no significant rust spots were noted around the locations of the water leaks, with the exception of some pipe penetrations.

To confirm the type and condition of the waterproofing membrane installed on the concrete slab above the parking garage, would require test cuts through the concrete topping. The termination of the at-grade waterproofing at the exterior building walls was also not confirmed. The exploratory openings at the base of exterior walls, however, did not indicate an adequate up-turn of the waterproofing membrane behind the stucco wall cladding.

At some locations, sealant has been applied between the concrete topping in the courtyard and the base of the exterior wall. The sealant at this location provides no significant benefit to the waterproofing of this detail because water can easily penetrate underneath the concrete topping, where the primary level of waterproofing is installed over the structural slab.

3. DISCUSSION

Ocean Vista is approximately 18 years old and some envelope components have reached the end of their expected lifetime and are in need of replacement. Several reports of water leaks to the interior have been reported and remedial action is necessary to address these leaks. It is apparent that significant remedial and renewals work is required to ensure that the building envelope of Ocean Vista provides an adequate and durable long-term barrier to the elements.

3.1 Interior Water Leaks

Many units at Ocean Vista are currently sustaining water ingress. A few of these units were reviewed as part of this assessment work. Based on a visual review and background information provided by others, it appears that there are several potential sources of the water leaks.

Units 102, 103

The leaks are occurring at the base of a concrete block divider wall between the units. It is possible that the leaks may be due to deficiencies in the at-grade waterproofing of the exterior wall adjacent to the location of the water leaks. It is also possible that the leaks are originating above, running down the concrete block wall and penetrating into the units where the wall and the ground floor slab connect. Leaks from above could potentially penetrate the brick wall cladding at any of the following locations:

- along the vertical intersection of the brick and stucco claddings
- at the cap flashing above the brick clad wall
- where the sloped or flat roofs connect to the brick clad wall
- At the stucco clad chimney cap flashing, or where the chimney connects to the top of the brick clad wall
- at the balcony of unit 303 above
- through the exterior brick partition wall between the patios of units 102 and 103, which does not have any waterproofing on top of the exposed bricks

Unit 109

The leak into unit 109 also occurs at the base of a concrete block wall with brick cladding. Similar to the leaks discussed above, this leak may result from a deficiency in the at-grade waterproofing or from water penetration past the brick cladding above. Based on investigations by others, it appears likely that the leak originates from above. The primary factor which would contribute to a water leak from above, is that

the amount of water which penetrates past the brick cladding cannot be accommodated by the underlying wall system. This suggests that either a significant amount of water is penetrating the brick or deficiencies exist in the underlying waterproofing details, or a combination of both.

No bricks have been removed to confirm the waterproofing details at the base of the wall behind the brick cladding. Proper waterproofing details at these locations are discussed in section 3.6.

Water penetration through the brick could occur at the cap flashing of the chimney above. Alternatively, water leaks may occur through joints in the metal cap flashing at the perimeter or the roof above. Due to access restrictions, the cap flashing was not lifted to confirm whether or not proper waterproofing details were provided under the flashing when the roofing membrane was replaced. Water may also penetrate the brick cladding where the balconies above connect the exterior walls, or may penetrate directly through the porous brick and accumulate at the base of the wall.

3.2 Exterior Walls

The stucco wall cladding at the Ocean Vista utilizes a face-seal strategy to manage water that comes in contact with the walls. Face-seal means that the performance of the wall is dependent on the exterior surface of the cladding and associated sealant to shed water. This system cannot easily accommodate water that penetrates past the exterior face since no positive drainage path is provided. Therefore, it is very important not to create any path for the water to get behind the stucco cladding. It is this type of wall system that has experienced the majority of failures that have occurred in recent years in the Lower Mainland.

This method of construction is typical of many similar buildings and any water, which does penetrate the cladding, often becomes trapped within the wall assembly. This type of wall system is very limited in the drying potential of its components, and when wetted, materials susceptible to moisture damage are likely to deteriorate in a short period of time.

Building paper is used with the intent to block incidental moisture penetrating past the stucco, but many fasteners are installed through the building paper, thereby creating many potential locations where water may penetrate the paper. The building paper also does not provide a waterproof barrier, and prolonged contact with moisture is also likely to result in water penetration directly through the paper. In addition, building paper is also often found to deteriorate as a result of the water ingress.

Areas of staining were noticed on the stucco cladding at various locations. The localized staining indicates concentrations of water at these locations. However, it

does not confirm moisture related problems in the wall components behind the stucco, only that excess moisture does come into contact with these areas. Concentrations of water could allow water to be absorbed directly into the stucco and reach the more moisture sensitive wall components behind.

Several cracks were observed in the stucco cladding in the complex. Cracks are a concern since they allow a path for water to penetrate past the cladding. Large cracks increase the amount of free flowing water that can penetrate the stucco, while small cracks allow water penetration by capillary action.

Seven of the ten exploratory openings revealed signs of current or previous moisture within the wall assembly, which included corrosion of the stucco wire mesh and metal fasteners, condensation on the steel studs, or moisture on the building paper or in wood blocking within the wall assembly. Moisture was observed within the wall assembly at four of the openings. The full extent of the problems could not be determined given the general nature of our current assessment work. However, based on the results of the exploratory openings, it appears that moisture is entering the wall assembly at various locations but has not resulted in significant deterioration of wall components at this time.

The lack of significant deterioration may, in part, be due to a greater drying potential of the wall assembly than newer buildings as a result of air leakage. Due to the age of the building, it is unlikely that air leakage was a major concern of intent of the building design. The black staining observed on the batt insulation is a typical sign of air leakage through the assembly. Despite the increased drying potential of the wall assembly due to air leakage during warm seasons, the air leakage also increases the chances of condensation occurring within the walls. The moisture observed at the exploratory openings may, in part, have been due to condensation resulting from interior air leakage.

The use of a continuous layer of semi-rigid insulation over the steel studs greatly reduces the amount of thermal bridging that may occur at the locations of the steel studs, thereby increasing the overall thermal performance of the walls. The structural significance of using the insulation in place of wood or gypsum sheathing was not investigated as part of this assessment work.

Brick clad walls are typically constructed as drained cavity, or rainscreen, wall systems. The brick cladding is separated from the back-up wall structure by an air space. This air space provides a capillary break between the porous brick and the underlying wall structure, in addition to permitting the drainage of incidental water which may penetrate past the cladding. In addition to improved performance against

wetting of the underlying wall structure, it is believed that this air space increases the drying potential of the wall assembly should water leakage occur.

The architectural drawings do not indicate an air space behind the brick veneer. However, based on past experiences, MH believes it unlikely that the brick veneer has been installed in direct contact with the concrete block wall behind. The weep holes observed are also evidence of a design intent to drain water out from behind the brick, which would only be possible if an air space has been provided.

Current technology for new construction and wall rehabilitation is to incorporate a drainage cavity behind all cladding materials, including stucco. The cavity is typically created by using 3/4" vertical metal strapping. This can achieve a rainscreen wall system for exterior walls with virtually any type of cladding. It is currently accepted that this type of wall system is required to enable an exterior wall to provide adequate performance against rainwater penetration in the coastal climate of British Columbia.

Brick veneer walls are typically constructed with steel shelf angles at each floor level, which support the bricks above. This design provides a separation of the wall area at each floor and may prevent water, which penetrates the brick, from running down the wall past any given floor level. Proper design would enable any penetrating water to be drained back out of the wall system at each floor level utilizing flashing and weepholes at the level of the shelf angles.

MH has not reviewed structural drawings and has not confirmed the method in which the brick is supported to the concrete wall behind. It is likely that the bricks are anchored to the wall with metal brick ties. Because water leaks are occurring at the base of brick clad walls, it is possible that the moisture is travelling down inside the air cavity behind the brick. Brick ties and mortar droppings within the air space behind the bricks are potential locations where water may cross the air space and penetrate to the structural wall behind.

3.3 Windows, Doors and Other Wall Penetrations

Water ingress at window locations may also occur between the window frame and adjacent wall cladding, or may occur through joints in the window frames themselves. Aluminum framed windows are prone to failures of the sealant in the mitred joints at the corners of the frames, which in turn allows water to enter the wall assembly. With movement of the wall through building settlement and thermal movements, the sealed joints can fail over time. If there is a failure of the seal at the mitre joints, water can penetrate through the frame, wetting the supporting structure, and result in deterioration of susceptible wall components and water leaks to the interior. MH is

unaware of any reports of water leaks occurring at window locations at Ocean Vista at this time.

Condensation in the building occurs when warm interior air contacts a colder surface, which is at a temperature at or below the saturation or dew point temperature. Typically, windows are not as thermally efficient as the adjacent exterior walls, and condensation is more likely to occur on or around them. The limited insulating characteristics of the windows themselves may permit temperatures cold enough to allow condensation on the interior. The windows at Ocean Vista do not have thermal breaks in their aluminum frames and will provide only limited thermal performance. Cold temperatures may also result from air leakage around the windows if they have not been adequately sealed at their perimeters. Although MH is unaware of any reports of condensation occurring at window locations, condensation was observed on the bedroom window of unit 303 during the field review. Condensation between the panes of glass indicates a failure of the glazing unit seal.

The water trapped between the panes of glass of skylights results from failure of the sealed units. The T-bar skylights are also prone to water leaks along the framing components, which appear to rely predominately on a bead of exterior sealant between the metal frames and the glass units. When this sealant fails over time, water leaks to the interior are likely to result. The interior plant growth observed at the base of skylights may result from water leaks to the interior, or from an accumulation of moisture due to interior condensation.

MH is aware of reported water leaks at the door to unit 105, and at the base of the door to the roof deck at the top of the central stairwell. The leaks may result from a deficiency in the waterproofing under the door threshold, or from a failure of the weatherstripping around the door perimeter. This could require water penetration testing or destructive investigation to confirm.

3.3.1 Vents

Dryer vents require routine review and cleaning to ensure that they do not become blocked with lint. Should a dryer vent become blocked, the warm, humid air that is produced by the dryer will not be properly discharged to the building exterior. When this occurs, there is a possibility that the air may penetrate through small discontinuities in the ducts and be expelled to the building interior or into the exterior wall assemblies. Should dryer exhaust be released into the exterior wall assembly, condensation is likely to occur, which may result in deterioration of the wall components.

3.4 Roof Assembly

The typical built-up roofing (BUR) membrane has an expected life of approximately 12 to 15 years, at which time significant repairs or replacement will likely be necessary. With proper and regular maintenance, the life of the membrane may often be extended for several additional years. The built-up roof areas at Ocean Vista have reached the end of their original expected lifetime and will likely require replacement within the next few years. Ponding water can have damaging effects on BUR membranes. The roofing felts used can absorb moisture which can cause the felts and asphalt to decay. The amount of water absorbed increases with the age of the roof, escalating the rate of deterioration. Water ponding can also cause hot and cool spots that may result in differential thermal movements of the asphalt and felt layers. Constant differential thermal movement and water absorption can reduce the expected life of the roof by several years. UV radiation can be even more damaging to the roofing membrane and there should be sufficient gravel cover to provide complete coverage of the membrane.

Proper detailing of the waterproofing at the roof perimeter should include extending the membrane over the curb and past the face of the wall cladding below. The removal of a section of metal cap flashing indicated that this important feature was not constructed at Ocean Vista. The metal cap flashing on the curb must not be relied upon to alone provide complete waterproofing. Its primary purpose is to provide weather protection for the waterproofing membrane beneath.

Concerns with the current built-up roofing areas include:

- Plant growth on the roof area may damage the membrane.
- Temporary patch repairs have been required to address water leaks.
- Inadequate detailing under the metal cap flashing at the perimeter curbs.
- Excessive bleed out of the membrane at some locations.

These factors, in addition to the age of the existing roof membrane, suggest that roof membrane replacement should be performed in the near future.

The assembly under the sloped metal roofing was not confirmed, because it would likely require removal of sections of the roofing. These types of roofing systems are prone to water leaks at the locations of the exposed fasteners. Sheet metal roofing with concealed fasteners would provide more durable performance. MH is unaware of any reported problems related to the sloped roof areas. A more thorough review of the sloped roof areas, including removal of sections of the metal roofing to confirm the underlying assembly, would require the use of long ladders and/or fall protection equipment to permit access.

3.5 Balconies and Roof Decks

The type of waterproofing membrane below the concrete topping at balcony and roof deck areas was not confirmed. It is possible that the foil backed bitumen sheet membrane, which was observed at the base of the exterior wall at exploratory opening no 4, has been installed throughout. However, the foil backing is typically used for protection of the membrane where they are likely to be exposed, such as along roof perimeters.

The majority of the membranes are likely to be those originally installed 18 years ago and may be reaching the end of their expected lifetime. Where liquid membrane patches have been installed at the upper roof deck areas, several deficiencies were observed and further water leaks are likely to result. Due to the age of the roof deck membranes, the temporary repairs that have been required to address water leaks, and current water leaks that may be a result of membrane deficiencies, it will likely be necessary to replace the existing waterproofing system in the near future.

MH does not recommend the installation of poured concrete topping over waterproofing membranes. Instead, concrete pavers or wood decking is typically recommended. This would allow removal of the walking surface to permit periodic review of the condition of the underlying membrane. The installation of the concrete topping makes maintenance of the membrane virtually impossible without significant demolition and removal of the topping.

At one location, the original roof deck membrane was replaced with a 2-ply modified bitumen waterproofing system. When properly installed, these systems typically provide a more durable barrier against water leaks than do the traditional built-up roofing membranes. The ridges observed in the new membrane and the detailing where the membrane connects to a brick clad wall suggests that the membrane installation was not well performed. Proper detailing of the membrane termination at the exterior wall requires the removal of the wall cladding at the base of the wall to allow the waterproofing membrane to extend onto the back-up wall system. Without this detailing, any water which penetrates the brick cladding will become trapped in the wall system and will likely penetrate the roofing system or into the units below.

With the exception of the conditions observed at exploratory opening no. 4, no up-turn of the roof deck membrane was observed onto the wall components behind the stucco cladding. This suggests that the membrane up-turn typically does not extend a sufficient distance up onto the exterior wall. This may potentially result in water on the concrete topping penetrating behind the stucco cladding at the base of the exterior walls. Alternatively, if the base of the stucco becomes saturated due to splashing of rainwater off the concrete topping, the moisture may penetrate directly through the

stucco and reach moisture sensitive components behind. Several of the exploratory openings performed near the base of exterior walls revealed signs of moisture behind the stucco cladding.

3.6 Underground Parking Garage & At-Grade Waterproofing

Over the course of many years, water leakage into underground parking structures causes deterioration of the reinforcing steel within the concrete. Water leaks into underground parking garages should typically be addressed in the long-term maintenance of the building. Because Ocean Vista is 18 years old, however, addressing water leaks may become a concern within the near future.

Leaks into below grade structures are often difficult to trace and may be costly to repair. Because of the time that it takes for corrosion of the reinforcing steel in the concrete to occur due to water ingress, leaks into parkades often cause more of a nuisance than a concern regarding occupant health or safety. Spalling of the concrete is typically the first indicator of structural distress and that repairs are required. No such signs of distress were apparent at Ocean Vista during the brief visual review of the underground parkade.

Deficiencies in the at-grade waterproofing may be the sources of some of the current water ingress problems at Ocean Vista. Previous water penetration testing by others confirmed water leakage into unit 103 when the planter outside of the patio was flooded. MH understands that the replacement of the planter membrane is believed to have stopped one source of the water leaks into this unit but further leaks have occurred during periods of rain. MH is also aware that water penetration testing of the patio has not resulted in any water leaks to the interior.

MH has not confirmed the detailing of the waterproofing membrane where the planter and the patio connect. In order for a water leak to originate from the planter and not from the patio, the water would have to penetrate the planter membrane and travel under the patio membrane and through the joint between the concrete slab and the base of the exterior wall.

Similar to the detailing of roof deck membranes at the base of exterior walls, proper detailing of at-grade waterproofing at the base of the exterior walls requires the membrane to extend up onto the wall components behind the cladding. Proper detailing would have the at-grade waterproofing extending from the concrete structural slab onto the vertical face of the concrete block wall. The moisture barrier (building paper) on the block wall should then lap over the membrane to ensure that any water within the wall cavity is shed onto the membrane and out of the wall assembly through the weepholes in the brick veneer at the base of the wall. During

this assessment, exploratory openings were performed only at steel stud wall areas and not through the brick veneer at concrete walls. Therefore, the tie-in between the wall moisture barrier and the at-grade waterproofing was not confirmed.

The membrane patch outside of unit 109 may provide questionable benefit, depending on the sources of the leak. The concerns with the patch repairs at this location include the following:

- The 7" wide strip of concrete removal may not enable proper tie-in between the existing membrane and the patched location.
- The membrane patch does not extend onto the concrete block wall behind the brick veneer, which is required to adequately waterproof this location.

One contractor who investigated the leak at unit 109 believed that water penetrating through weepholes at the base of the brick veneer wall was contributing to the water leak to the interior and suggested reducing the amount or size of weepholes at the base of the brick wall. Water ingress to the unit interior resulting from water penetrating the brick suggests a deficiency in the waterproofing at the base of the wall. Sealing the weepholes in the brick is likely to increase the problems because it prevents water from exiting the wall assembly through the weepholes, in accordance with the design intent of this type of wall system.

4. RECOMMENDATIONS

The following recommendations are based on visual observations and sample locations of exploratory openings through the stucco cladding. Because of the general nature of this assessment, the full extent of water ingress and the resultant damage has not been determined.

Note that quantity estimates were generally obtained from copies of the architectural drawings. Because the drawings were reproduced from microfilm, they are not at a standard scale and the quantities and costs provided are intended to be order of magnitude estimates to provide a general indication of the costs associated with the recommended repairs.

4.1 Interior Water Leaks

Interior water leaks may be addressed on an as-needed basis. However, because many units are experiencing water ingress at this time, MH recommends that a more extensive rehabilitation plan be established to provide a long-term solution rather than short-term repairs. These long-term repairs and renewal items are described in the following sections.

MH understands that some of the recommended repairs may take some time before they can be implemented, due to the magnitude and the cost of the repairs. It is possible to provide short-term solutions to address the current water leaks that are occurring at Ocean Vista. Because we have not performed water penetration testing to confirm the path(s) of water ingress into the units, we cannot make specific recommendations at each of the units, and any recommendations would be based predominately on investigative work by others. Similarly, we have not reviewed all reported locations of water leaks, and therefore cannot provide recommendations, which would alleviate these problems without performing the more extensive testing indicated below.

The recommended repairs which would address the current water leaks are included in the following sections. It may be possible to phase the repair work according to priority of the locations of current water leaks. Although this may be the least cost effective method of solving the problems over the long-term, it may be the most appropriate solution to address the immediate concerns of the current water leaks.

4.2 Exterior Walls

The nature of the face-sealed stucco walls is such that the details cannot be significantly improved or economically maintained in a fashion that would eliminate all water penetration problems. Therefore, we recommend that you plan on a future

rehabilitation program that replaces the current face-sealed stucco wall system, on metal framed wall areas unprotected from wind driven rain, with a drained cavity system with improved detailing at the windows, doors and other critical areas.

Note that significant deterioration of wall components was generally not discovered during this assessment, and immediate rehabilitation of all the metal framed exterior walls is not necessarily required at this time. However, several of the exploratory openings did reveal moisture behind the stucco cladding, and MH believes that the only appropriate solution to address these problems is to improve the design of the wall system. In addition, any deteriorated wall components will require replacement, which would necessitate the removal of the stucco cladding. The only way to ensure that all water ingress problems through exterior walls are addressed would be to rehabilitate all exposed stucco wall areas.

The unit cost for rehabilitation of stucco-clad metal-framed walls is estimated at approximately $\$35/ft^2$. This will vary, depending on the specific assembly and the detailing of the rehabilitated wall areas. Extensive rehabilitation of all steel stud walls does not appear necessary within the immediate future. An overall budget for future wall repairs is difficult to provide, since the cost will depend on the timing of the repairs and the condition of the walls.

The reported water leaks generally do not appear to be directly related to the stucco clad metal framed walls, and it may be possible to delay much of the wall replacement work so the typical locations of the water leaks may be addressed first. Once these areas of higher priority are addressed, a maintenance, renewals and restoration plan may be established.

The drained cavity or rainscreen wall system and improved details has a proven history of successful performance and can normally be expected to provide a long life span with normal but necessary maintenance activities (sealant replacement, cleaning, recoating).

Brick veneer walls typically provide a drained cavity wall system, MH does not believe it necessary to rehabilitate the brick wall areas at this time. The details will require improvement however, to reduce the amount of water that may penetrate the brick cladding and to ensure that any water that does penetrate is able to exit the assembly at the base of the wall. The areas where water is likely to penetrate includes windows, metal cap flashing on top of the walls or over chimneys, where the roof decks or balconies connect to the brick clad walls, and along intersections of brick and stucco clad walls. Water may also penetrate through cracks or openings in the brick veneer. Sealing the cracks and/or providing a water resistant coating on the brick may limit the amount of moisture which can penetrate through the field area of the brick cladding. This type of work should be performed as part of a standard

building envelope maintenance plan, which is discussed in section 4.9.

The intersections of the stucco and brick clad walls can be addressed during the repairs to the stucco wall areas. If this work is delayed, however, the installation of a sealant joint between the brick and stucco is required to enable these locations to provide a basic level of performance until more comprehensive repairs are performed. The various repairs at each of the other details indicated above are discussed in the appropriate following sections.

4.3 Window, Doors and Other Penetrations

The rehabilitation of exterior stucco walls identified above includes incorporating improved waterproofing details at all windows, doors, and other wall penetrations. The costs associated with the detailing are included in the above wall replacement estimate.

MH recommends that maintenance of the windows be performed, which includes the replacement of sealant around all windows, re-sealing the joints in the window frames, replacing those units with failed glazing seals, and replacing gaskets and weatherstripping around windows, as required. The cost for this type of maintenance work will vary, largely dependent on the number of failed sealed units. At this time, MH recommends budgeting an allowance of approximately $150/window for this maintenance work.

A recommended option is to replace the existing windows when they are removed during the wall rehabilitation. The windows are 18 years old, and have non-thermally broken aluminum frames. New window units would provide better thermal performance and improved resistance against wind driven rain and air leakage. However, the above cost estimate for wall rehabilitation does not include the new windows. The estimated material cost to replace the existing windows during the wall rehabilitation is approximately $500 per window.

It has not been confirmed that any problems exist with windows in brick veneer and concrete wall areas. It may be cost effective to replace all windows as part of a comprehensive renewals plan, which could also include replacement of windows in sheltered locations. MH estimates that replacement of the windows in the brick veneer walls would cost in the order of $1,300/window. Replacement of the windows in the concrete walls is estimated at approximately $1,100/window. Note that these unit rates do not include providing access to the window locations, and will depend largely on the scheduling of this work. We believe that window replacement should be considered as a renewals item and is not a high priority at this time. With proper maintenance, the existing windows may provide several more years of functional life.

Several deficiencies and concerns were noted with regard to skylights at Ocean Vista. Essentially the only means of maintaining these units against water penetration is to ensure an adequate exterior seal between the glazing and the metal frames. When this seal fails, water leaks to the interior will likely occur. The most appropriate solution to address these water leaks would be to replace the existing skylights with new units. However, because extensive water leaks do not appear to be resulting from failures of the skylights, replacement may not be required at this time. It may be possible to maintain the existing skylight systems over the next few years. For this to be feasible, however, MH recommends that all failed glazing units be replaced, new glazing seals be installed and all exterior sealant replaced. This would require removal of each glazing unit. We recommend a total budget allowance of approximately $6,000 for the maintenance and repairs described and recommend that this work be performed at the time the adjacent roofing membrane is replaced.

An option would be to replace the existing skylights at the time of the rehabilitation of the adjacent envelope components.

4.4 Roof Assemblies

The built-up roofing membrane has reached the end of its expected lifetime, and several deficiencies or performance concerns were noted during this assessment. MH recommends complete roof membrane replacement within the next few years. This work should include:

- Removal of all gravel and existing built-up roofing membrane.
- Removal of the metal cap flashing and all moisture effected wood blocking along the roof perimeters.
- Re-sloping the substrate, as required, to ensure proper drainage.
- Inspect for and add ventilation of the joist space, as required.
- Install new waterproofing membrane. A 2-ply modified bitumen sheet membrane system is recommended.
- Lap the membrane over the roof curb, extending the membrane to the exterior of the wall cladding below.
- Ensure proper up-turn of the membrane onto exterior walls, chimneys, etc., behind the wall cladding.
- Install new perimeter cap flashing.

In addition to this work, MH recommends that all metal cap flashing on chimneys be replaced. If a single, continuous piece of metal cannot be used, MH recommends that waterproofing membrane be installed under the cap flashing, which directs any penetrating water to the exterior of the wall cladding below.

MH estimates the total cost for flat roof repairs to be approximately $28,000, based on an estimated roof area of 2,800 ft^2 at a unit rate of $10/$ft^2$. An additional allowance of approximately $6,000 is estimated to replace the metal cap flashing at 11 chimneys.

4.5 Balconies and Roof Decks

MH is unaware of any current problems associated with the few balconies at Ocean Vista. However, due to the age of the existing balcony membranes and due to the problems associated with similarly constructed roof deck areas replacement of the balcony membranes within the next several years may be required.

MH does not consider further patchwork repairs to the roof deck membrane to be appropriate and recommends complete replacement of the existing membranes. Due to the installation of the concrete topping, it is not feasible to maintain the deck membranes. The problems associated with the waterproofing are likely due, in part, to the age of the membranes.

Tie-ins are required between the balcony and roof deck membranes and the exterior wall systems and it would be prudent to carry out membrane replacement concurrently with the exterior wall repairs.

The scope of work for balcony and roof deck rehabilitation is as follows:

- Remove the existing concrete topping, insulation and deck membrane.
- Remove all sliding and swing doors.
- Remove the metal cap flashing and the stucco cladding from the parapet walls.
- Replace all damaged wall and deck components.
- Revise the drainage system, as required, by providing adequate slope of the deck and installing new scuppers or drains.
- Install a new deck membrane, turned-up at walls and lapping to the interior below doors. The use of a 2-ply modified bitumen (SBS) membrane, or similar waterproofing system, is recommended.
- Replace existing, or install new balcony and roof deck sliding and swing doors.

- Install drainage matt over membrane. Reinstate or replace rigid insulation.
- Install filter cloth over insulation.
- Install concrete pavers over the filter cloth.
- Install waterproofing membrane at the top of the parapet walls, sloped to shed water to the exterior of the wall cladding.
- Install new stucco wall system, as described for wall replacement, on parapet walls.
- Place new metal cap flashing on parapet walls.
- Install rain water leader to collect the water drain from balconies and roof decks as required.

In addition to the above membrane replacement, MH recommends that localized repairs be performed at the northeast roof deck, where the installation of the 2-ply modified bitumen membrane is suspect. The repairs should consist of removal of the bricks at the base of the wall to enable the membrane to be extended onto the concrete block wall behind. In addition, MH recommends removal of the curb cap flashing to ensure that the roofing membrane extends to the outside of the brick wall cladding below. If the membrane does not extend to the exterior of the brick, MH recommends that repairs be performed at this location prior to reinstating the metal cap flashing.

A total budget cost of $69,000 is estimated for the roof deck repairs, based on an average unit rate of $30/ft^2 and a total area of approximately 2,300ft^2. Balcony repairs are estimated at approximately $2,500 per balcony for each of the four balconies. Because the balcony sliding doors will require removal to properly detail the waterproofing membrane, this would provide an opportune time to replace the existing doors with new models. New doors would provide improved thermal resistance and resistance to water penetration and air leakage. The material cost for new balcony doors is estimated at $800 each.

Note that the above scope of work for balconies and roof decks includes installing waterproofing membrane and new metal cap flashing on top of all parapet and divider walls. Because some of the water leaks may be originating through the cap flashing over the walls, an additional cost breakdown, of approximately $13 per lineal foot, for this work is provided.

4.6 Parking Garage and At-Grade Waterproofing

The areas of past leaks and repairs should be monitored to determine if an increase of water penetration is occurring, and remedial action taken as appropriate. A future

proposal can be provided if it is required to investigate the extent of damage in the underground garage due to water penetration.

To properly alleviate water leaks into the parking garage would require excavation of the courtyard, planters and patios around the building to replace the failed waterproofing membrane. Because leaks through the concrete structures are generally not as urgent a concern as water leaks into living spaces, the replacement of the at-grade waterproofing may be delayed to a future date. MH recommends accumulating funds for the eventual replacement of the waterproofing membrane. A budget cost for this work can be provided upon request.

Several units at Ocean Vista are experiencing water leaks at the base of brick clad walls. The exploratory openings near the base of stucco clad walls generally did not reveal sufficient up-turn of the roof deck or at-grade waterproofing membrane. To properly detail the base of exterior walls would require the following work:

- Cut and remove the concrete topping along the exterior wall.
- Removal of the cladding at the base of the exterior wall.
- Install a membrane patch, which extends from the existing at-grade waterproofing and turns up a minimum 8" onto the wall behind the cladding.
- Lap the existing wall building paper over the new membrane patch.
- Reinstate the wall cladding.
- Install a drainage mat over the membrane patch.
- Install concrete pavers or reinstate poured concrete topping.

The unit rates for the above work is difficult to estimate and will depend largely on the magnitude of the repairs. In order to establish an accurate unit rate for the work, MH recommends that a trial repair area be carried out along with further investigative work. We believe it would be appropriate to perform this work at the base of the exterior wall outside of unit 109. This would enable a better understanding of the source(s) of water leaks into this unit, the detailing at the base of the wall behind the bricks, and the costs associated with the above repairs. As a preliminary budget, MH recommends an allowance of approximately $3,000 for the contractors' cost to perform the repairs. Engineering fees for this work are discussed in section 4.7.

4.7 Second Stage Assessment/Leak investigation

To provide a better indication of the extent of damage, further assessment of the building envelope is recommended. This should consist of further exploratory openings to provide a better indication of the magnitude of the problems, and allow

for a more realistic and phased implementation schedule for the recommended rehabilitation plan.

This initial assessment provides a review of the overall condition of the building envelope for the complex and focuses on specific locations where it was reported that water ingress has been occurring.

By performing a second stage assessment the owners would be provided with a more accurate understanding of the extent of damage, and hence a more accurate budget for immediate versus deferred repairs and renewals. We believe that this would be the most cost-effective path of action. The assessment work could also provide increased knowledge of the various envelope details, which would aid in the design of the necessary repairs.

In addition to further exploratory openings through stucco cladding, selective openings through the brick cladding should be performed to confirm the detailing behind the brick veneer. A closer review of the problem areas identified during this assessment should also be performed.

In addition to the further assessment work, individual leak investigations may be performed to enable temporary repairs to be completed to alleviate current water leaks, or to prioritize the envelope repairs and renewals to address the locations of the current water leaks. During the course of this assessment, MH was asked to specifically review water leaks into units 102, 103 and 109. It is apparent that additional units are also experiencing current water leaks. Understanding that renewal and rehabilitation work may take considerable time to implement, focussing an investigation to provide relief of current water leaks is a viable and recommended option for the owners.

MH believes that some of the repairs recommended by various contractors who have performed water leakage investigation at Ocean Vista are generally either short-term solutions or do not address all likely sources of the leaks. At this time the owners may opt to follow recommendations by a contractor who has performed water penetration testing, with the understanding that, depending on the repairs, they should be considered more of a temporary fix rather that a long-term solution.

MH recommends budgeting approximately $6,000 to $10,000 for further building envelope assessment and investigation. Please note that this budget may vary significantly, depending on the extent of investigation that is desired to address current water ingress problems.

4.8 Repair Priority

The recommended building envelope repairs and renewals items are fairly significant and expensive. Due to the general nature of this assessment, MH is unable to provide a recommended schedule to implement the repairs. We can however, provide a general indication of what we believe to be the high priority items which require immediate attention. Scheduling of the remaining repairs and renewals items can be established over the next few years once the more urgent concerns are addressed.

Based upon our current understanding of the building envelope of Ocean Vista, we believe the main priority is to complete additional investigative/assessment work. Limited deterioration of envelope components was observed during this assessment and MH believes that addressing the active leaks to be of utmost importance. Maintenance items and localized repairs will likely be required to address the water leaks. Once the active water leaks are addressed, a more comprehensive repairs or renewals plan may be established.

At this time, MH believes that renewals of the waterproofing membranes at roof areas, balconies, and roof decks will be required within the next few years. Exterior steel stud wall rehabilitation may be scheduled once the investigative work is complete and greater knowledge is gained regarding the condition of the various wall areas.

4.9 Maintenance and Renewals Plans

All building envelope assemblies and components have a finite expected lifetime, and will require maintenance to ensure that expected lifetime is reached. Several of the above recommendations address maintenance and renewals items to enable the building envelope of Ocean Vista to provide an adequate barrier to the elements.

Once the high priority repairs are addressed, MH recommends that the Strata establish a maintenance and renewals plan for each building envelope assembly or component. The maintenance items include such things as inspecting and replacing sealant, cleaning dryer vents, cleaning and re-painting wall cladding, and cleaning roof drains, gutters and downspouts. Renewals items include replacing roof and balcony membranes, replacing failed glazing units, etc.

Maintenance and renewals plans are necessary to prevent premature failure of the building envelope and to prepare for the financial requirements of replacing components once they have reached the end of their functional lifetimes. A budget for the maintenance and renewals items cannot be provided until the plans are established.

4.10 Summary of Costs

The remedial work recommendations are summarized in Table 1, Appendix A. The costs provided are expressed in 2000 dollars and are based on our current knowledge of the condition of the envelope. Budget costs are provided for repairs which are recommended to be performed within the next few years. Additional budget costs for lower priority items, such as rehabilitation of exterior steel stud walls, can be provided once additional investigative work is complete.

These "order of magnitude" costs are for initial budgeting purposes only. Accurate costs for the rehabilitation plan, however, can only be obtained for work of this nature once the design, specifications and detailed tender documents are complete. .

With any envelope rehabilitation, there may remain some potentially significant unknown costs. For example, the extent of deterioration and thus the magnitude of structural repairs required cannot be determined precisely until the demolition occurs.

Most of the envelope repairs are recommended to be performed over the next several years. In order to provide a phased implementation schedule for the repairs or renewals of the various building envelope components, further assessment and investigative work is recommended. Once the extent of the problems and a better understanding of the current condition of envelope components are established, a realistic repair schedule can be provided.

MORRISON HERSHFIELD LIMITED

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Building Science Specialist

APPENDIX A: Tables

Table 1. Summary of Remedial Work Recommendations

DESCRIPTION	Estimated Unit Cost	Estimated Budget Cost
Supplementary Investigation		
Additional investigative work, including leak investigations (estimated budget range)		$6,000 to $10,000
Exterior Wall Repairs		
Stucco wall remedial work – scheduling dependant upon supplementary investigations	$35/sq. ft.	To be determined
Windows, Doors and Other Penetrations		
Option: Replace windows in stucco clad walls during wall rehabilitation work (material cost only)	$500/window	
Option: Replace windows in brick veneer. Cost does not include access to window location (i.e. scaffolding)	$1,300/window	
Option: Replace windows in concrete walls. Cost does not include access.	$1,100/window	
Window maintenance	$150/window	$10,000
Skylight maintenance/repairs		$6,000
Roofing		
Replace existing built-up roofing with 2-ply modified bitumen roofing membrane system	$10/sq. ft.	$28,000
Replace cap flashing at 11 chimneys		$6,000
Balconies and Roof Decks		
Install new balcony membranes	$2,500/balcony	$10,000
Recommended Option: replace sliding glass doors – material cost only. (Work should be performed at the time of balcony membrane replacement).	$800/door	$3,000
Replace membrane on all roof decks (includes tie-in at adjacent walls).	$30/sq. ft.	$69,000
New cap flashing and waterproofing membrane at parapet and guardwalls (budget allowance is included in roof deck repair costs)	$13/ft.	
Parking Garage and At-Grade Waterproofing		
Modify waterproofing and base flashing at base of exterior walls (budget allowance for trial repair area at unit 109 only) – future costs to be determined		$3,000

DESCRIPTION	Estimated Unit Cost	Estimated Budget Cost
Maintenance and Renewals Plans		
Establish a maintenance and renewals plan for building envelope components		To be determined
Subtotal		**$145,000**
General Contingency (estimate 20% of Sub-Total)		$29,000
Engineering Fees (est. 15% of Sub-Total + General Contingency)		$26,000
G.S.T. (allowance, based on 7% of Subtotal + Engineering Fees)		$12,000
Total		**$212,000**

Notes:

1. These order of magnitude costs are for initial budgeting purposes only and are rounded to the nearest $1,000.
2. The above budget costs are for items likely to require repairs within the next few years. Additional costs, such as for further repairs at base of exterior walls, stucco wall rehabilitation, maintenance items, etc., are to be determined once the investigative work is complete.
3. For work of this nature, more accurate cost figures can only be calculated once a further investigation of the building envelope has been undertaken, and the design, specifications and detailed tender documents are completed.
4. Engineering fees for design and field review of building envelope repairs typically range from 12% to 15% of the total construction cost and will depend on the magnitude of the repairs.

APPENDIX B: Photographs

Photo No. 1 – Unit 303, location of water leak in upper bedroom closet. Corrosion of the metal wall framing was observed and the carpet was wet at the time of the field review.

Photo No. 2 – Location of repair to at-grade waterproofing membrane outside of unit 109, where a water leak has been reported.

Photo No. 3 – South elevation in courtyard.

Photo No. 4 – Typical cracks in the stucco cladding at metal framed wall assembly.

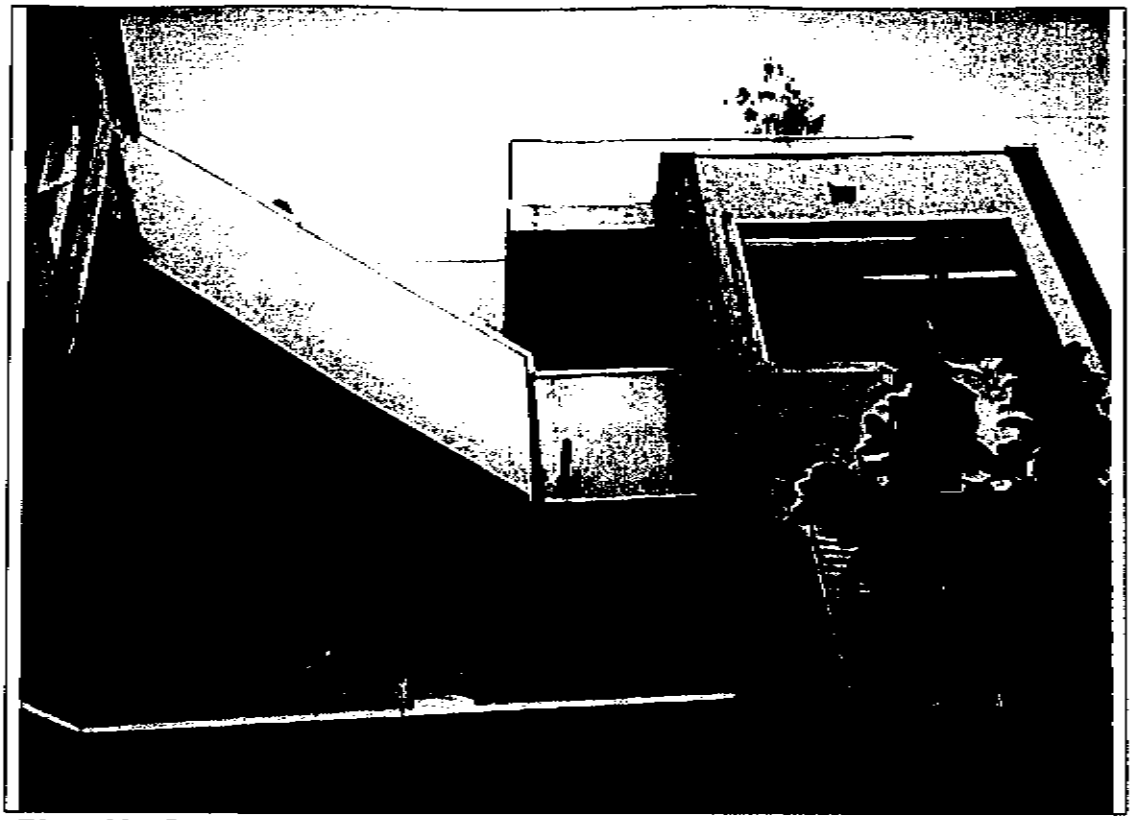

Photo No. 5 – Typical staining of the stucco cladding below a joint in the metal cap flashing.

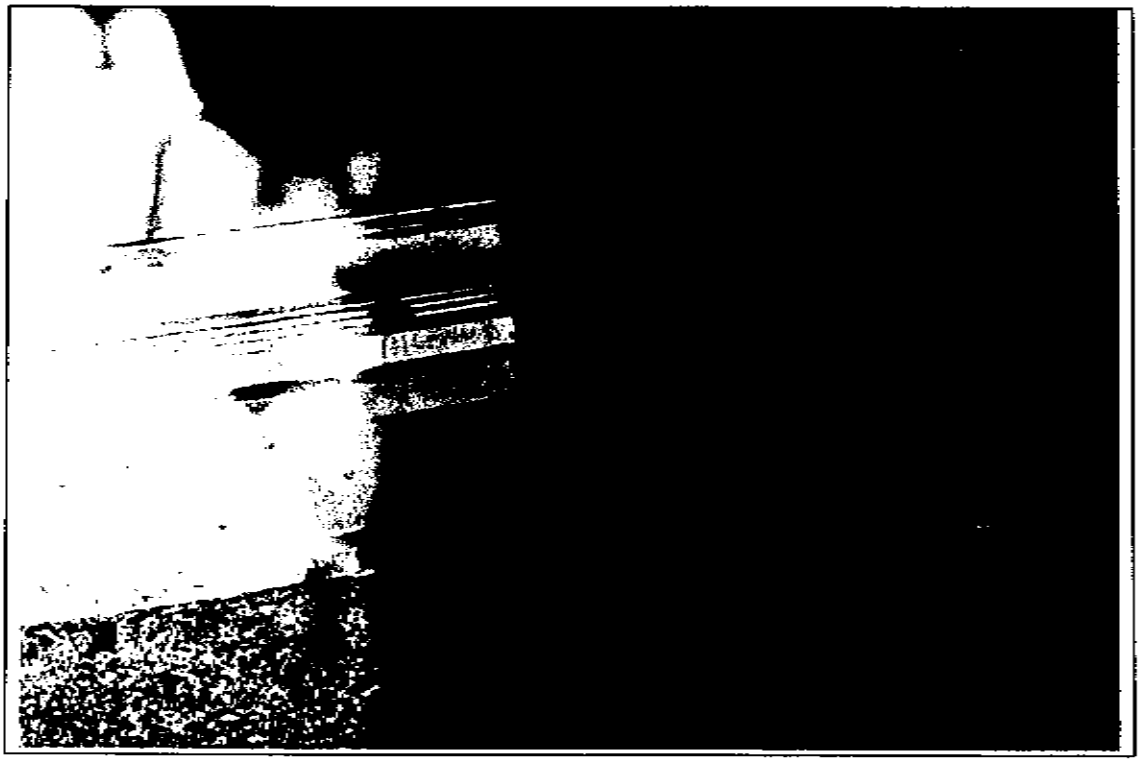

Photo No. 6 – Sealant installed between the concrete topping and the base of the stucco cladding. The stucco should have a greater clearance from the top of the concrete.

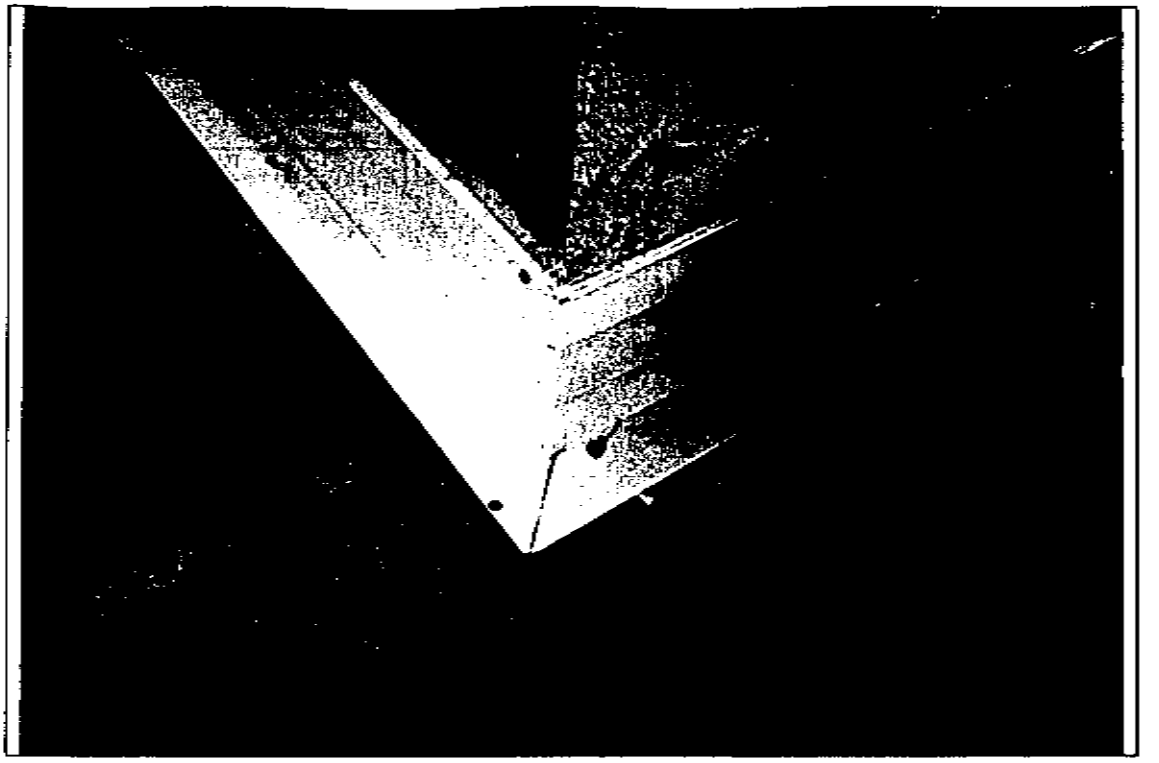

Photo No. 7 – Base flashing installed at the exterior wall of the central stairwell at the roof deck.

Photo No. 8 – Significant corrosion of the metal stucco trim adjacent to a south facing door in the courtyard.

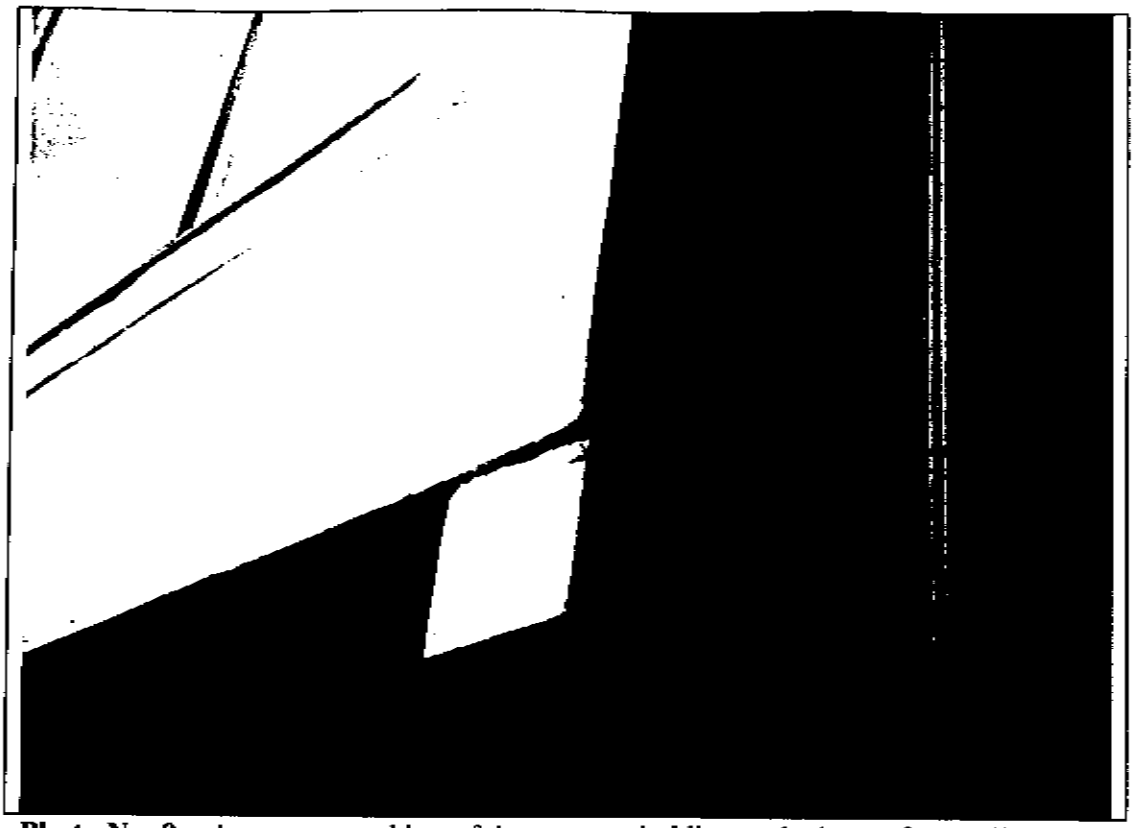

Photo No. 9 – Apparent patching of the stucco cladding at the base of a cantilevered wall area. Note the cracks and staining of the stucco cladding.

Photo No. 10 – Typical unsealed gap along the vertical intersection between stucco and brick claddings.

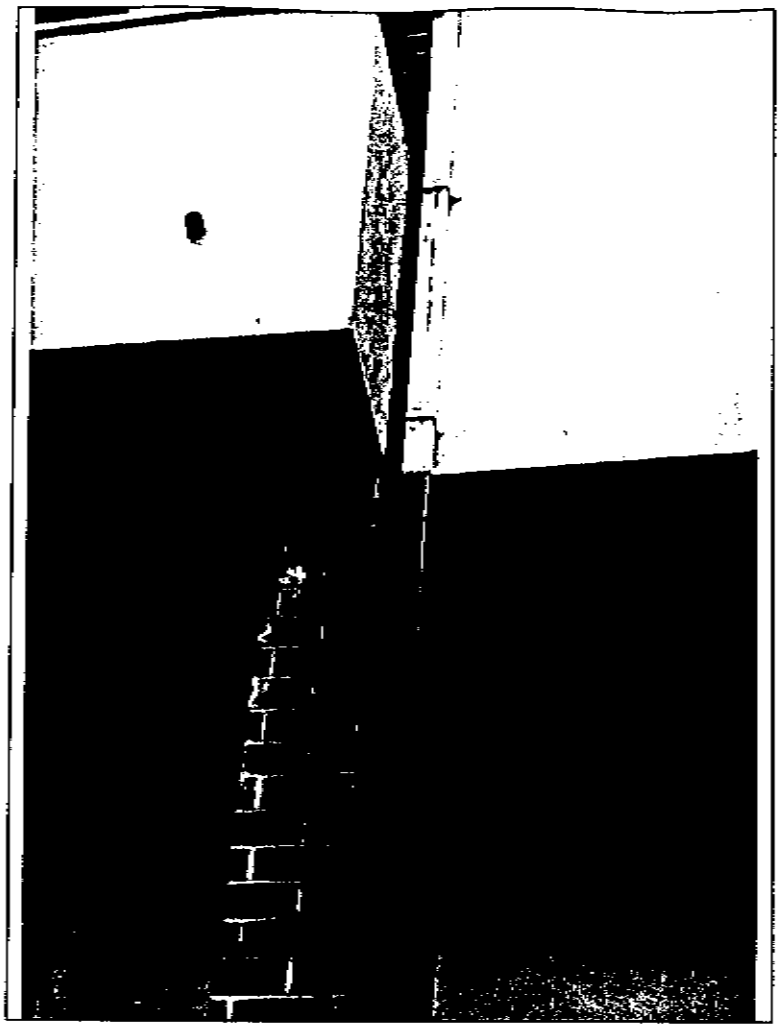

Photo No. 11 – Significant staining and efflorescence on the brick cladding below the edge of a balcony.

Photo No. 12 – Metal base flashing installed below the brick cladding. Note the sealant between the brick and the flashing, which may limit drainage of water from behind the brick.

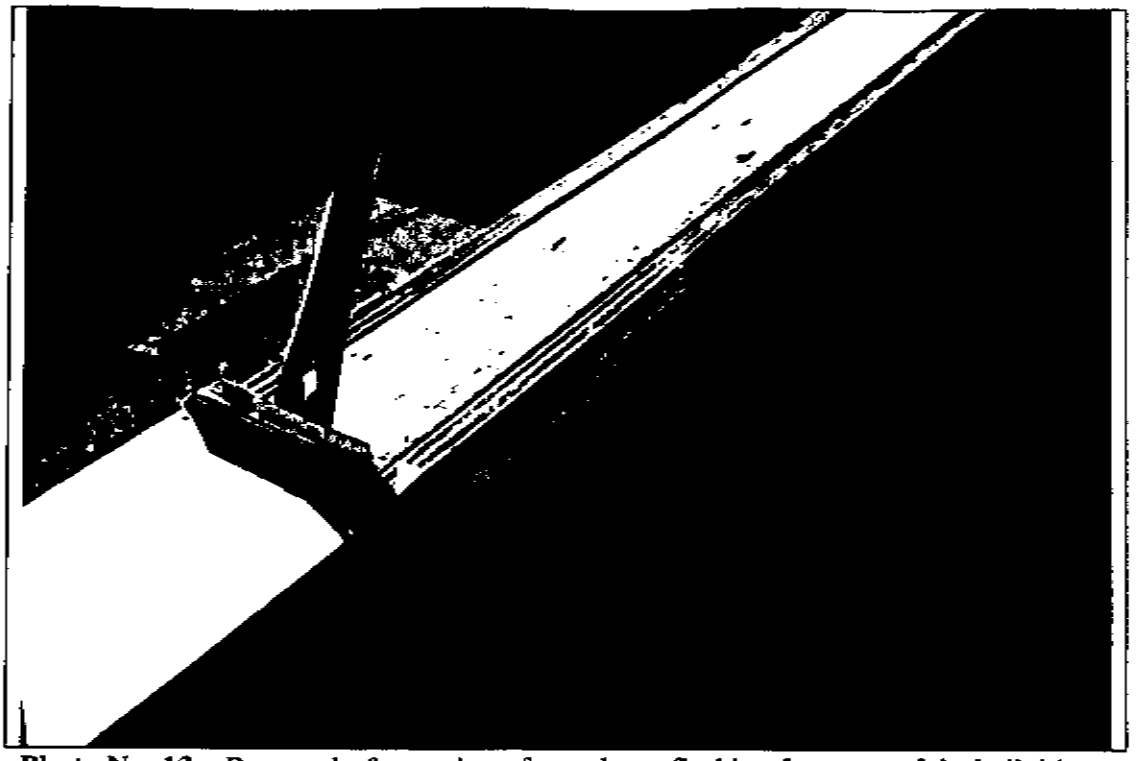

Photo No. 13 – Removal of a section of metal cap flashing from a roof deck divider wall, which revealed that no moisture barrier was installed under the flashing.

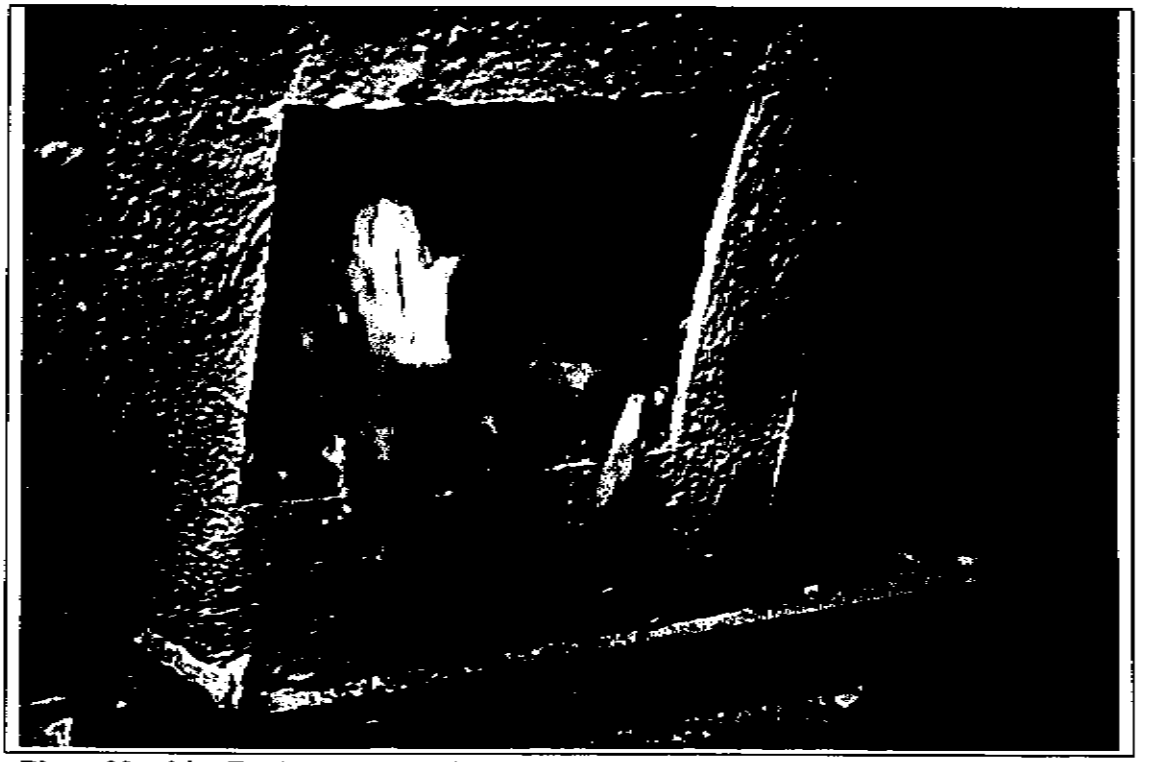

Photo No. 14 – Exploratory opening no. 1, which revealed corrosion of the stucco wire mesh and metal fasteners.

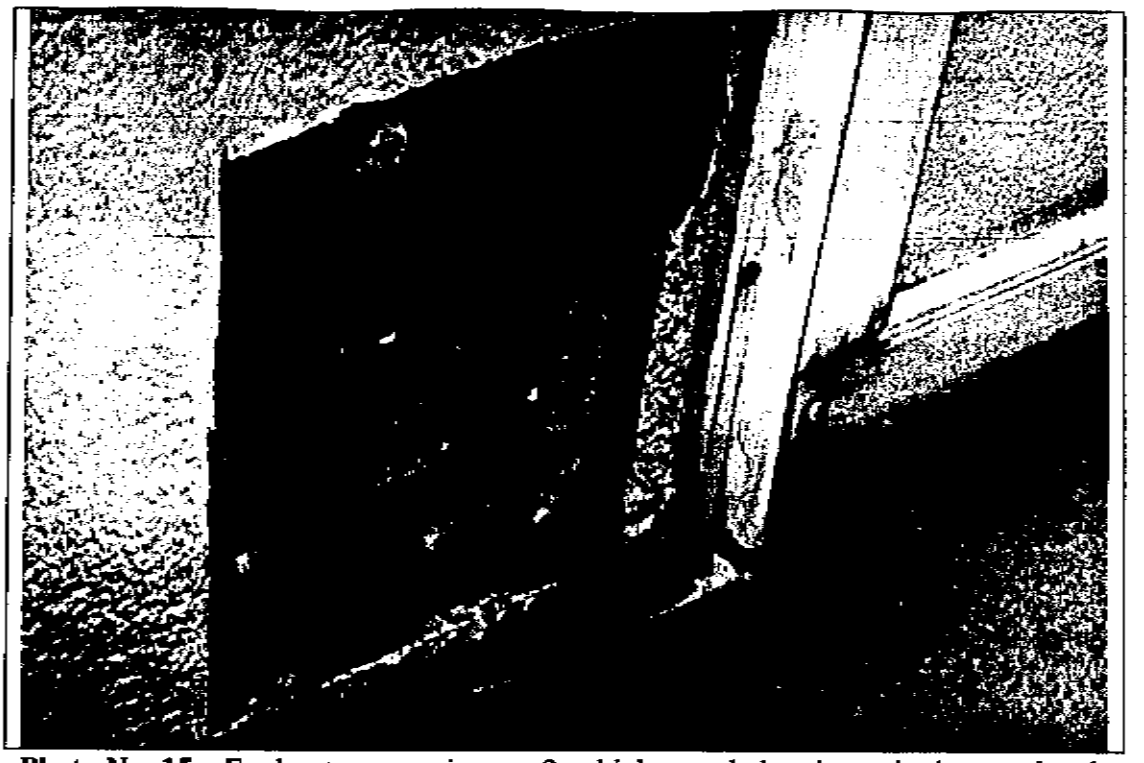

Photo No. 15 – Exploratory opening no. 2, which revealed moisture in the wood and insulation within the stud cavity.

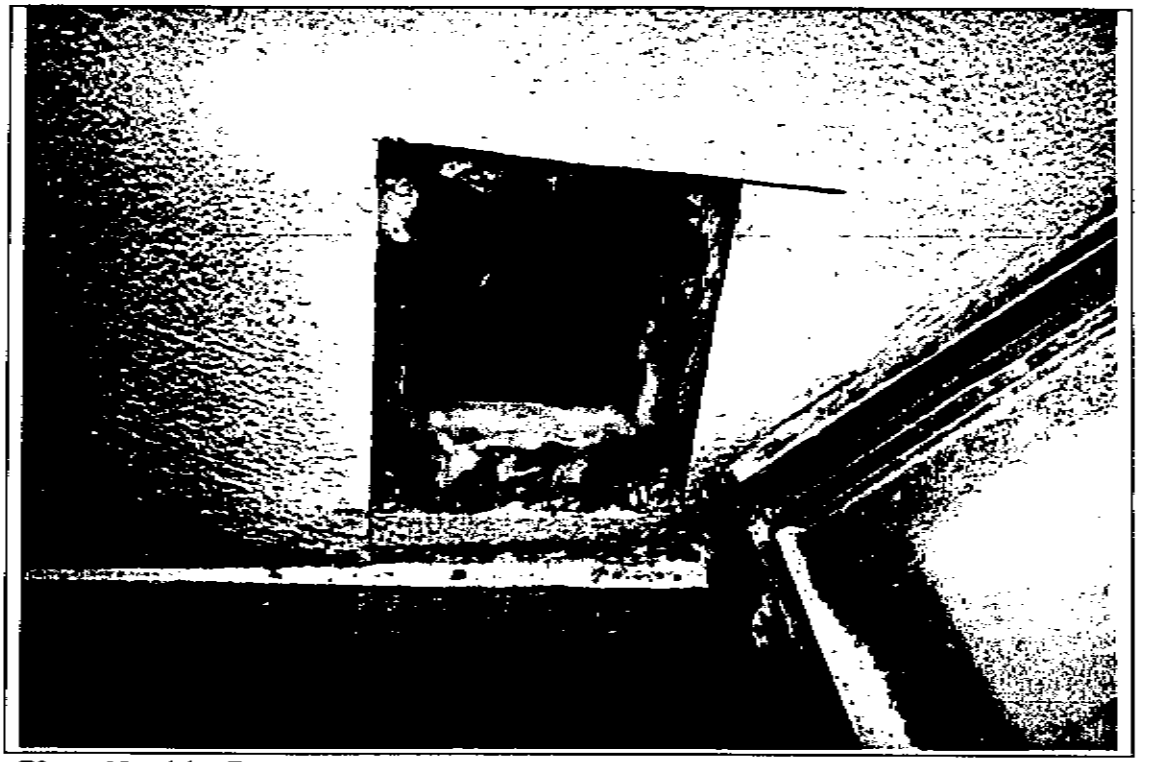

Photo No. 16 – Exploratory opening no. 3, which revealed corrosion of the stucco wire mesh and black staining of the batt insulation.

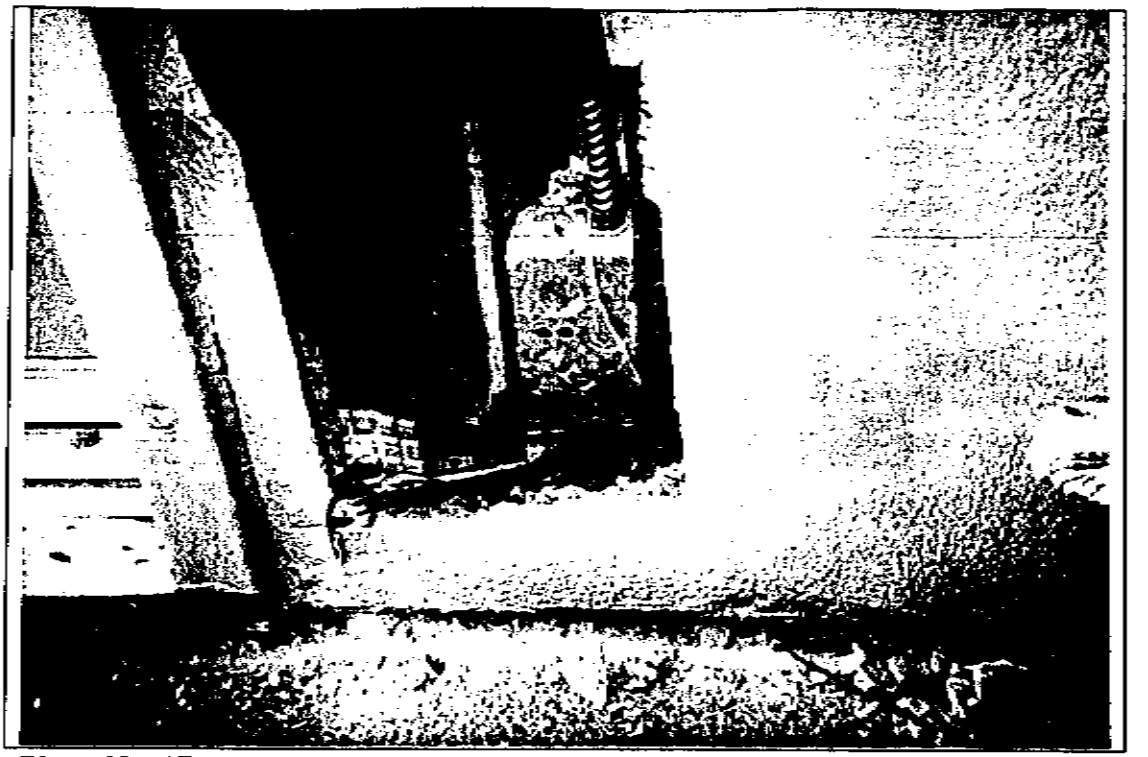

Photo No. 17 – Exploratory opening no. 4, which revealed dry wall components. The deck membrane was observed to extend up behind the stucco cladding about 6" from the concrete topping of the roof deck.

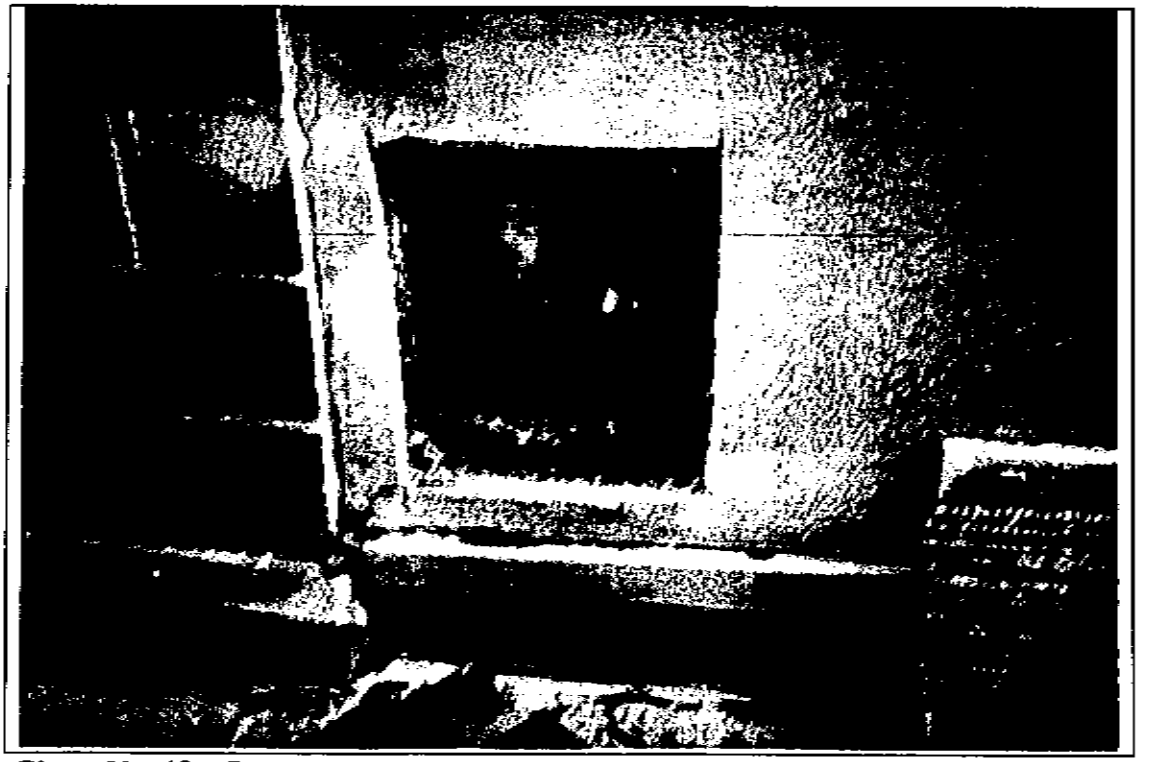

Photo No. 18 – Exploratory opening no. 5, which revealed moisture on the interior face of the building paper and wet wood behind the stucco at the base of the wall.

Photo No. 19 – Typical head flashing at window installed in stucco clad wall. Note the lack of an end dam on the flashing.

Photo No. 20 – Typical sill flashing at window installed in brick veneer.

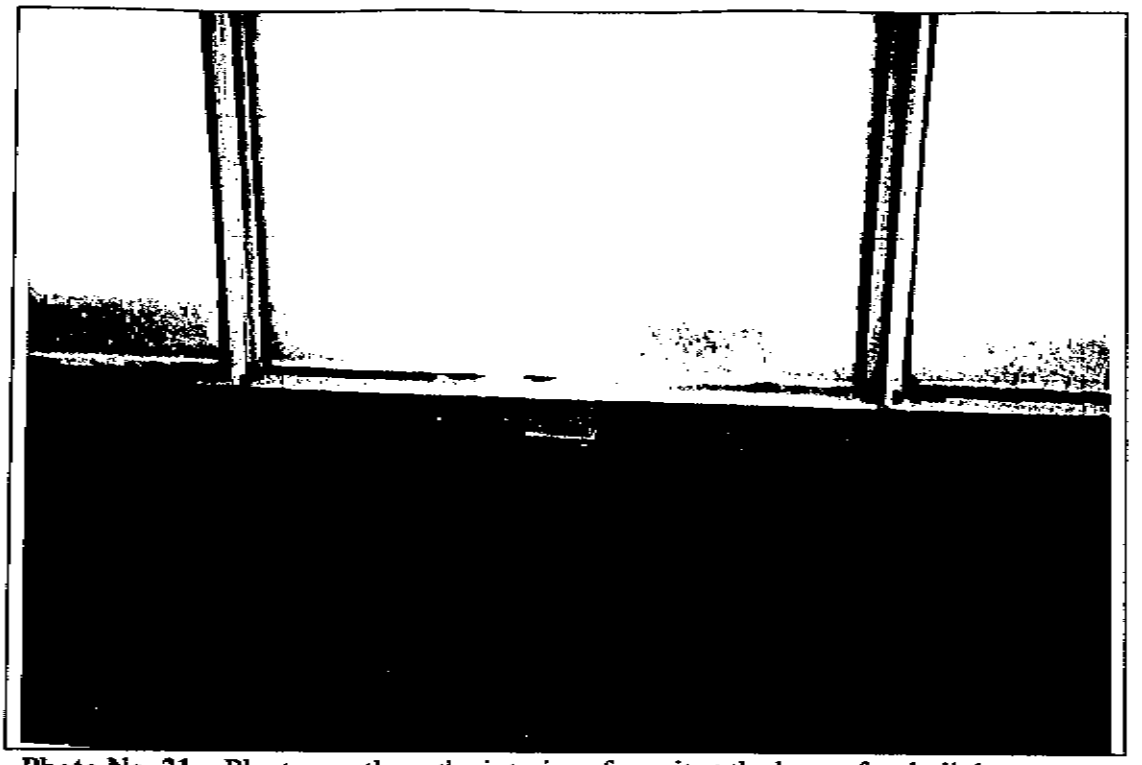

Photo No. 21 – Plant growth on the interior of a unit at the base of a skylight.

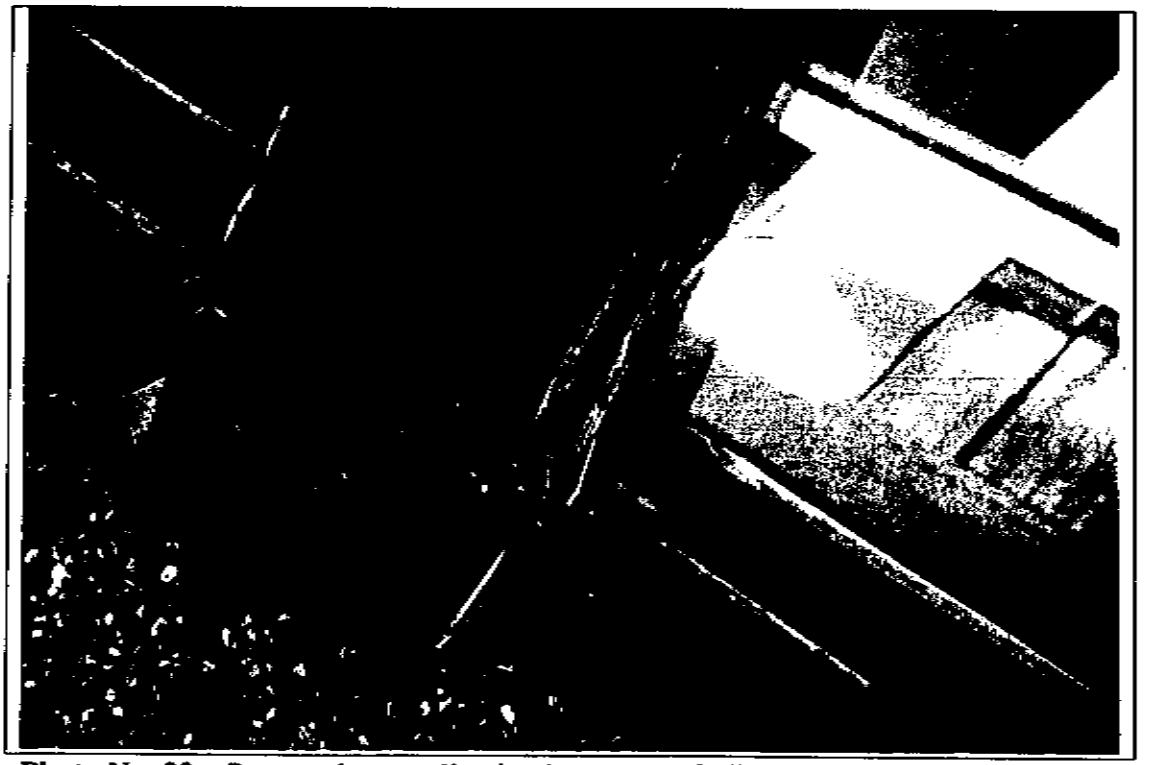

Photo No. 22 – Poor sealant application between a skylight and the adjacent metal flashing.

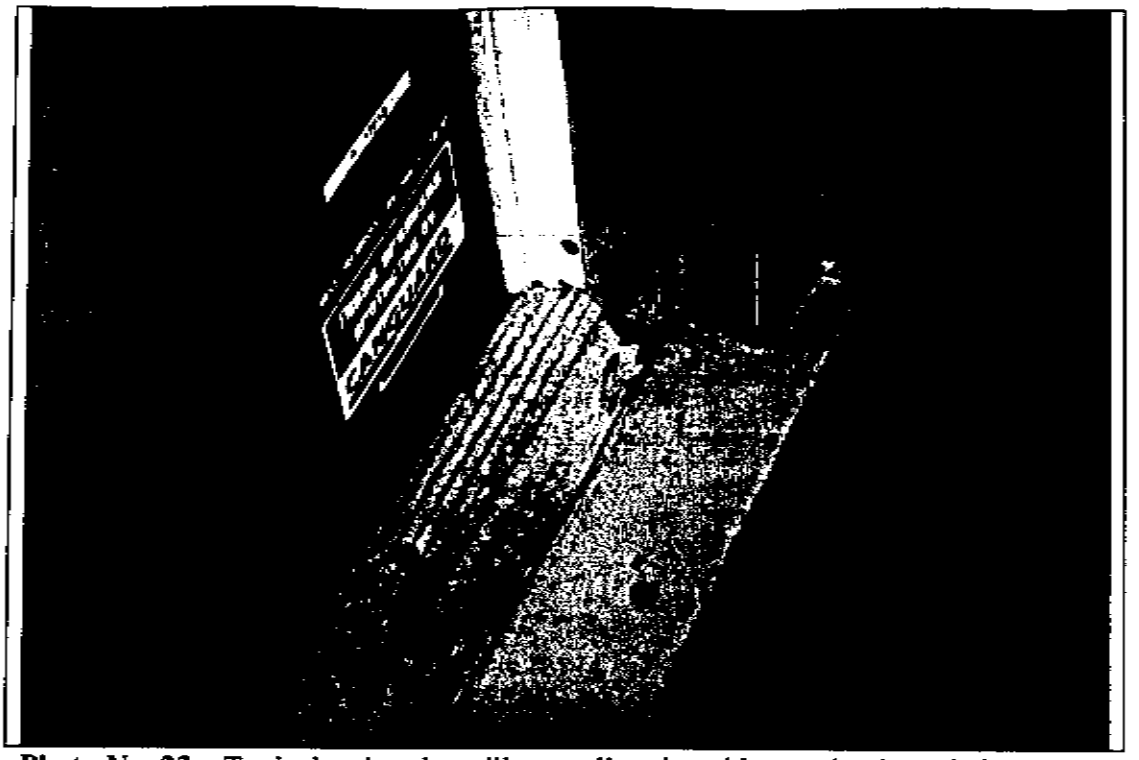

Photo No. 23 – Typical swing doorsill, revealing the rubber gasket intended to seal between the swing door and the metal threshold.

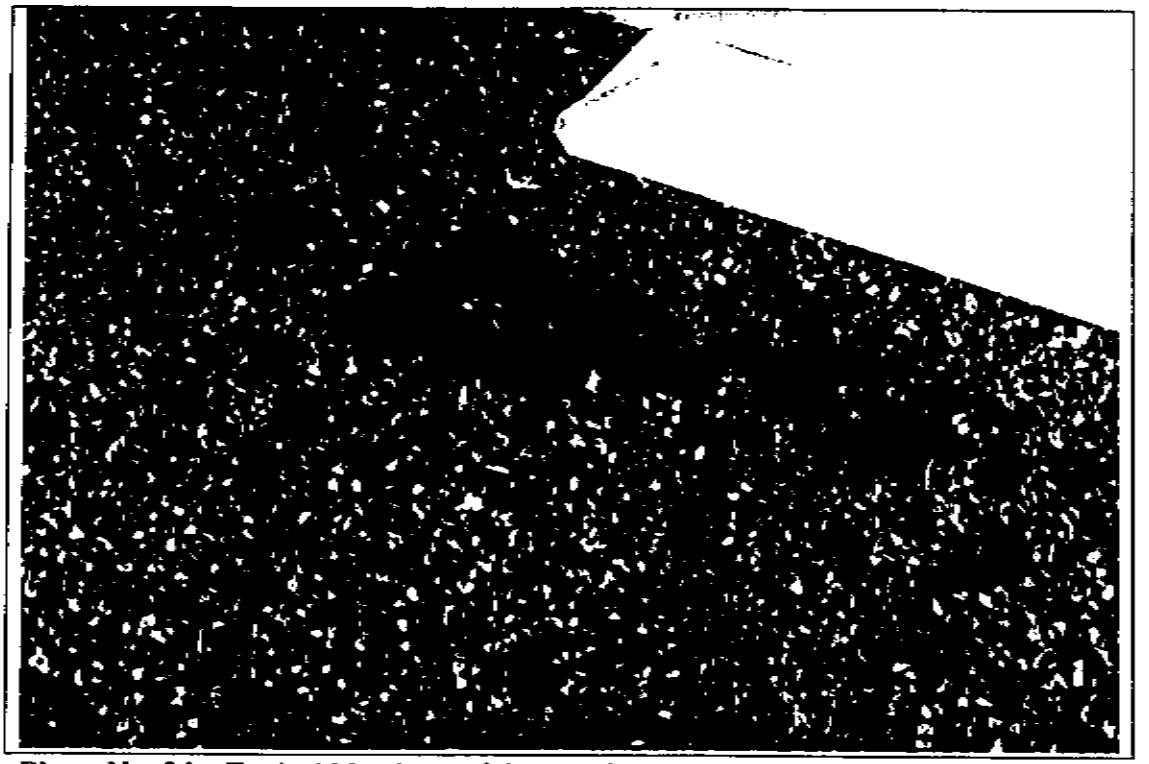

Photo No. 24 – Typical bleed out of the membrane at a built-up roof.

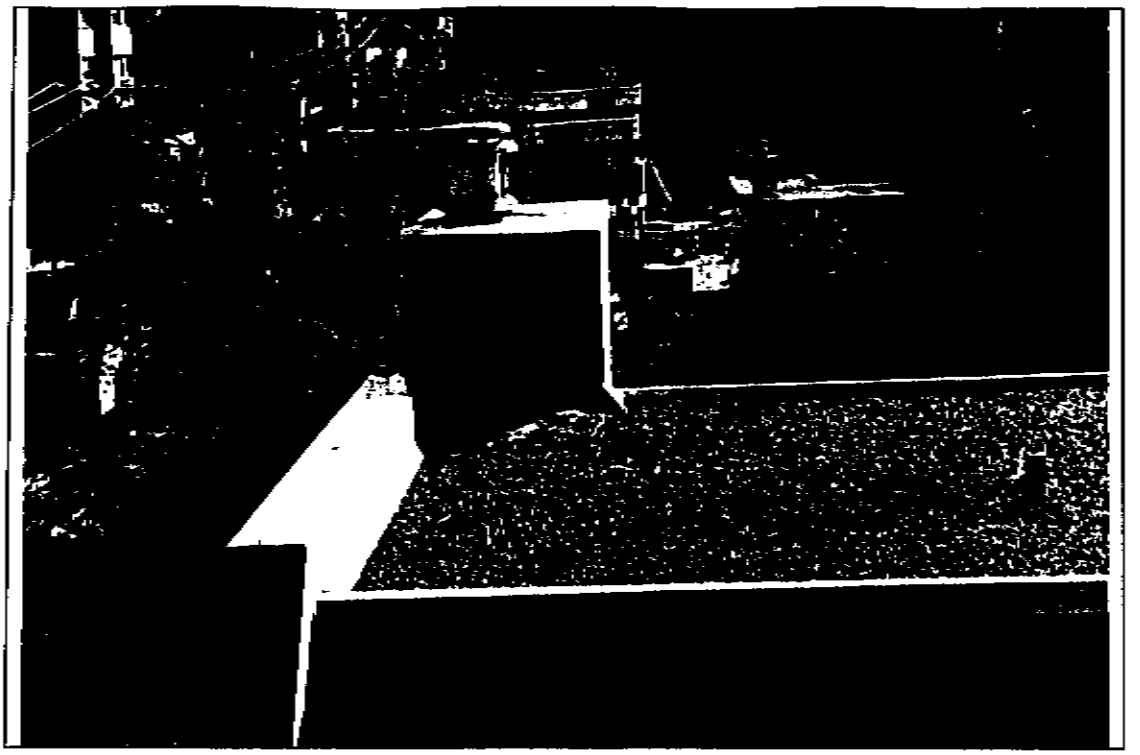

Photo No. 25 – Typical plant growth on a built-up roof. The plant roots may damage the waterproofing membrane.

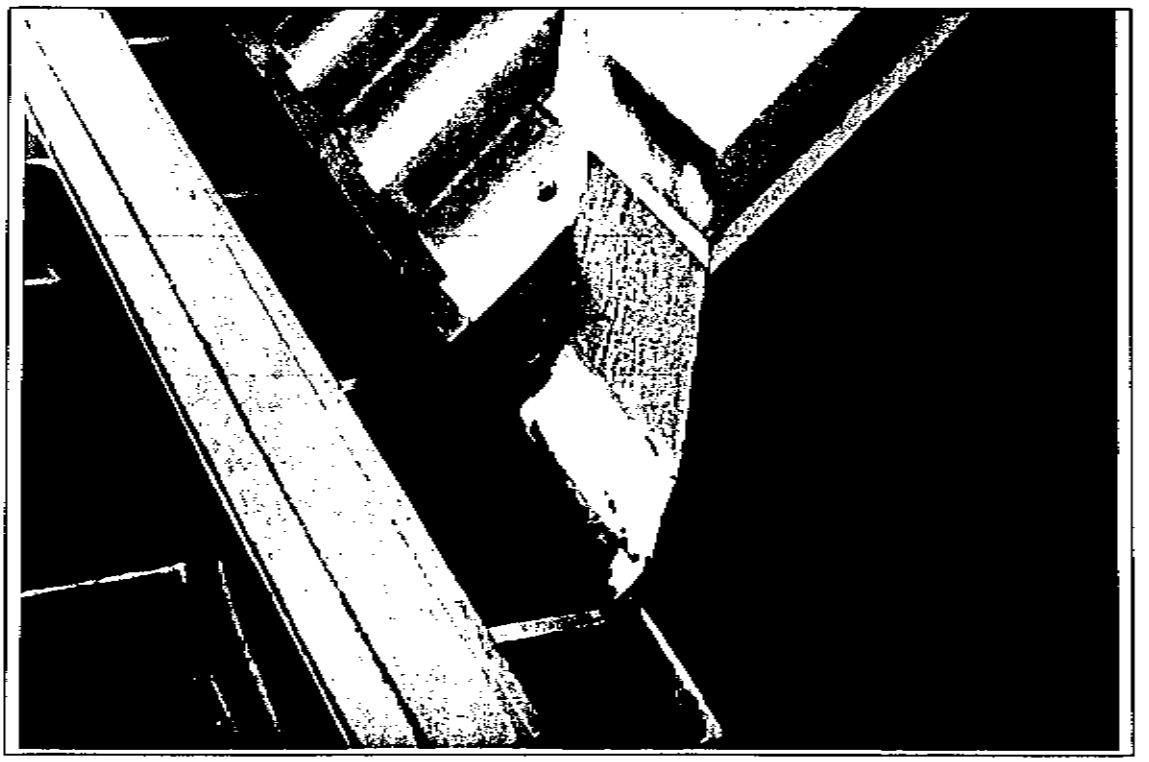

Photo No. 26 – End of a sloped metal roof, revealing a small section of metal flashing installed to direct water into the gutter below. Note the debris in the gutter.

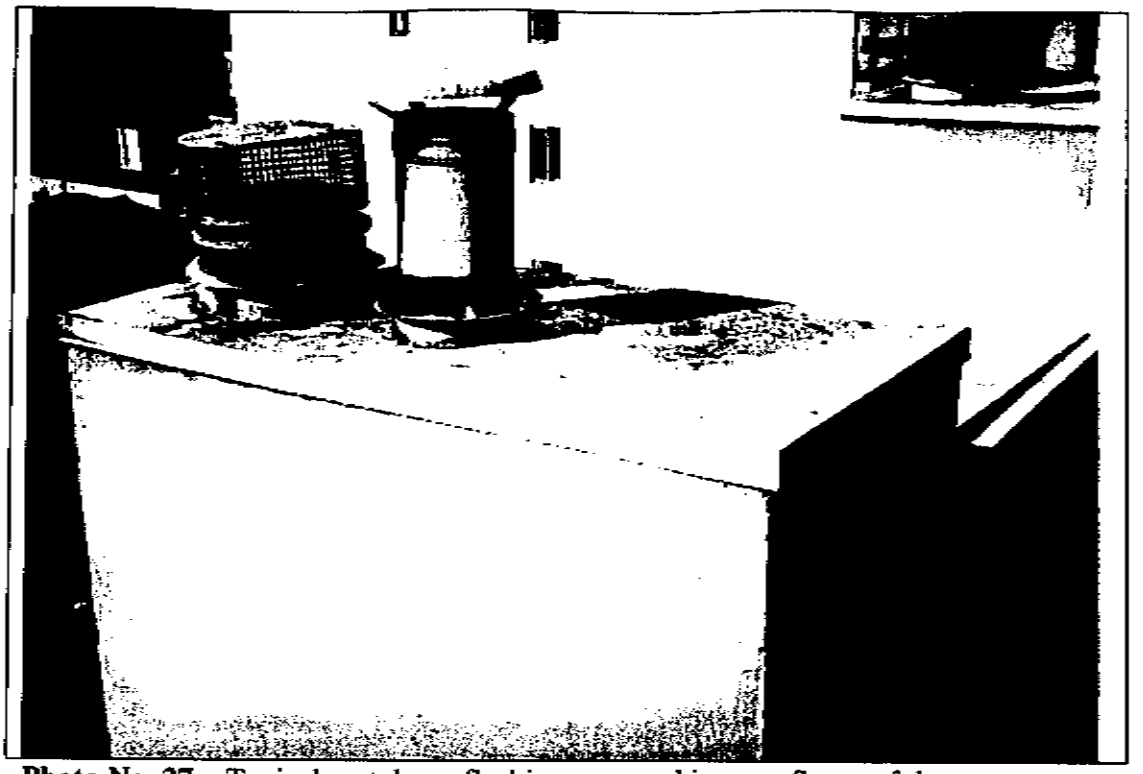

Photo No. 27 – Typical metal cap flashing over a chimney. Some of these cap flashings were not properly sloped to shed water.

Photo No. 28 – Typical deficiency in a previously patched roof deck membrane.

Photo No. 29 – Ridging of the modified bitumen roofing membrane at the northeast end of the building.

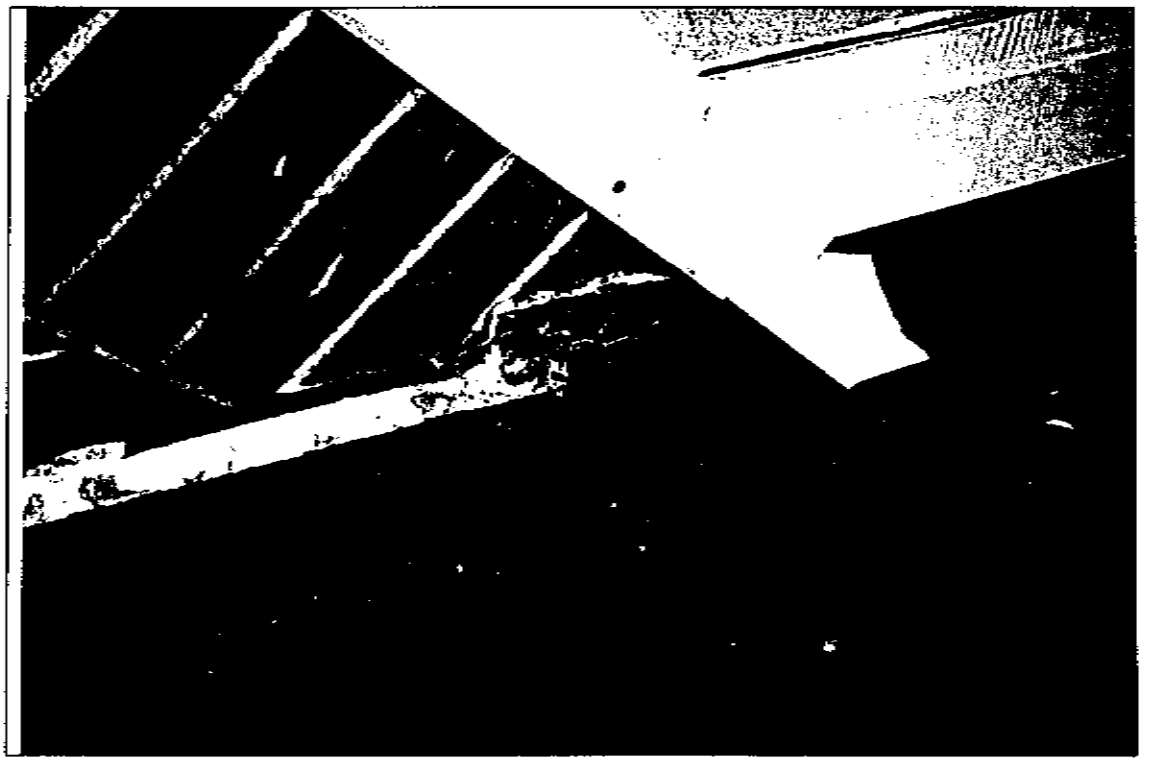

Photo No. 30 – Termination of the modified bitumen membrane at the base of a brick clad wall. The membrane does not extend behind the bricks which is required to properly detail this location.

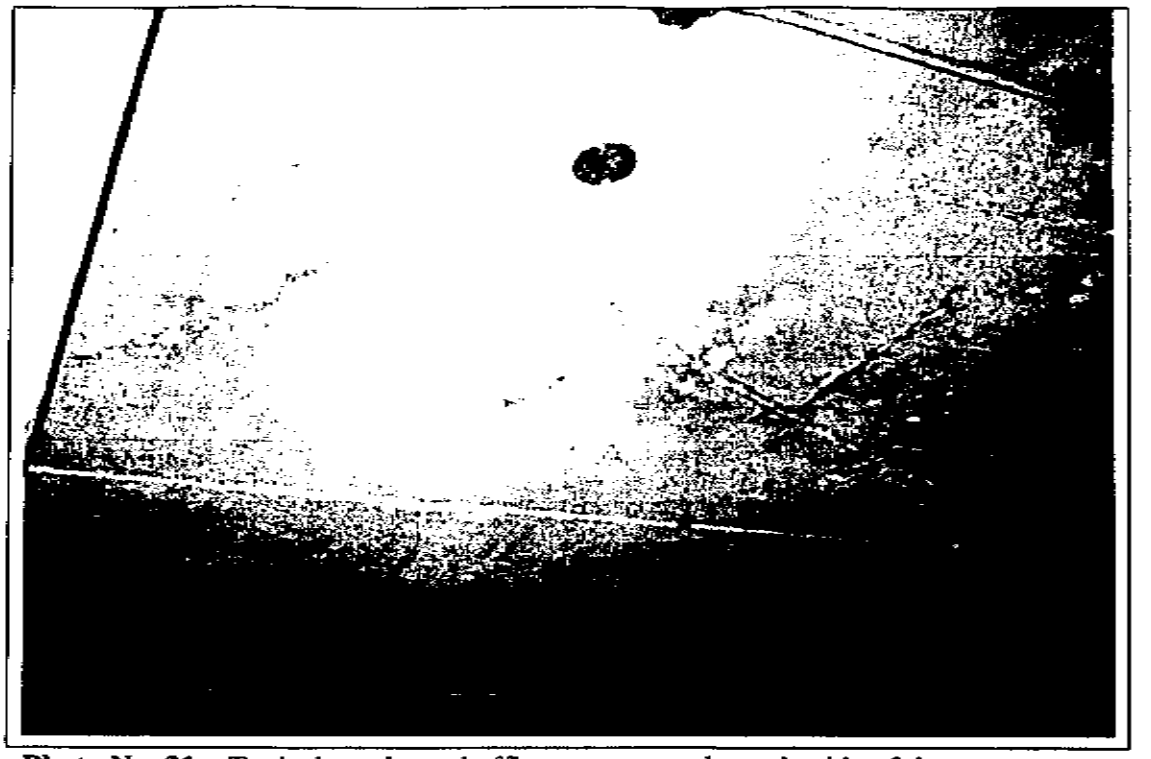

Photo No. 31 – Typical cracks and efflorescence on the underside of the concrete parking garage ceiling slab.

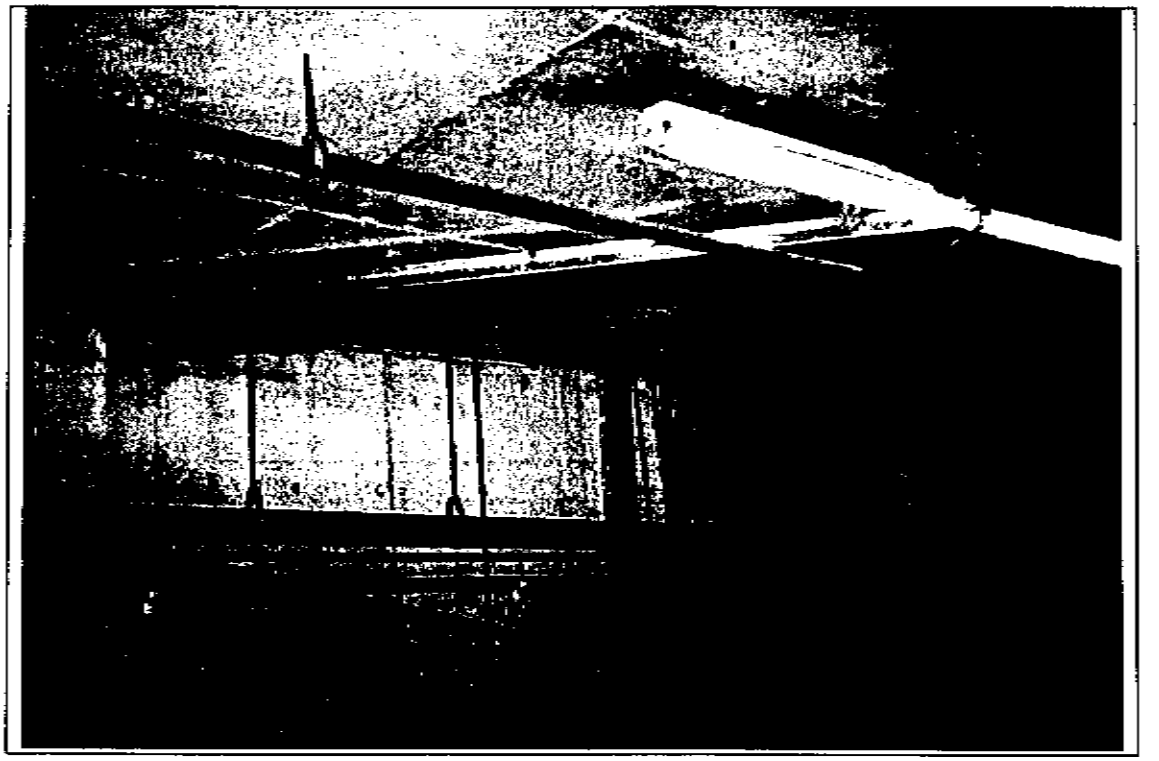

Photo No. 32 – Metal channel installed at the underside of the parking slab, likely to collect water penetration. Note the corrosion of the pipe penetrating the slab.