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COURTYARD PLAZA CONDITION EVALUATION

For

**Marina Place
1181-1199 West 7th Avenue
Vancouver, B.C.**

Prepared For:

**STRATA PLAN VR 447
C/O PACIFIC QUORUM PROPERTIES
1051 – 409 Granville Street
Vancouver, BC
V6C 1T2**

Prepared By:

**READ JONES CHRISTOFFERSEN LTD.
3rd Floor, 1285 West Broadway
Vancouver, B.C.
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May 2002

RJC Reference No. 38359-01



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1.0 INTRODUCTION

At the request of Mr. John Peccia, on behalf of Strata Plan VR 447, Read Jones Christoffersen Ltd. (RJC) has undertaken to review the present general condition of the courtyard plaza suspended slab at Marina Place, 1181-1199 West 7th Avenue, Vancouver, B.C.

The intent of this investigation was to assess the present general condition of the plaza suspended slab, provide recommendations with regard to methods of repair and protection, and to present probable costs for budget purposes.

This report has been prepared in accordance with generally accepted engineering practices. No other warranties, expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report. A detailed review of the structural system, including seismic restraint, was not included in the scope of work.

Services performed and outlined in this report were based in part, upon visual observations of the site. Our opinion cannot be extended to portions of the site that were not reviewed or situations reasonably beyond the control of RJC. Any conclusions, recommendations, or opinions of probable cost presented in this report were determined from the limited information available from random testing and visual inspections.

A brief description of the scope of work that was undertaken is as follows:

- Report on visual inspection and test results with photographic records.
- Evaluation of areas for visible distress in the structure, with recommendations on their repair.
- Recommend options for repair and protection of the structure in terms of priorities and levels of urgency.

Photographs referred to in this report can be found in Appendix A.

2.0 DESCRIPTION OF STRUCTURE

The courtyard plaza suspended slab is a long narrow portion of the development situated between wings of low-rise residential strata units, abutting the north and south edges (Photo 1 & 2). The plaza area is used to access all residential suites. The suspended slab is located over the secured parking for the residential units. The property is situated on a steep upward slope from north to south with vehicle entrance to the parkade located from the back alley on the north side. The pedestrian entrance to the plaza slab is from the side street (Alder Street) or from stairs located in an alcove entrance off 7th Avenue (Photograph 3). Pedestrian access to the parkade below is via two stairwells located within the plaza area.

The area of the plaza suspended structural slab is approximately 150' x 18'. The plaza is adjacent to a lower 4' step in the slab with an area of 150' x 11'. The lower area consists of sunken patio wells on the suspended slab for the north units and elevated stair access for the second level of the north units. The lower area of the plaza is not included in the scope of work for this evaluation.

The building was constructed circa 1976. W.A. Walrond & Associates Ltd. are the Structural Engineers of Record. Two companies were involved with the pre-cast concrete design: Gulf Concrete Products Ltd. and Great West Dycore, a Division of WallClad Manufacturing Co. Ltd.

The building is constructed of concrete at or below grade and in the parkade area. The remaining structure is wood framing. The plaza suspended slab is a reinforced hollow-core pre-cast concrete panel construction with a continuous structural 2" concrete topping. The depth of structural members varied with varying span lengths. The pre-cast panels are supported on inverted T pre-cast girders that are supported on the structural columns, or extensions (corbels) off the column, as well as the perimeter retaining walls. The concrete columns and retaining walls are founded on concrete footings.

The Plaza area consists of tiled walkways and concrete block planters. The planters are approximately 2' deep with a combined area of approximately 750 ft². The 4' plaza step is infilled with concrete block that extends up to the top of the pre-cast panels. The block wall either continues as a planter wall or has a concrete topping to match the tiled walkway.

The existing structural drawings provided by the Owner are in poor condition and as a result, information attainable from these drawings is limited. As well, the Owner provided RJC with information from a conversation held with an individual who indicated involvement with the original construction of the project. This information provided showed that the tile was placed on a 1½" topping, over a waterproof membrane that was placed over the 2" structural topping and pre-cast panels.

3.0 DETERIORATION OF REINFORCED CONCRETE

The deterioration process of conventionally reinforced concrete is briefly described. In uncontaminated concrete, reinforcing steel is protected from corrosion by the presence of lime in the cement that creates a strong alkaline environment. Under these conditions, the steel acquires a passive protective layer and will not corrode. Chlorides and carbonation can destroy the "passive" nature of the steel and, when oxygen and moisture are available, the corrosion process is activated.

Chlorides in concrete can be present from several sources: de-icing salts applied to the deck surface during winter months or tracked in from municipal roadways by pedestrian traffic, air pollution from industry, salt air from the ocean and chlorides added to the concrete at the time of construction.

As steel rusts, the volume of steel with the corrosion products increases, exerting splitting forces within the concrete. This causes the concrete to separate or “delaminate” and eventually spalling of the surface of the slab becomes evident. As the surface spalls, the reinforcing steel is directly exposed to salt contamination that accelerates the corrosion activity. If allowed to continue, the structure’s load carrying capacity can be reduced to the point where the structure is no longer safe to occupy, particularly in the slabs.

4.0 CONDITION SURVEY

4.1 Visual Survey

A visual examination of the structure was conducted to locate areas of deterioration.

.1 Suspended Plaza Slab

The plaza slab walkways are covered with a ceramic tile that is in generally good condition. Two locations of the tile were debonded from the structure; both of them are located at the west side of the plaza. One location (Photograph 4) appeared to be floating due to water underneath it. Near the center of the building, the tile has a joint filled with caulking running north to south (Photographs 5 and 6). As well, the tile has a continuous joint filed with caulking at the edge of the 4’ step. Cracking of the tile was noted at the debonded locations and a few other minor locations beside planter walls.

The plaza has a number of concrete block planters that vary in size and shape. One planter had the soil removed prior to our inspection (Photograph 6). No waterproof membrane was observed in this planter (Photograph 7). The block planter walls were generally in good condition with some cracking observed. Moisture and efflorescence staining was noted on the outside face of the block (Photographs 1, 2, and 4-6).

The east stairwell entrance had staining and efflorescence on the north wall adjacent to a planter area (Photograph 9). As well, water appeared to be leaking off the top canopy and into the stairwell at the east side (Photograph 8). A parging material covers the walls of the stair. The parging has a number of cracks and has debonded from the structure at a number of locations.

Concrete spalling and cracking were observed on the stair treads of the east stairwell (Photograph 10). Although the alcove entrance off 7th Avenue was not included in the scope of work, we did observe a number of stair treads with similar spalling and cracking.



The west stairwell entrance also had efflorescence and moisture staining observed on the north wall that was adjacent to the tile walkway (Photograph 11). The walls are also covered in a parging material. Large horizontal cracks were noted at various levels near the plaza slab elevation.

Active leaking and varying degrees of moisture was observed on the soffit (i.e. ceiling) of the plaza slab. Efflorescence and rust staining was observed at pre-cast panel joints and at panel girder beam supports (Photographs 12-15). Metal drip trays have been installed at multiple locations to redirect areas of leakage (Photograph 16). No concrete spalls or delaminations were observed. Some areas with extensive signs of leakage have been covered by the metal drip trays and may conceal some areas of damage.

The face of the block infill at the plaza step was observed with extensive efflorescence and rust staining and active leakage (Photographs 17-20). Rusting of mechanical services (electrical conduit, lighting fixtures, fire proofing and drainage pipes, etc) was observed at multiple locations, notably at the block infill wall (Photographs 21 and 22). The exterior of the block was covered in stucco with a crushed rock finish and had areas of staining (Photograph 23).

The leakage pattern on the interior of the blockwall indicates some areas of leakage at the base only. A planter area against the base of the block wall in the patio wells was noted. Although the patio wells were not included in the scope of this investigation, we noted one patio stone that was elevated and easily moved. A membrane was visible below the stone (Photo 31) and appeared to be ripped and debonded from the structure.

.2 Drainage

Areas of the plaza walkway had varying levels of ponding to approximately ½" deep (Photograph 6). A number of drains were observed on the plaza level. The plaza appeared to have minimal slope to the existing drains.

No drain was observed at the bottom of the planter with the soil removed. Slotted openings at the base of the planter block walls are used for draining the planters onto the tiled walkway. The condition of each of these slots varied, with some being plugged with debris, concrete mortar, or caulking.

The planter with the soil removed had a pond approximately 1" deep at the block walls (Photograph 7). The base of the planters was ½" (approximate thickness of the tile) lower than the adjacent tiled walkway. As a result, water would have to be deeper than the thickness of the tile to drain.



The planters located on the south side of the plaza area had metal drainpipes extending through to the top of the soil (refer to Photograph 7). The decorative metal vertical gutters used to drain the roof above extended into the top of the metal drainpipe in the soil. At two locations, the vertical roof gutters were observed to be partially draining into the landscape soil where it was completely saturated.

.3 Vertical Elements and Precast Support Items

Metal plates installed at the connection point of the main girders and the structural columns exhibited significant rusting and corrosion (Photographs 24 and 25). A review of the existing drawings indicated that metal support plates were installed in both the pre-cast girders and the concrete column.

Some areas of spalling on the concrete columns below the metal support brackets was observed (Photograph 26). In general, the concrete columns and the south retaining wall appear to be in good condition.

Concrete blocks have been used in multiple areas of the parkade as interior partition walls, including the stairwells. The room adjacent to the west stair and the areas below the stairwells was not accessible.

5.3 Test Excavations

Two test excavations were made in the plaza slab top surface to assess the condition of the plaza membrane and investigate the actual construction of the deck. These locations were chosen to minimize impact on the residents while maximizing the potential to represent typical existing conditions.

.1 Test Location #1

The first location was chosen to determine the condition at the slab step and adjacent to the planter wall (Photographs 27 and 28). The tile was removed and was found to be well bonded onto the concrete topping. The concrete was then removed to a depth of 3½", where the top of the pre-cast panel was uncovered with no membrane present. A joint in the concrete topping was located at the joint of the pre-cast panel and the block wall. The caulked joint in the tile running east to west is located along this joint and continues along the inside of the planters on the north side of the plaza.

The topping over the block wall portion of the step was also 3½" thick and extended towards the north, where it was supported on wood framing (Photograph 29). The wood below the topping was observed to be very wet.



A yellow material was found near the top of the pre-cast panel, as seen in Photograph 28. This material is not a waterproof membrane; rather, we suspect it to be construction debris not completely removed at the time of construction (such as sawdust).

.2 Test Location #2

The second location was located within the planter with the removed soil (Photographs 29 and 30); the location also corresponded to a caulked joint in the tiled walkway. Once again, the concrete was removed to a depth of 3½" to the top of the pre-cast panel with no membrane found. The concrete was also removed to expose the end location of the pre-cast panel slab. As well, a "construction joint" was located at this location, which corresponded to the caulking of the tile walkway running north to south. Construction joints are located at the time of construction to separate areas of work.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Structural Repairs

The structure appears to be in generally good condition. There are some early signs of corrosion related deterioration of the structure, but at this time, significant damage does not appear to have occurred. However, with the amount of water currently leaking through the structure, an increased rate of deterioration and corrosion of the structure can be expected. As well, some areas have been covered with drip trays that may be covering existing structural defects. The majority of the repairs at this time would be for aesthetic reasons or to eliminate potential hazards.

The cracking and debonding of the stair tread edge is not a structural concern but a potential tripping hazard. The cracking and debonding is a result of corrosion of the embedded reinforcing steel. The reinforcing bar appears to have a minimal amount of concrete cover. As the corrosion process continues, the concrete surrounding the reinforcing bar will lose its bond strength and eventually break away. Due to the fact that these spalls are located in an area where a trip could result in a significant fall, we recommend that these areas be addressed in a timely manner.

Repair of top surface spalls, including the stair tread edge, begins with the removal of the unsound concrete. Additional sound concrete around the patch perimeter and below the exposed reinforcing steel would also be removed to fully expose corroded steel for cleaning. The reinforcing bars would be cleaned of concrete and corrosion related residue. The patches would then be prepared and patched with an appropriate cement-based concrete.



Concrete columns support the pre-cast girders. At the connection of these items, steel plates armour the nosing and provide bearing surfaces. Significant structural damage is not evident. However, these elements should be cleaned of all corrosion and coated with a sacrificial zinc coating to prevent further damage.

6.2 Leakage Protection

The testing completed on site revealed no waterproofing membrane on the suspended courtyard plaza slab. We recommend installation of a waterproof membrane on the plaza suspended slab to prevent water ingress, corrosion related deterioration of the structure, as well as nuisance leakage onto parked cars below. As well, the water that is penetrating the structure is reducing the life expectancy of the building services located underneath the plaza slab.

Waterproofing of the structure would involve the removal of the existing floor finishing and planters, installation of a new waterproof membrane, and reconstruction of the finish features.

The sunken patio wells were not included in the scope of this investigation, but a likely source of moisture contamination is along the base of the block wall at the patio level. The cost of repairing this location is not included in this report.

In considering the above, it should be recognized that at present, significant structural deterioration has yet to occur. This affords the Owners some latitude in terms of the urgency with which the overall recommended repairs could be implemented.

We also considered the possibility of performing isolated repairs to address the worst leakage. In doing so, we note that the cost to perform repairs in such a manner could outweigh the benefits. Specifically, depending upon the extent of repair performed, it would likely require more labour intensive methods in order to mitigate damage to any other areas of the courtyard. This, in turn, raises the probable cost of the isolated repairs sufficiently that we believe anything more than installing additional drip trays would not be a prudent expenditure of funds (short of the entire recommended program, of course).

6.3 Phasing

In reviewing the overall site layout, we noted that the only means of egress for the north units is from the plaza courtyard area. Means of temporary access for these suites would have to be considered during the completion of the recommend waterproofing work.

7.0 PRELIMINARY OPINION OF PROBABLE COST FOR RECOMMENDED RESTORATION PROGRAM

The following probable costs to restore and protect the structure are divided into several sections. Section 7.1 deals with costs related to minor structural repairs in the plaza area. Section 7.2 deals with costs associated to moisture and leakage protection. Section 7.3 addresses the uncertainties involved in estimating the scope of work on a preliminary basis. Section 7.4 provides a summary of Total Probable Costs.

7.1 Structural Repairs

- .1 The structural repairs includes the repair of stair treads (including the alcove entrance off 7th Avenue) and refurbishing the metal plates at the column and girder connections below the plaza area.

Probable Cost: \$ 7,000

7.2 Leakage Protection - Entire Plaza Slab

- .1 The following estimate includes removal and replacement of all planters and tile walkways on the courtyard suspended slab and installation of a waterproof membrane. Waterproofing of the patio wells is not included in this estimate.

Probable Cost: \$ 40,000

As mentioned previously, it is possible to complete the above work in phases to address areas of the worst leakage, but this would result in a significantly higher overall cost. If phasing of the work is desired, details and method of construction would best be had once appropriate budgets have been established.

7.3 Contingencies

We recommend that a 10% contingency also be added to the probable cost estimates to cover unforeseen costs such as:

- .1 Variation in estimated unit prices due to competitive bidding.
- .2 Additional work required to repair any damage to electrical system caused by or discovered during the construction.
- .3 Additional repair work resulting from reinforcing steel corrosion that is not visible from a visual inspection.
- .4 Unknown conditions that may be encountered during construction (i.e. temporary access for north residential units, etc).



7.4 Total Probable Cost

Including the above contingency, the total probable cost to complete the recommendations made in this report is as follows:

DESCRIPTION OF REPAIRS	COST (\$)
Structural Repairs	\$ 7,000
Leakage Protection	\$ 40,000
Subtotal	\$ 47,000
Contingency Amount (10%)	\$ 5,000
Total Probable Cost:	\$ 52,000

The above probable costs do not include engineering required to prepare specifications and contract documents, administer the contract and evaluate the work. Opinions of probable cost are based on the present extent of deterioration and unit prices obtained from current projects. These figures do not include GST.

Also, it should be highlighted that the probable costs presented are intended to represent parts of an overall construction program. Performing any single part on its own could result in higher costs for that particular item.

8.0 CLOSING

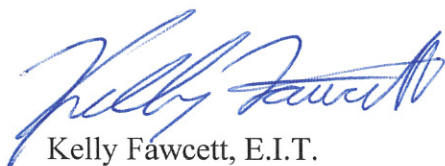
The suspended courtyard plaza slab at Marina Place is experiencing excessive leakage through the structure in many areas. Despite this, little evidence of significant structural deterioration is present to date. Two test holes were completed during our investigation with no means of waterproofing found at either location. We expect that if left unprotected, structural deterioration will begin to occur with time, resulting in the need for more costly and disruptive repairs in the future. Repair recommendations have been made in Section 6.0 and are intended to preserve the structure's integrity.

Our opinion of the probable cost to complete the work described in this report is approximately **\$52,000.00**. The probable cost estimate is based on visual inspection and random testing and the associated limitations. These figures do not include the cost of engineering and testing or GST. Further investigation and field work will be required to refine the repair quantities and to determine waterproofing details.

Should you have any questions or comments upon review of the information presented, please feel free to contact the undersigned. We remain available to review and discuss findings and future actions.

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Prepared by:

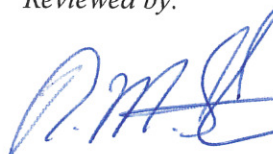


Kelly Fawcett, E.I.T.

KF/lp

cc: Doug Clark, RJC

Reviewed by:



Roger Steers, M.Eng., P.Eng.
Principal



APPENDIX A

PHOTOGRAPHS





PHOTOGRAPH NO. 1
GENERAL PLAZA AREA LOOKING EAST



PHOTOGRAPH NO. 2
GENERAL PLAZA AREA, LOOKING WEST TOWARDS ALDER STREET



PHOTOGRAPH NO. 3
ALCOVE ENTRANCE TO PLAZA AREA OFF 7TH AVENUE, LOOKING SOUTH



PHOTOGRAPH NO. 4
TILE HAS DEBONDED FROM CONCRETE TOPPING



PHOTOGRAPH NO. 5
CAULKED JOINTS NEAR CENTRE OF PLAZA AREA



PHOTOGRAPH NO. 6
PLANTER WITH SOIL REMOVED
CAULKED JOINT IN TILE (NORTH TO SOUTH)



PHOTOGRAPH NO. 7
INSIDE OF PLANTER WITH SOIL REMOVED



PHOTOGRAPH NO. 8
EAST STAIRWELL
LEAKAGE FROM OVERHEAD CANOPY ON EAST WALL



PHOTOGRAPH NO. 9
EAST STAIRWELL
EFFLORESCENCE AND STAINING OF NORTH WALL



PHOTOGRAPH NO. 10
EAST STAIRWELL, CRACKING AND DEBONDING
OF CONCRETE IN STAIR TREAD DUE TO CORROSION



PHOTOGRAPH NO. 11
WEST STAIRWELL
EFFLORESCENCE AND STAINING OF NORTH WALL



PHOTOGRAPH NO. 12
EFFLORESCENCE AND RUST STAINING AT PRECAST GIRDER



PHOTOGRAPH NO. 13
EFFLORESCENCE AND RUST STAINING AT PRECAST GIRDER



PHOTOGRAPH NO. 14
EFFLORESCENCE AND RUST STAINING
AT PRECAST GIRDER WITH ACTIVE LEAKAGE



PHOTOGRAPH NO. 15
EFFLORESCENCE BETWEEN PRECAST PANEL SLABS



PHOTOGRAPH NO. 16
AREAS OF LEAKAGE WITH DRIP TRAYS INSTALLED



PHOTOGRAPH NO. 17
BLOCK WALL AT SLAB STEP WITH
EFFLORESCENCE, RUST STAINING AND ACTIVE LEAKAGE





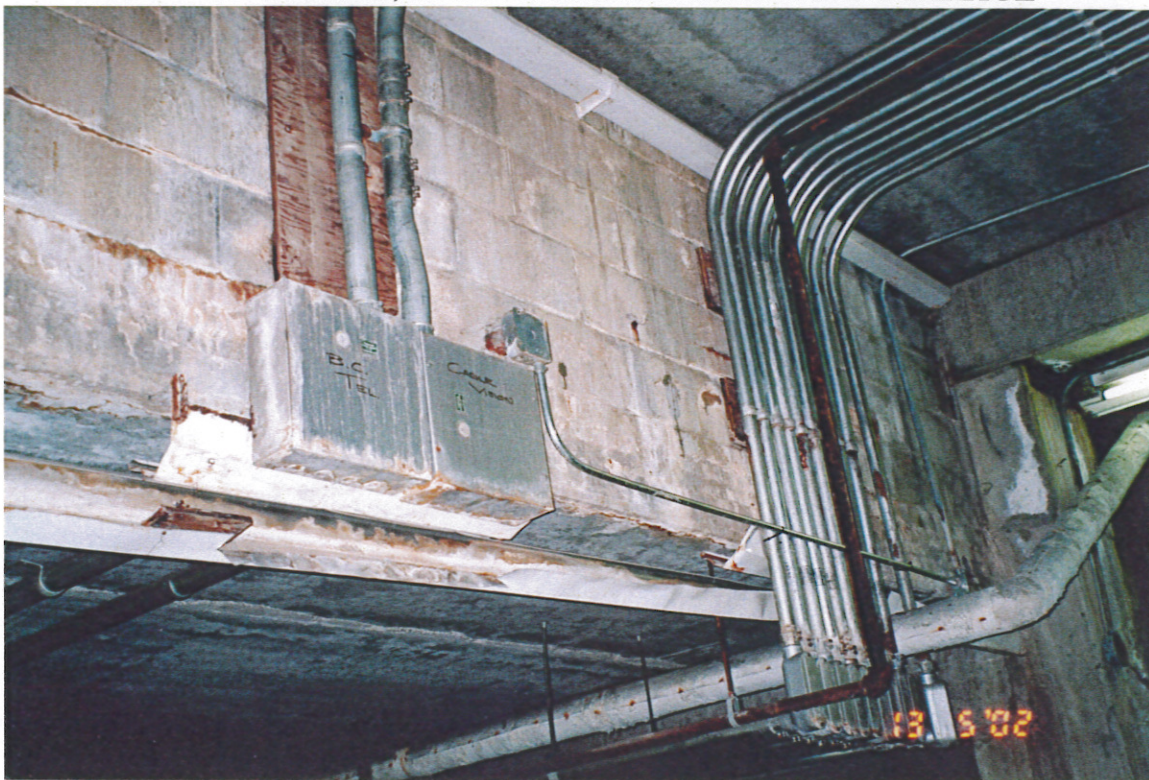
PHOTOGRAPH NO. 18
BLOCK WALL AT SLAB STEP WITH
EFFLORESCENCE, RUST STAINING AND ACTIVE LEAKAGE



PHOTOGRAPH NO. 19
BLOCK WALL AT SLAB STEP WITH
EFFLORESCENCE, RUST STAINING AND ACTIVE LEAKAGE



PHOTOGRAPH NO. 20
BLOCK WALL AT SLAB STEP WITH
EFFLORESCENCE, RUST STAINING AND ACTIVE LEAKAGE



PHOTOGRAPH NO. 21
MECHANICAL SERVICES WITH CORROSION AT BLOCK WALL



PHOTOGRAPH NO. 22
DRAIN PIPE WITH MOISTURE AND RUST STAINING PRESENT



PHOTOGRAPH NO. 23
OUTSIDE FINISH OF BLOCK WALL AT SLAB STEP



PHOTOGRAPH NO. 24
GIRDER AND COLUMN CONNECTION
HEAVY CORROSION ON EMBEDDED METAL PLATES



PHOTOGRAPH NO. 25
GIRDER AND COLUMN CONNECTION
HEAVY CORROSION ON EMBEDDED METAL PLATES



PHOTOGRAPH NO. 26
CONCRETE SPALLING BELOW GIRDER AND COLUMN CONNECTION



PHOTOGRAPH NO. 27
TEST LOCATION #1 AT SLAB STEP



PHOTOGRAPH NO. 28
TEST LOCATION #1 AT SLAB STEP



PHOTOGRAPH NO. 30
TEST LOCATION #2 IN PLANTER

☒ For Your Review

☐ For Prompt Reply

☐ As Requested

☐ _____

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JONES

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RJC #: 38359-01

Date: June 3, 2002

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PAGE

1 of 1

FROM: Kelly Fawcett

RE: Marina Place - Courtyard Evaluation Report

TO: Dave Millar

Strata Plan VR447

1191 West 7th Ave.

CC: John Peccia

Pacific Quorum Properties Inc

1051 - 409 Granville Street

Vancouver, BC V6C 1T2

Roger Steers

Read Jones Christoffersen

Dave,

In addition to the one unsigned copy of the evaluation report that was dropped off on Friday, a signed copy is now enclosed. As well, a signed copy of the evaluation report has been forwarded to John Peccia.

Please contact me if you have any questions or if you require further copies.

Cheers,

Kelly Fawcett, EIT
Restoration Engineering

Document1

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June 25, 2002

Strata Plan VR 447
c/o Pacific Quorum Properties
1051 – 409 Granville Street
Vancouver, BC
V6C 1T2

Attention: John Peccia

Dear Mr. Peccia:

Re: Courtyard Plaza Condition Evaluation
Marina Place, 1181-1199 West 7th Avenue, Vancouver

RJC No. 38359-01

We are writing to expand on one area of our report dated May 2002. Specifically, we erroneously believed that specific discussions regarding the patio wells on the north residential units should be omitted from our evaluation of the courtyard. As such, we had only mentioned them in relation to pertinent discussions on the courtyard. This letter is intended to provide the strata with the necessary additional information regarding the patio wells and should be attached to the original report as an addendum.

Based on observations made during our investigation, we believe removal and reinstallation of the waterproofing in the patio wells should also be considered on a similar time line to our recommendations for the courtyard. Given the size and number of wells, and the complexity of working about the living units, we estimate the probable cost to perform this work to be \$45,000. This probable cost includes a 10% contingency but not GST. The probable cost is based on removal and replacement of paving stones and planters, and installation of a waterproof membrane on the suspended slab and block wall. We assume drainage at these patio wells is sufficient at this time. Existing patio stones would be re-used as much as possible.

The elevated walkways to the north units, located within the patio wells, appear to be the only means of egress for these units. The walkways are supported on wood stud pony walls supported on the structural slab of the patio wells. Waterproofing below the stud walls will be required. Replacement of these walkways or special detailing for temporary shoring during the installation of the waterproofing could affect the probable cost noted above depending upon the limitations placed on the contractors for phasing of their work.



The above probable costs do not include engineering required to prepare specifications and contract documents, administer the contract and evaluate the work. Opinions of probable cost are based on limited visual observations and unit prices obtained from previous projects.

We trust that this meets your current needs and should you have any further questions or comments upon review of the information presented, please feel free to contact the undersigned. We remain available to review and discuss findings and future actions.

Yours truly,

READ JONES CHRISTOFFERSEN LTD.

Prepared by:



Kelly Fawcett, E.I.T.

Reviewed by:



Roger Steers, M.Eng., P.Eng.
Principal

KF/lp

cc: Doug Clark, RJC

