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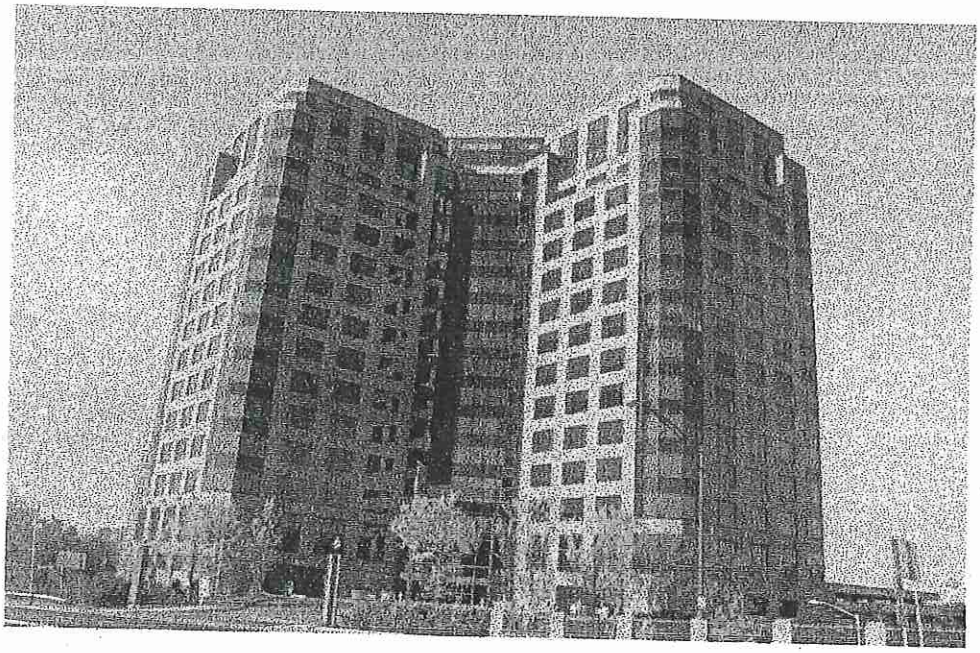
BUILDING ENVELOPE STUDY

25 Sigourney Street
Hartford, Connecticut

PROJECT NO. BI-2B-033
98-08



STATE OF CONNECTICUT
Department of Public Works
State Office Building
165 Capitol Avenue
Hartford, CT 06106

Prepared By:

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Date:
May 15, 1998

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References

ASTM C 216 - 89: Standard Specification for Facing Brick
ASTM C 270 - 89: Standard Specification for Mortar for Unit Masonry
Brick Institute of America (BIA) technical Notes:

7	Water Resistance of Brick Masonry Design and Detailing Part I of III
7A	Water Resistance of Brick Masonry Materials Part II of III
7B	Water Resistance of Brick Masonry Construction and Workmanship Part III of III
7C	Moisture Control in Brick and Tile Walls
7D	Moisture Resistance of Brick Masonry Walls Condensation Analysis

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EXECUTIVE SUMMARY

Although the building is only ±18 years old, it has suffered severe water damage to both the masonry exterior and interior finishes. In general, the building has not performed well resulting in unsatisfied occupants and high maintenance costs by the owner.

- Original water infiltration occurred through defective coping joints. As a result, the parapet eventually deteriorated due to freeze / thaw cycles causing spalling and cracking of the masonry. Additional water entered through the now damaged masonry and mortar joints until it reached down to the through wall flashings.

- Water is also entering through the curtain wall system. The gaskets are drying out, shrinking and coming loose allowing more water to get within the frames than the system was designed to handle. Also, it appears some field changes were made during construction, especially along the header where a metal cap covers the curtain wall. This cap is improperly installed with a slope back to the building where it holds water.

- Through wall flashings are set back from the face of the wall allowing water to get under and within the wall system. End dams which prevent water form getting within the cavity at heads and jambs were observed at some, but not all locations. Water can travel down within the wall cavity and enter the building along the sill wherever dams are omitted..

- Sealant has failed both cohesively and adhesively. The incorrect backer rod was installed causing sealant to adhere to three surfaces restricting proper movement. The type of sealant is also questionable. It appears to be an oil based type, which does not have the same elastic properties as silicone or any of the other high modulus sealants on the market today.

- The expansion joint between the parking garage and building has completely failed and needs replacement.

Extensive repairs are necessary to rectify the water infiltration problems outlined above. Recommended repairs include:

- Reconstruction of all parapets (main roof, penthouse and terraces) including copings and replacement of damaged or defective masonry. New sheet metal copings are recommended.

- Install all new through wall flashings at window head and shelf angles.

- Inspect and replace any damage or defective masonry.

- Install backer rod and sealant at wall penetrations, openings and control joints.

- Replace defective gaskets on curtain wall system.

- Reinstall lightning suppression system to inside face of parapet.

- Repair existing sheet metal flashings.

- Install new expansion joint at parking garage/building juncture.

Estimated cost of repairs..... $ 1,326,248.00

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INTRODUCTION

PREAMBLE

On March 19th, 1998, Martin A. Benassi, AIA - Architect, received written authorization to investigate and prepare a study of the exterior envelope on 25 Sigourney Street, Hartford, Connecticut. Excluded from this report is the semi-detached parking garage and its emergency stairwell. The intent of this study is to evaluate existing conditions and propose recommendations for repair. Toward this end, several site visits were made to document existing conditions using photographs and sketches, some of which are included in this study under the appropriate appendix. Site visits and meetings were made on:

Date	Present	Remarks
January 21, 1998	Martin Benassi, AIA Barbara F. Gegsinger, AIA Benjie Roccapriore, Tunxis Mgmt. Vibha Buckingham, Tunxis Mgmt. Ward Ponticelli, DPW	To review general scope of work.
April 2, 1998	Martin Benassi, AIA Barbara F. Gegsinger, AIA Benjie Roccapriore, Tunxis Mgmt.	To photograph and document existing conditions.
April 18, 1998	Martin Benassi, AIA John Petta, New England Masonry Frank Nunoz, New England Masonry Dennis, Tunxis Mgmt.	To take masonry samples and cuts.

DATA COLLECTION

A full set of Working Drawings dated May 1 1985, were retained for evaluation. Architect of Record was Welton Becket Associates, Architects, 200 Madison Avenue, New York, New York. Drawings included Architectural, Structural, Mechanical and Electrical as follows:

Consultants included:

Architectural
Brennan Beer Gorman
515 Madison Avenue
New York, NY 10022
212-888-7663

Structural
Lev Zetlin Associates
641 Avenue of the Americas
New York, NY 10011
212-741-1300

Mechanical
Burton and Van Houter, Inc.
10 North Main Street
West Hartford, CT 06107
860-236-2365

Landscape
CR 3 Inc.
571 Hopmeadow Street
Simsbury, CT 06070
860-658-1988

Specific reference was made during the course of our investigation to the following sheets:

S - 24	Sections & Details - Tower
A - 15	Office Floor No. 3
A - 16	Office Floor No. 4-9
A - 17	Office Floor No. 10 & 11
A - 18	Office Floor No. 12
A - 19	Office Floor No. 13 & 14
A - 20	Office Floor No. 15
A - 21	Office Floor Roof Penthouse Plan
A - 22	North & East Building Elevations
A - 23	South & West Building Elevations
A - 24	Building Sections
A - 28	Roof Details
A - 29	Exterior Greenhouse Elevations & Details
A - 30	Greenhouse Sections & Details
A - 31	Typical Tower Window Wall Elevation, Section & Details
A - 32	Typical Tower Curtain Wall Elevation & Details
A - 33	Penthouse Elevation & Sections Roof Details
A - 34	Exterior Terrace Details
A - 35	Typical Exterior Masonry Wall Sections & Details
A - 36	Brick Details

Also reviewed was a Roof Coping and Masonry Repairs Survey prepared by Hoffmann Architects, 432 Washington Avenue, North Haven, Connecticut, dated June 7, 1996.

FIELD TESTING

Samples of brick flashing and mortar were retained for in-house testing and evaluation. Results of our findings are included under the Evaluation portion of this report.

FORMAT

This survey is organized into four sections: Introduction, Observations, Evaluations, Recommendations. Activities are listed by a two-digit code followed by a broad scope heading generally identifying the subject being discussed in accordance with the construction Specification Institute (CSI) 16 Division format.

This report is not for construction and was prepared for the sole use by the State of Connecticut, Department of Public Works (DPW). Any reprint or copies of this report without the written consent of the Architect or DPW is unlawful.

END OF SECTION

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OBSERVATIONS

01 GENERAL

The structure is 19 stories high (15 stories + penthouse +3 basement parking) with a total roof elevation of approximately 200 feet above grade. The building Use Group is classified as "B - Business" with a total floor area of approximately 300,000 square feet. There is a semi-detached multilevel concrete parking structure with its own emergency stairwell. Both parking garage and stairwell are excluded from this report. There are 13 terraces located on the 17th floor and 12 terraces on the 15th floor. Original Working Drawings would indicate the building is approximately 18 years old. (See cover and photo # 1).

The building is constructed of a reinforced concrete infrastructure with a masonry cavity wall veneer. Curtain wall systems are located at the building corners and over the front entrance/greenhouse.

Moisture staining of the interior finishes was observed, especially above window heads, through light fixtures located directly under penthouse exterior walls and under terraces. Property Management reported that they are constantly repairing the building interior finish surfaces damaged by water leaks. (See photos # 28, 29).

There are two roof top window washing rigs (one specifically for the glass curtain wall at the entrance and the other for the remaining windows and corner oriels). Both window washing units were inoperable at the time of inspection, but have since been repaired. They travel along the roof on a concrete pad designed to protect the roofing membrane below.

Under an emergency repair procedure, all of the parapets had been covered with an EPDM (ethylene propalyene dinene monomer) membrane in an attempt to stop further deterioration of the masonry. (See photos # 2, 7, 9, 13).

03 CONCRETE

Structural framing members are cast in place reinforced concrete beams and columns with post-tensioned slab construction. (See photo # 3).

There is a concrete runway which runs around the perimeter of the roof and is used for the window washing rig. Numerous cracks in the concrete were observed.

04 MASONRY

The building façade is constructed of a masonry cavity wall comprised of a six inch concrete block back-up, 2 - 3 inch air space with a standard, glazed, core brick. (See photos # 17, 18).

There is extensive efflorescence on the inside face of the parapet walls in both the brick and mortar. Numerous hairline cracks were observed in the masonry at the roof top level. Condition of the masonry is similar along the terrace parapets. (See photos # 8, 9, 10).

Penthouse parapet walls are constructed of a CMU interior with an exterior brick veneer. Some masonry displacement was observed at the corners. A cementitious type coating has been applied to the interior face of the parapet wall. Deterioration of the masonry has started and in one location has completely spalled off. (See photos # 12, 13).

Masonry test cuts exposed the following construction:

Cut #1: Taken at coping on roof. (See photo # 14)

Glazed coping brick set on a thermoplastic type waterproofing membrane (membrane held back from face of wall approximately 1½") over 3½" glazed brick veneer on exterior and interior with a concrete masonry core - total thickness is 12". The mortar was deteriorated and wet. Copings were constructed of two separate 6" wide pieces with a sealed joint down the middle. Weeps were observed on the inside face of the parapet wall only and bed joint sealed.

Cut #2: Taken at through wall flashing in parapet on roof. (See photo # 15)

Metal flashing is set into wall approximately 3" and covered with a thermoplastic type membrane. This membrane starts back 2" from the interior face of the parapet and covers only the last inch of the metal before dropping down 4 bricks and covers the exterior brick veneer but was not exposed. The mortar joints were wet and somewhat deteriorated. Standard "truss" type reinforcement was observed.

Cut #3 Taken at 17th floor terrace. (See photo # 16)

Metal flashing is set into wall approximately 3" and covered with a thermoplastic type membrane. This membrane starts back 1" from the face of the wall and continues back up the vertical face of the CMU back-up before being set into the mortar joint of the CMU. There is 1" rigid insulation within the air space. The brick veneer is anchored back with galvanized metal ties. Seams in the flashing were lapped with no sealant observed. Materials were found to be wet. It appears the through wall flashing at this location had been repaired previously.

Observed were several large cracks in the brick veneer. Most were located directly under end points of a shelf angle or window opening. (See photos # 3, 4, 6, 7, 11).

05 METAL

Shelf angles are typically set 2'-4" below every floor line and secured into the concrete beams with expansion type anchors. This angle also aligns with window heads. There are early signs of rusting and water staining on the underside of most lintels. (See photos # 3, 4, 6, 21, 22).

07 THERMAL AND MOISTURE PROTECTION

Observed were several different types of sealant throughout the building making it difficult to determine which material was original. Most sealants show signs of cohesive or adhesive failure. There are soft joints in the parapet wall set at approximately 10 foot intervals. Sealant was also applied to the perimeter of most window frames and gaskets in an attempt to stop leaks. (See photos # 5, 26).

There is an expansion joint between the parking garage and the office building which has split apart and complete failed. (See photos # 19, 20).

Roofing system observed was an IRMA (inverted roofing membrane assembly) composed of stone ballast, protection mat over 2" rigid extruded polystyrene type insulation over an EPDM membrane.

There is a concrete platform which runs around the perimeter of the building for the window washing rig. Penthouse base flashings terminate directly under the window sill. There was no termination bar observed nor did the membrane continue up under the window sill.

Voids were observed in both seams and terminations of the sheet metal counter flashing most noticeably along the base where the window washing platform abuts the parapet. (See photos # 23, 24).

The inside face of the penthouse parapet had been coated with a cementious type coating. There were numerous spalled and cracked areas. (See photos # 12, 13).

Openings were made through the interior gypsum board surface at several locations to observe the flashing construction within the wall. These openings were made prior to any scheduled site visits. Observations indicate end dams in some, but not all, of the through wall flashings. Openings were made on either side of terrace doors.

Terrace details indicate a quarry tile surface on a concrete setting bed over a liquid applied roofing membrane. A concrete curb raises the door sill above the roof line by approximately 6 inches. Flashings ran up the curb and under the door sill. Leaks are occurring around doors, but there exact point of origin is unknown. It was reported that ponding water on the terraces has been a problem in the past.

08 WINDOWS AND DOORS

The curtain wall system along the front entrance and corner oriels are made of an extruded anodized aluminum frame, insulated glass secured with drive-in gaskets and a snap-on cover trim. In many instances, the gasket was loose and not fully set into the frame. Also, observed were numerous gaps in the gasket. Cap flashing above the curtain wall assemblies pitches incorrectly back towards the building facade. This appears to be a problem as evidenced by the excessive amount of sealant applied at this location. (See photos # 25, 26).

Other windows are similar in construction and detail to the curtain wall assembly.

15 MECHANICAL

Original terrace drains have been removed and the sump cleaned out. It is my understanding that new drains will be installed at a lower elevation to correct ponding problems. (See photo # 27).

16 ELECTRICAL

Lightning suppression system runs continuously along the top face of the roof parapet copings. Rods and wire are anchored directly into the brick coping causing cracks and spalling.

END OF SECTION

EVALUATIONS

GENERAL

The water penetration into the building can be traced back to several distinct areas:

- Copings and related masonry parapets.
- Flashings including sheet metal and through wall type.
- Curtain walls and window assemblies.
- Sealant failure - both cohesive and adhesive.

The roofing system appears to be in good condition with the exception of some base flashing along the penthouse and mechanical curbs. The lack of a termination bar along the top edge allows flashing to pull away creating a gap which permits water to penetrate behind the system.

Water penetration into the building has caused both interior and exterior damage resulting in costly repairs, inconvenience to occupants and damage to the structure. Review of The Brick Institute of America (BIA) technical notes shows that *"successful performance of a masonry wall depends on limiting the amount of water that enters the wall system. If water penetration can be limited, for all practical purposes, the wall will remain dry. Water resistance of a masonry wall depends on four key factors:*

1. *Design, including detailing*
2. *Construction*
3. *Materials*
4. *Maintenance"*

All four of the above criteria must be given careful attention in order to produce a satisfactorily performing masonry wall.

Design

It is nearly impossible to keep a heavy, wind driven rain from penetrating a single wythe of brickwork. Therefore, control of this moisture is important. There are two items which provide this control in a cavity wall design such as this - weep holes and flashings.

Flashing is a membrane installed within the wall system designed to divert any water which has penetrated the veneer back to the exterior. Location of the flashing is critical in the design of a wall - especially cavity walls. The flashing should be installed at all bases, window heads, sills, shelf (relieving) angles, projections, recesses, tops of walls and roofs (parapets). End dams should be provided wherever flashings terminate such as window heads. This flashing should be secured to the inside wythe and extend beyond the face of the exterior veneer to form a drip. Other flashing details which must be incorporated are: Proper gravel bed to prevent clogging of weep holes; flashing around inside and outside corners and vertical supports; and continuity of flashing - no breaks.

Original construction drawings are relatively clear with respect to flashing details. For example, under the coping (See Detail A/SK-3) indicates metal flashing extending beyond the inside and outside face of the parapet wall. Only a thin 25mil thermoplastic membrane exists under the coping and the edges fall short of the brick face by 1½". This design, had it been constructed as detailed,

would have prevented much of the parapet wall deterioration. Also, the shelf angle flashing is detailed as extending beyond the face of the veneer.

Weep holes must be installed at not over 24 inch on center in order for water which has penetrated the veneer to be diverted to the exterior. Weep holes exist in most cases where called for on the drawings. However, where the cavity wall was exposed, there was no evidence of any gravel to prevent clogging of the weeps. If the weeps become clogged water which does penetrate the wall system has no place to escape and either passes into the interior causing damage to finishes or freezes within the wall cavity causing spalling of the brick face. Both of these conditions were observed on the building. Spalling has occurred to the parapet walls and interior face of the terrace setbacks.

The two-piece coping was a poor design. Parapets, in general, will suffer the most deterioration simply by the fact they are exposed on all three sides making water penetration from the top, exterior and inside face possible. This exposure also means the wall is subjected to thermal expansion and contraction of a greater magnitude than other building components. When examining the parapets on this building, one can easily follow the water entry path starting from the coping joints down around the flashing and within the masonry parapet. The deteriorated mortar joints, efflorescence and spalling of the brick face are a direct result of this water penetration. Thermal expansion has caused the penthouse parapet to push out at the corners resulting in cracks. Control joints needed to be installed at the corners in order to compensate for this movement and thereby preventing the masonry from cracking.

Construction

According to original architectural and structural construction drawings, shelf/relieving angles are clearly indicated (see Detail S24/SK-3). The reason for shelf angles is to limit compression of brick and mortar to one story. Problems such as cracking will occur should the brick weight become excessive. For this reason, shelf angles are installed at each floor line. However, bricks absorb moisture and over time expand, increasing in size unlike the concrete infrastructure which shrinks over time. Provisions in the form of soft joints must be provided to allow for the brick expansion. Location of this soft joint is directly under the shelf angles according to standard detailing and is shown on the drawings (see Detail C/SK-3). This compressible space allows the brick veneer to expand upward. In some locations on the building, the soft joint has been pushed out due to the expansion of the brick. At several other locations the soft joint was omitted and the space filled solid with mortar, restricting expansion of the brick by the angle and causing spalling and cracking of the brick. The defect now allows moisture to easily penetrate into the wall. The moisture freezes within the wall, expands and causes additional deterioration of the materials including some of the interior finishes.

Covering of the copings is a "temporary" patch only and corrective measures should be performed soon to prevent additional deterioration of the materials.

Water is also entering the wall through defective perimeter sealant around penetrations such as doors, windows and vents. Both adhesive and cohesive failure in the sealants were observed.

Improper installation of the through wall flashing membrane has contributed to the water infiltration problems. Holding the membrane back from the face of the brick veneer permitted water to pass back under the flashing and back within the masonry as opposed to having extended the membrane beyond the face as indicated on the drawing (see Details sheet SK-3). By extending the flashing any water would be diverted to the exterior. Flashings seams are lapped and not sealed. As water travels along the flashing, it can easily penetrate into the wall at these unsealed laps. Also, dams are required at terminations to prevent water from dumping back into the wall cavity at both ends.

This is especially critical at window heads where the water travels back within the frame and jamb assembly. Some, but not all, of the inspected areas had dams.

Materials

Masonry

Glazed standard bricks in general conform to Type FBX, Grade SW, in accordance with ASTM C-216 *Standard Specification for Facing Brick*. In-house testing indicate an acceptable absorption rate for brick of SW grade. However, the sample saved indicates a poor bond between mortar and brick which results in hairline cracks. Water will pass through a masonry wall via these hairline cracks. Under normal conditions very little moisture will pass though the glazed surface of a brick - unless the original facing has become defective due to spalling or splitting.

Masonry ties used within the wall are standard, galvanized adjustable steel hook & eye type. This is standard for the trade. However, with the amount of water penetration into the wall, some of the masonry ties are most likely rusting and losing their structural effectiveness. The galvanized truss type reinforcement observed within the masonry parapet wall has started to rust due to excessive moisture.

In house testing indicates a soft colored mortar with a very high lime content. Type N (750 psi) is the preferred standard for exterior above grade use. In general, bond strength is more important that compression. The ability of the mortar to flex, or resist cracking, water retentivity and good work-ability are what is needed to maintain water tightness of a wall. In this case, it appears the poor bond between the mortar and brick may be a contributing factor.

Curtain wall / windows

Some of the moisture problems are attributable to the poor condition of the curtain wall assembly. The drive-in gasket which secures the glazing in place has loosened, dislodged and shrunk leaving up to a 1" gap at corners. Most curtain wall assemblies are designed to handle water infiltration, but not to the extent being permitted by the gaps in the gasket observed on this building. According to EFCO technical support, a typical curtain wall manufacturer, there gaskets are inserted at optimum temperatures and closely mitered at corners. They also use EPDM for gaskets which they have found to be more stable than some of the other materials on the market.

Installation of the curtain wall differs from that which is shown on the drawings - there is no metal cap at the head. This appears to have been a field condition and one that needs to be corrected.

Flashings

Sheet metal flashing along the parapet has, in some locations, come loose and pulled out of the reglet. There are gaps in the joints and terminations which allow wind driven rain to penetrate and get behind the base flashing below. Repairs can be easily made by installing splice plates over joints and gaps.

Sealant

Some of the sealants used have not cured which would indicate an oil based type sealant not recommended for joints subjected to extreme thermal movement. A construction grade silicone would have been more appropriate. An open-cell type backer rod was removed from a typical control joint in the masonry. Backer rods should be of a closed-cell type to prevent the sealant from adhering to three surfaces. For a sealant joint to function properly, it should be adhered to the two

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end surfaces only and allowed to move freely. All of the sealants need to be inspected and evaluated prior to replacement.

Miscellaneous

Lightning suppressor system securement has contributed to the deterioration of the parapet by allowing water to penetrate around the fasteners set on the top side of the copings. It is important that a new method of securement be designed into the parapet reconstruction which prevents this from reoccurring.

Expansion joints between the parking garage and building face have completely failed both adhesively and cohesively. A completely new design needs to be detailed - possibly one that involves a counter flashing set into a reglet along the vertical brick face of the building. A pre-fabricated neoprene roofing joint similar to Expand-O-Guard by Johns Manville would be an option.

Ponding on the terrace roofs is directly related to the type of drain and the lack of any sump. Resetting of the drains should rectify any ponding and decrease the water entry along the deck sills. Also, most liquid applied membranes require a sealant "cove" be installed to accommodate the horizontal to vertical transition. There are no coves detailed on the drawings. The actual construction is unknown.

END OF SECTION

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RECOMMENDATIONS

GENERAL

The damage observed on this building is directly related to water infiltration. Cosmetic repairs such as applying sealant and EPDM over copings will only mask and not correct the problems. Leaks have progressed to the point where extensive damage has occurred and a major undertaking must be considered to correct the problems. It has been determined that the problems are directly related to design, workmanship and materials and not just one particular element.

RECOMMENDATIONS

- Rebuild all parapets (penthouse, main roof and terraces) to correct problem of water infiltration. This would require the installation of a new coping system. We recommend the installation of a lead coated copper or stainless steel coping in lieu of the masonry units which exist. This would allow for a more water tight installation. A new pressure treated wood block anchored to the masonry and covered with EPDM would prevent any water which did get past the sheet metal from entering the wall.

  As part of the parapet repair, we recommend removing damaged or defective masonry and reconstructing with new brick to match existing. Internal through wall flashing can be installed which will properly divert water to the exterior.

- Remove 5 courses of brick along every shelf angle and window head to allow for installation of new fabric flashing, weep holes at not over 24" o.c. and soft joints. All flashing needs to be carefully detailed to ensure end dams are installed and the flashing extends beyond the face of the wall. Consideration should be given to installing a stainless steel drip under the flashing and separated from the top of the steel shelf angle by # 15 felt. This material makes for a cleaner appearance on the exterior.

- Inspect and remove any damaged / defective brick veneer on entire building facade. A damaged brick is one that is cracked, spalled or chipped, thereby losing its waterproofing properties.

- Install new backer rod and sealant at all wall penetrations, opening and control joints. Install new control joints at corners to compensate for thermal expansion in masonry.

- Replace defective gaskets on curtain wall and windows where the existing material has shrunk or become loose. The new material should be installed in accordance with the original manufacturer's recommendations. If installed correctly, the gasket should not shrink or leave gaps at edges.

- Reinstall lightning suppression system to the interior face of the parapets. Use all stainless steel anchors.

- Repair existing sheet metal flashing by installing new splices and covers over open joints and seams. All rivets should be coated with a dab of silicone sealant.

- Remove existing expansion joint between parking garage and building, clean joint and prepare surfaces for new pre-fabricated expansion joint. Design must not only allow for differential movement between the structures, but must also act as a gutter system for rain water.

- Remove existing sheet metal cap on curtain wall head and replace with new designed to shed water to the exterior face. This work can be performed at the same time as installing the flashing along the steel angle as noted above.

Reason:

Corrective work will provide a means by which water that has penetrated the wall an escape route via weep holes and flashing. Soft joints will allow for differential movement between dissimilar materials.

Advantages

Maintains the original character of the building. Masonry has a long life expectancy when properly installed and detailed.

Disadvantages:

High restoration cost. Maintenance is required on sealant work to prevent future deterioration.

ESTIMATED COST OF RESTORATION WORK

Some of the dollar figures used were calculated based on information obtained from the 1997 Building Construction Cost Data, published by Robert Snow Means Company, Inc., Kingston, Massachusetts. Additional figures were obtained from similar active projects with inflation and geographical percentages included and manufacturer's pricing. The final dollar amount shown is for guidance only and is a "ball park" figure. An assumption is made that all repair work will be performed under one contract and not spaced out over a period of time. Also the use of the existing window washing rig will be made available to the restoration contractor in lieu of scaffolding the entire building. The amount does not include any Architectural/ Engineering fees or contingencies. Cost estimate work sheets are included under Appendix B.

Estimated Cost.....$ 1,326,248.00

END OF SECTION

Photo No. 1
5A-4/18/98

FRONT (NORTH/EAST) ELEVATION.

Photo No. 2
6-4/2/98

EMERGENCY REPAIR TO PREVENT LEAKS - FULLY ADHERED EPDM OVER COPINGS AND FACE OF WALL SECURED WITH TERMINATION BARS.

Photo No. 3
5-4/2/98

COMPRESSION CRACK DUE TO LACK OF SOFT JOINT AT LINTEL AND POSSIBLE DETACHMENT OF LINTEL FROM CONCRETE BEAM.

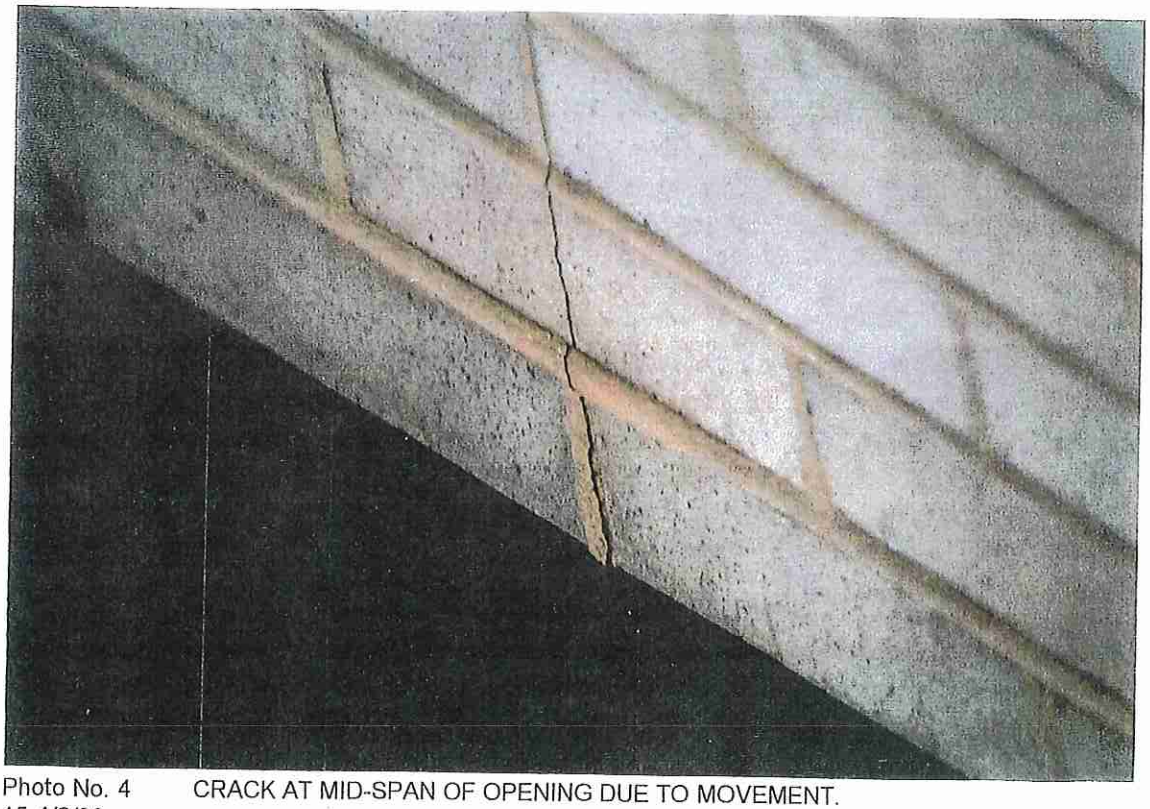


Photo No. 4
15-4/2/98

CRACK AT MID-SPAN OF OPENING DUE TO MOVEMENT.

Photo No. 5
16-4/2/98

SEALANT AT SOFT JOINT BEING PUSHED OUT DUE TO THERMAL EXPANSION IN BRICK VENEER.

Photo No. 6
20A-4/18/98

COMPRESSION CRACK AT LINTEL BEARING DUE TO LACK OF PROPER SOFT JOINT AND POSSIBLE DETACHMENT OF LINTEL TO CONCRETE BEAM.

Photo No. 7
7A-4/18/98

CORNER CRACK AND DISPLACEMENT IN MASONRY VENEER DUE TO THERMAL EXPANSION. NOTE PATCH FROM PREVIOUS INSPECTION.

Photo No. 8
6A-4/18/98

SEVERE EFFLORESCENCE DUE TO WATER INFILTRATION. NOTE HAIRLINE CRACKS IN BRICK VENEER.

Photo No. 9
7-4/2/98

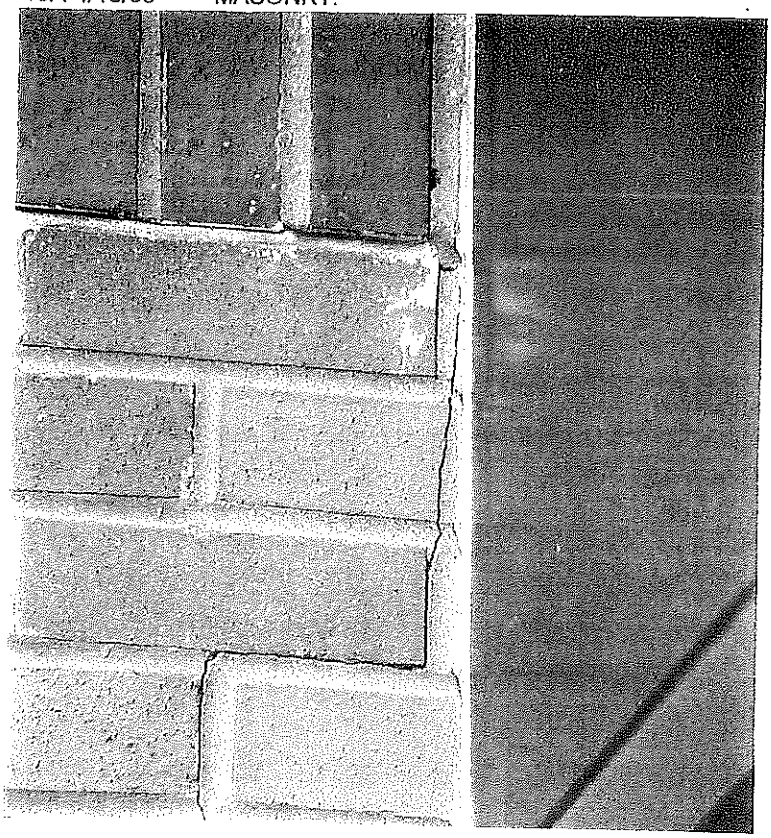
SEVERE EFFLORESCENCE DUE TO WATER INFILTRATION. NOTE DEFECTIVE MORTAR JOINT AND EPDM COPING COVER.

Photo No. 10
9A-4/18/98

CLOSE-UP PHOTO OF SEVERE HAIRLINE CRACKING IN BRICK VENEER. NOTE DEFECTIVE MORTAR JOINTS.

Photo No. 11
19A-4/18/98

CLOSE-UP OF CRACK IN BRICK VENEER WHERE CURTAIN WALL ABUTS MASONRY.



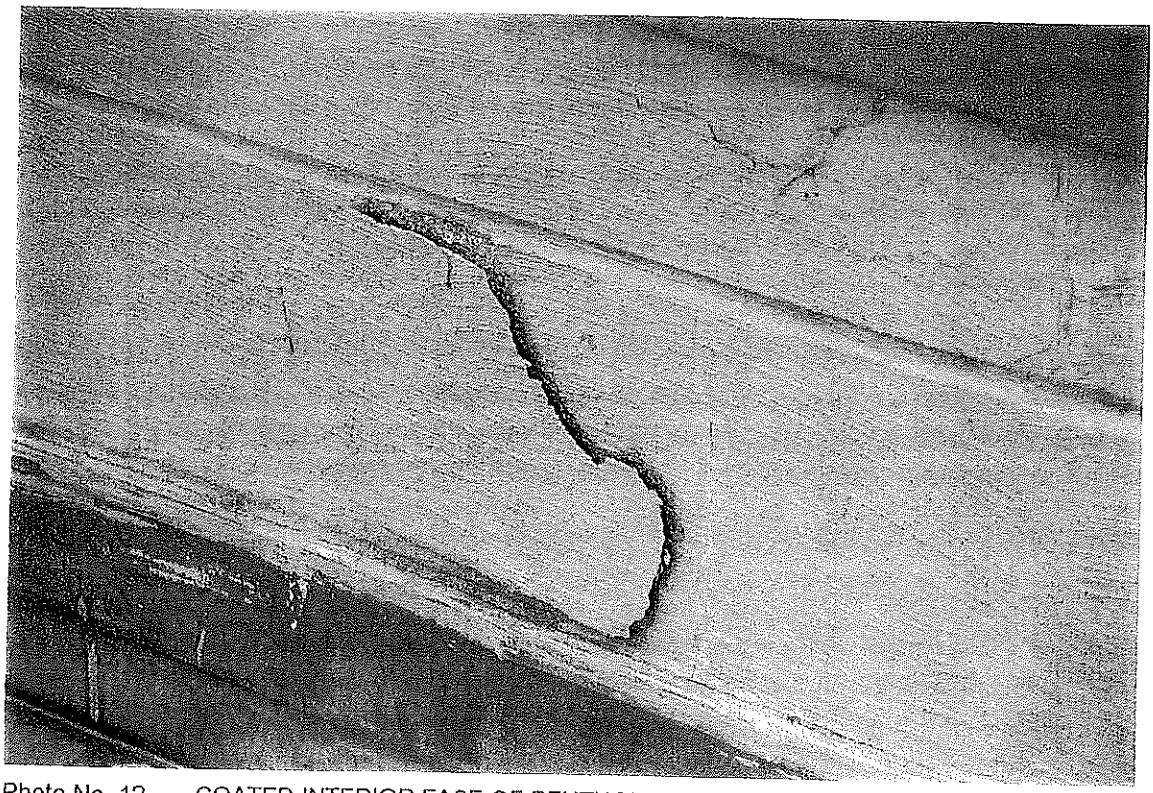


Photo No. 12
10-4/2/98

COATED INTERIOR FACE OF PENTHOUSE PARAPET WALL. NOTE SPALLED MASONRY.

Photo No. 13
12-4/2/98

COMPLETE DETERIORATION OF MASONRY PARAPET BACK-UP DUE TO WATER INFILTRATION. NOTE EPDM COPING COVER REPAIR.

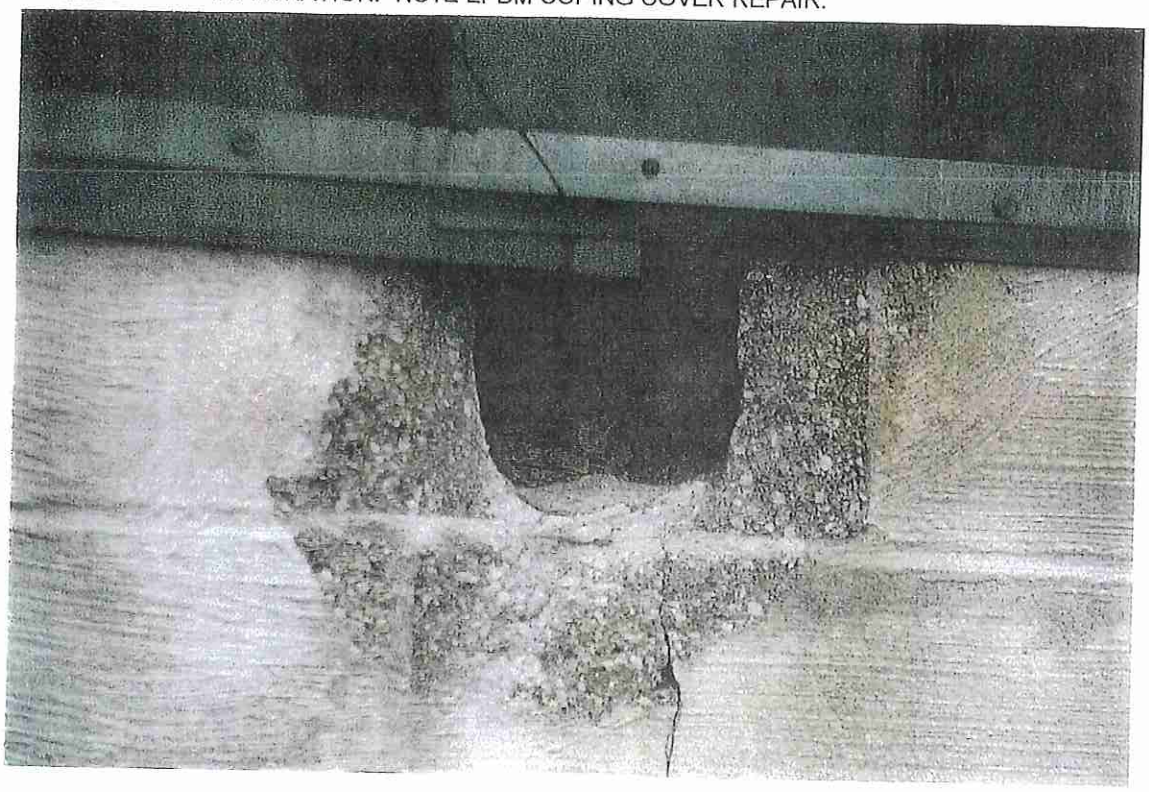


Photo No. 14
11A-4/18/98

CUT NO. 1 - COPING MAIN ROOF. NOTE FLASHING UNDER COPINGS IS HELD BACK 1" FROM FACE OF BRICK.

Photo No. 15
12A-4/18/98

CUT NO. 2 - BASE OF PARAPET MAIN ROOF. NOTE FLASHING IS HELD BACK 2" FROM FACE OF BRICK.

Photo No. 16
14A-4/18/98

CUT NO. 3 - 17TH FLOOR TERRACE. NOTE: 3" CAVITY WITHIN WALL AND FLASHING HELD BACK 1½" FROM FACE OF BRICK.

Photo No. 17
15A-4/18/98

CLOSE-UP CAVITY WALL CONSTRUCTION. NOTE FLASHING SET IN CMV BACK-UP.

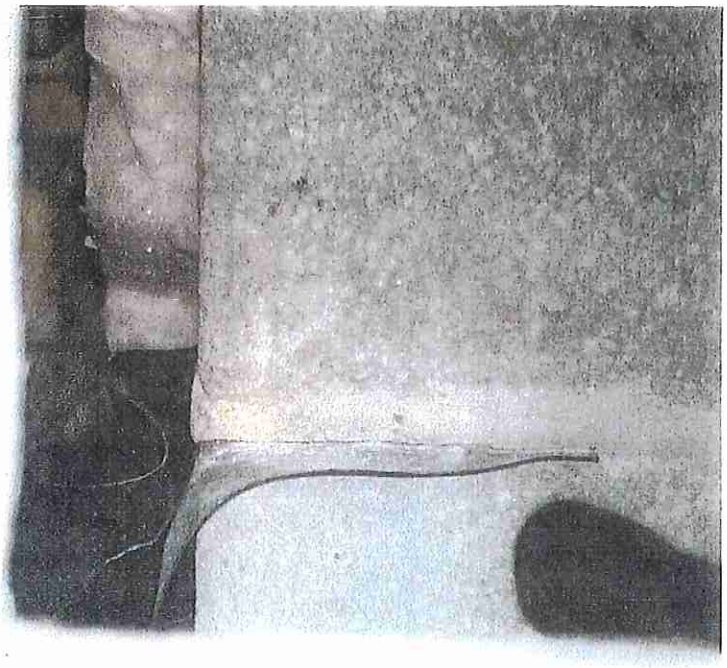


Photo No. 18
17-4/2/98

CLOSE-UP OF CAVITY WALL CONSTRUCTION. NOTE GALVANIZED MASONRY ANCHORS AND FLASHING.

Photo No. 19
23A-4/18/98

TYPICAL HORIZONTAL EXPANSION JOINT BETWEEN PARKING GARAGE AND BUILDING ENTRANCE.

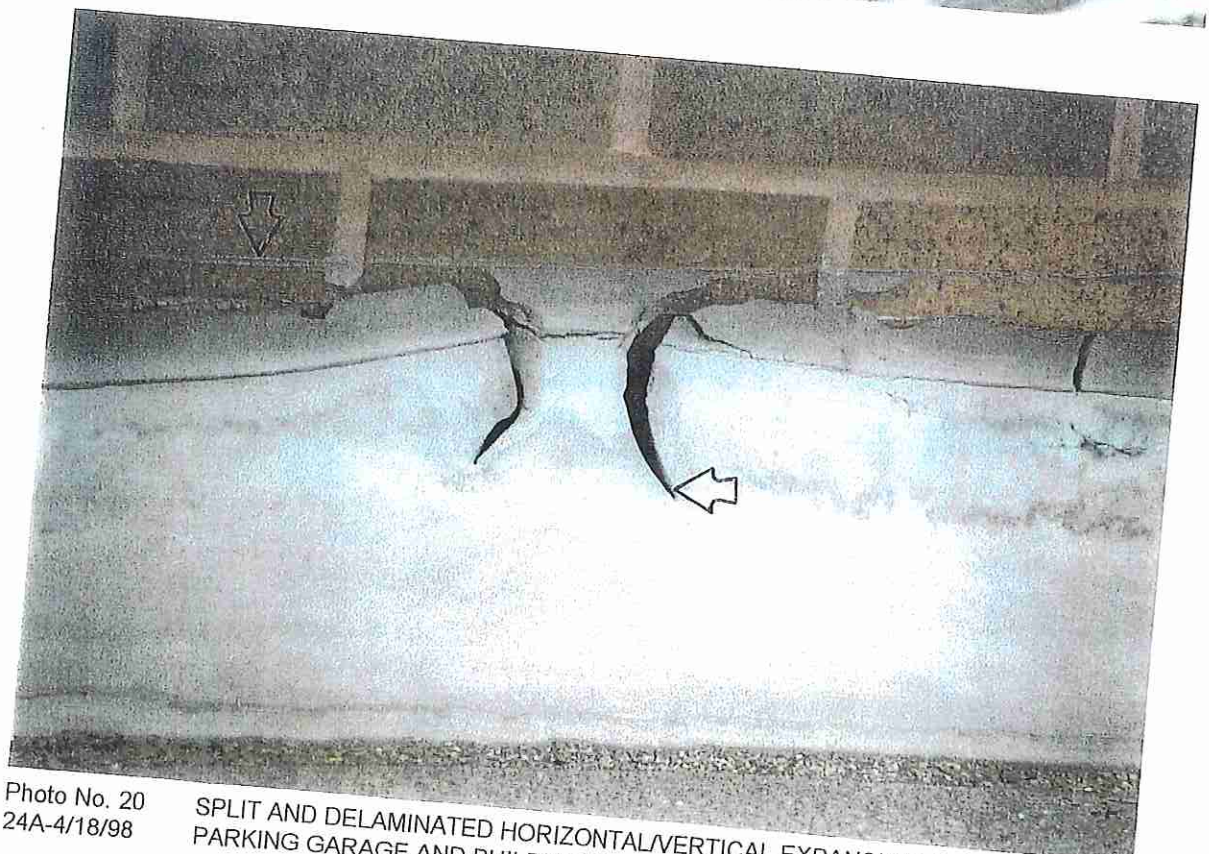


Photo No. 20
24A-4/18/98

SPLIT AND DELAMINATED HORIZONTAL/VERTICAL EXPANSION JOINT BETWEEN PARKING GARAGE AND BUILDING ELEVATION.

Photo No. 21
13A-4/18/98

CLOSE-UP PHOTO OF WINDOW LINTEL. NOTE JOINT AT EDGE OF STEEL IS FILLED SOLID WITH SEALANT.

Photo No. 22
22A-4/18/98

CLOSE-UP PHOTO OF LINTEL FLASHING CONDITION. NOTE FLASHING STOPS SHORT OF EDGE OF STEEL AND JOINT IS FILLED SOLID WITH MORTAR.

Photo No. 23 VOID IN SHEET METAL COUNTER FLASHING AT PARAPET WALL.
8-4/2/98

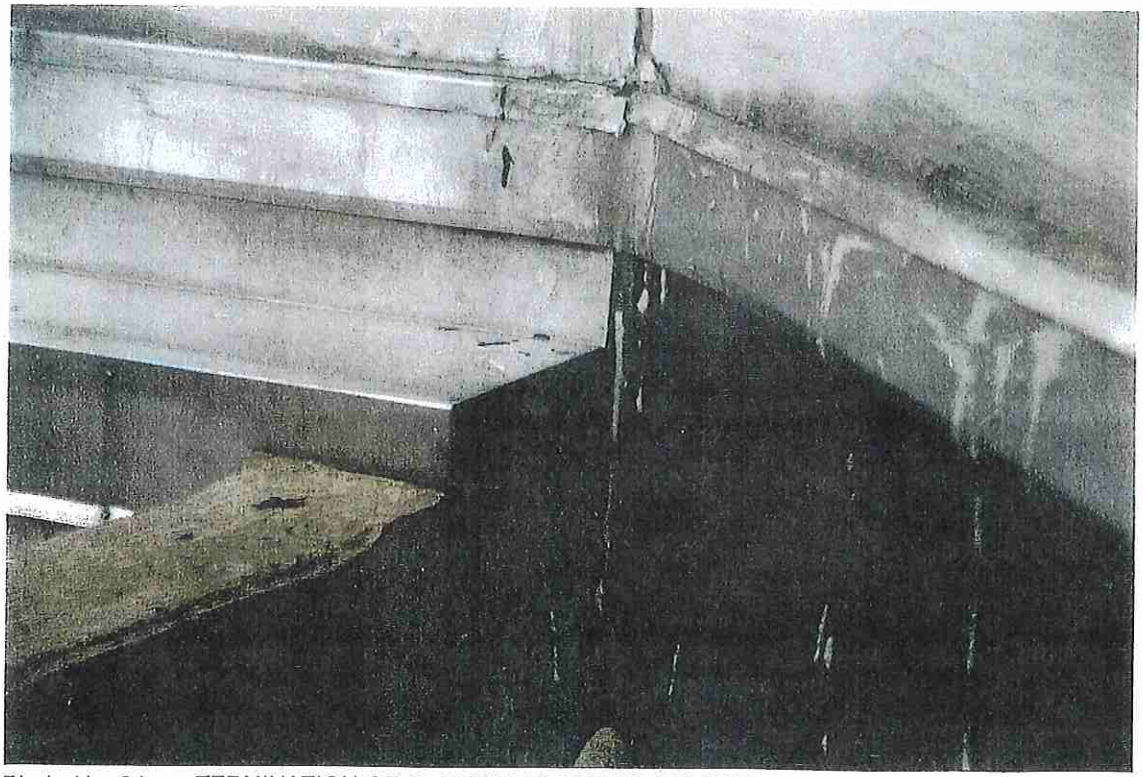


Photo No. 24 TERMINATION OF COUNTER FLASHING AT WINDOW WASHING PLATFORM - PENTHOUSE. NOTE OPEN JOINTS AND SEAMS.
11-4/2/98

Photo No. 25
10A-4/18/98

CLOSE-UP PHOTO OF CURTAIN WALL ASSEMBLY. NOTE LOOSE AND MISSING COVER, EXPOSED SCREW HOLD AND LOOSE GASKET.

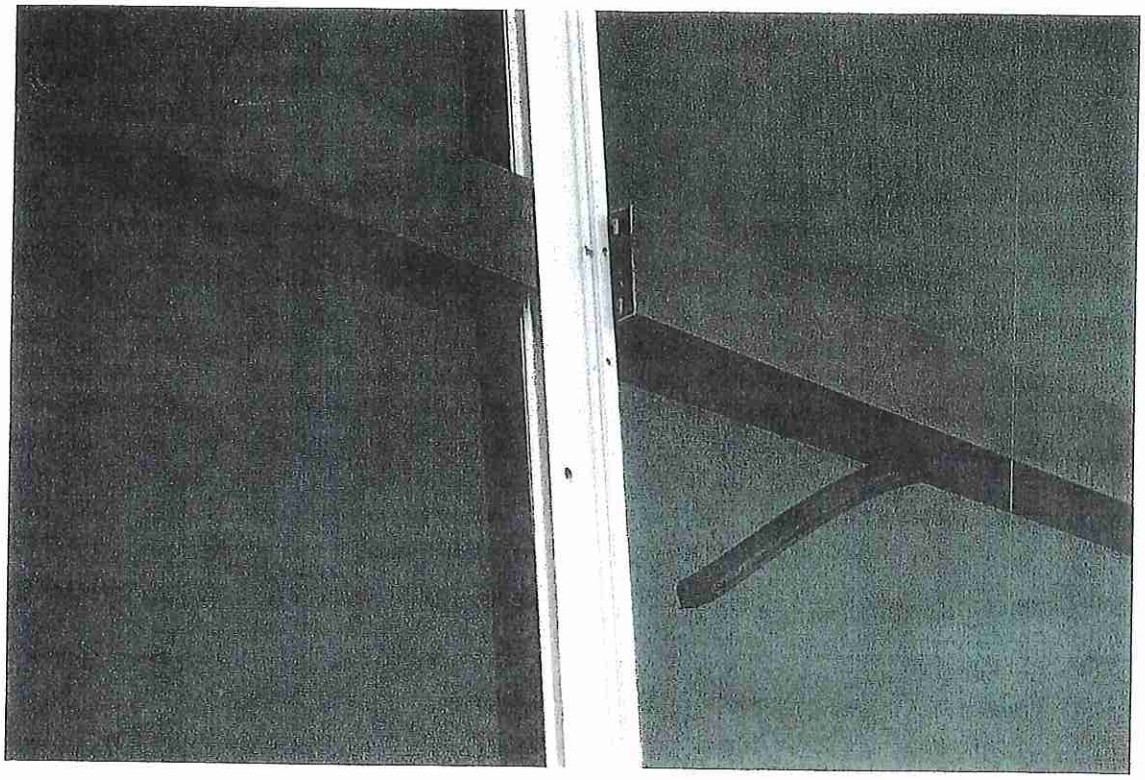


Photo No. 26
8A-4/18/98

METAL CAP ON CURTAIN WALL TILTS BACK TOWARDS MASONRY AND PONDS WATER. NOTE POOR APPLICATION OF SEALANT AND OPEN SEAM.

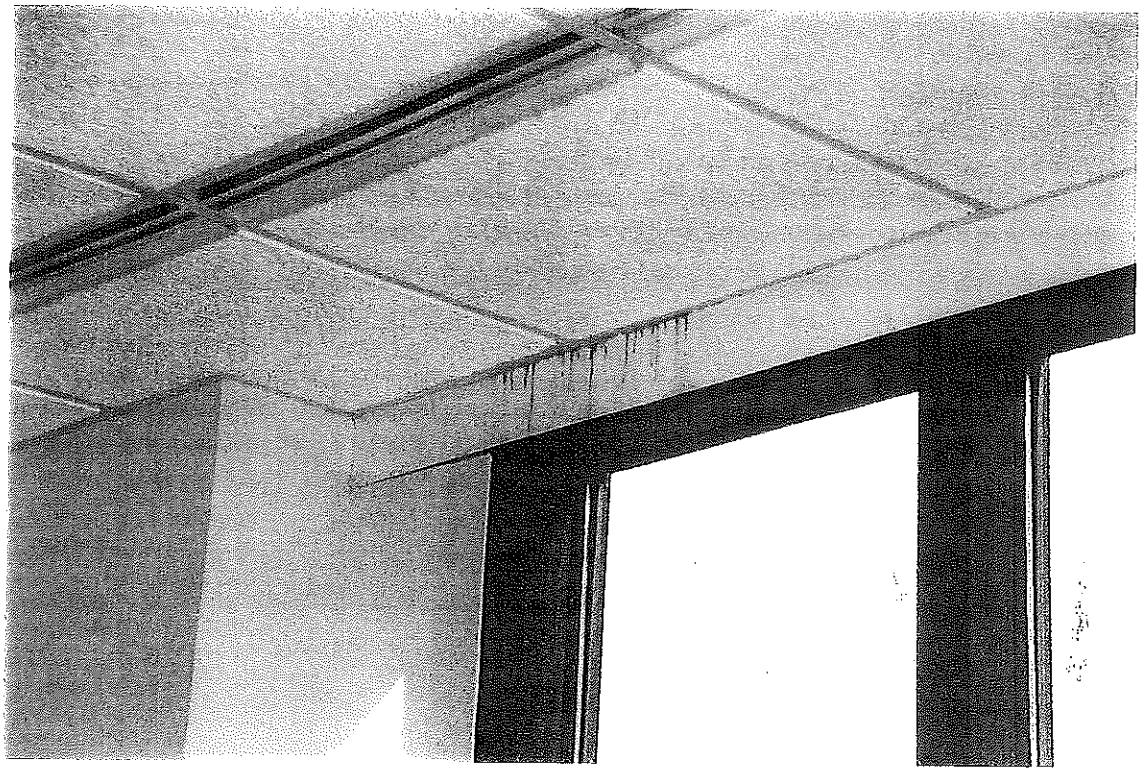
Photo No. 27
13-4/2/98

TYPICAL TERRACE DRAIN REMOVED TO ALLOW FOR DRAINAGE OF SUMP. NEW DRAINS SCHEDULED TO BE INSTALLED LOWER.

Photo No. 28
18A-4/18/98

INTERIOR WATER DAMAGE AT WINDOW HEAD - 17TH FLOOR.

Photo No. 29 INTERIOR WATER DAMAGE AT WINDOW HEAD - 17TH FLOOR.
17A-4/18/98



Martin A. Benassi AIA		QUANTITY SURVEY			
Architect		Project No. BI-2B-033 / 98-08			
Estimate For: 25 Sigourney Street Prepared By:	MAB	Date: 5/15/98		Page 1 of 1	
DIV. PRINCIPAL TRADE ITEM AND ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	ITEM PRICE	PRINCIPAL ITEM COST
1 GENERAL					
bonds, permits, insurance/supervision	u	1	80,000.00	80,000	
field office/expenses	mo	8	6,000.00	48,000	
mobilization/demobilization	u	2	8,000.00	16,000	
trash removal	u	20	800.00	16,000	
					160,000
4 MASONRY					
shelf angle work: s/s drip edge/flashing/weeps	lf	7,000	40.00	280,000	
parapet reconstruction	sf	19,000	34.80	661,200	
masonry repair	sf	200	30.00	6,000	
					947,200
7 THERMAL & MOISTURE PROTECTION					
new sealant at openings	u	1	10,000.00	10,000	
expansion joint	lf	100	25.00	2,500	
sheet metal repairs	u	60	15.00	900	
					13,400
8 WINDOW AND DOORS					
glazing	lf	22,200	2.25	49950	
					49,950
16 ELECTRICAL					
lightining suppression system	lf	1,000	13.60	13,600	
					13,600
SUBTOTAL					1,184,150
CITY COST INDEX: 1.12					142,098
TOTAL					1,326,248
APPENDIX B					