BUILDING ENVELOPE CONDITION ASSESSMENT
THE ELECTRA CONDOMINIUM
989 NELSON STREET
VANCOUVER, BC

Prepared for:

Atlific Property Management, Inc.
1110 Howe Street
Vancouver, BC
V6Z 1R2

Attention: Ms. Lauren Russell

Levelton Engineering Ltd.
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March 7, 2000

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EXECUTIVE SUMMARY

The Electra comprises a 21-storey office tower that has been converted to residential space, and a 3-storey Annex. Tenants have reported active water leaks into several suites, especially on the North elevation of the tower, although there is no definite pattern and leaks have been reported on both major facades (north and south).

Several suites were reviewed from the interior, and a boatswain's-chair drop was made to survey the North elevation of the tower from the exterior. Additional visual reviews were conducted on the exterior of the Annex from the roof level.

Several deficiencies were noted with respect to weep-hole screens, which are becoming plugged with dirt and debris and preventing proper drainage. The caulking on this face-sealed curtain-wall is observed to be deteriorating, and would require maintenance on a regular basis if it is decided to keep the face-seal design. Some exterior glazing gaskets are too short to perform their intended function, and all of the window mitre-joints examined were not sealed.

The best solution to this problem would be to modify the system to a rainscreen design, and this would require additional investigation to determine how best to implement such a remediation. Alternatively, it is suggested that the curtain-wall could be re-caulked as part of regular maintenance, to maintain the face-seal design, but this is not the most optimum approach. For the face-seal system to work, glazing gaskets should also be replaced, and the mitre joints in the corner of each window should be sealed under the glazing stop.

In either case (i.e., rainscreen or face-seal), the weep-hole screens should be removed or re-designed to permit drainage.

1. INTRODUCTION

1.1 TERMS OF REFERENCE AND SCOPE OF SERVICES

Levelton Engineering Ltd. was retained by Atlific Propertty Management, Inc., on behalf of The Electra Strata Corporation LMS 1866 to assess the current condition and performance of the building envelope and assess the source of water ingress in residential suites. The work was conducted in accordance with the scope of services described in our proposal dated December 6, 1999 (Appendix A).

Several suites were reviewed from the interior, and a boatswain's-chair drop was made to survey the North elevation of the tower from the exterior. Additional visual reviews were conducted on the exterior of the Annex from the mezzanine roof level.

Levelton Engineering Ltd. has prepared this report solely for the use of the Strata Corporation for building repair purposes only. Use of this report by anyone other than the Strata Corporation, without written consent of Levelton, is prohibited. Also, this report is not to be used or relied upon for any other reasons or by any third parties. Levelton accepts no responsibility for damages suffered by any third party as a result of decisions or actions based on this report.

1.2 BUILDING DESCRIPTION AND BACKGROUND

The Electra comprises a 21-storey office tower that has been converted to residential space, and a 3-storey Annex. The building conversion was completed approximately 6 years ago, and the exterior envelope is a pressure-glazed curtain-wall construction, with metal cladding over concrete structural columns and metal spandrel panels. It appears that it was originally intended that this system would incorporate a rainscreen design, but remedial caulking on the exterior of the mullion caps has effectively converted it to a face-sealed system.

Tenants have reported active water leaks into several suites, especially on the North elevation of the tower, although there is no definite pattern and leaks have been reported on both major facades (north and south).

2. OBSERVATIONS

2.1 GENERAL

A general visual review of interior suites was undertaken in December, 1999. Some evidence of water ingress was observed in Suite 1312 at the top corner of a fixed window, with water stains along the jamb glazing stop. On the exterior, this window abuts an architectural column. Other suites visited showed no signs of water staining, although tenants had complained of leaks. There was evidence that the tenant had removed any stains that may have been present.

A review of suites in the Annex showed evidence of moisture that had been sitting on the windowsill trim: the paint was blistered and stains were evident in several locations. The exterior of these windows showed staining below each vertical mullion (see Photo 1), indicating that water had been directed through the hollow curtain-wall framing.

2.2 EXTERIOR REVIEW

One boatswain's-chair drop was performed to evaluate the building envelope components of the high-rise building and to investigate some of the reported problematic locations. The drop is a vertical descent on the north wall at "Bay 18" (see Drawing 2.01 from Advanced Glazing Systems, dated October 6, 1994), but lateral movement is possible below the 15th storey (i.e., once a sufficient amount of line is deployed to permit freer movement). Thus, we were able to examine the exterior of Suites 1413, 1312 and 1213 where leaks had been reported.

On the exterior of Suite 1413, the caulking appeared to be deteriorated more than usual. There was also a small section of caulking at a non-typical location. The caulking at both locations appears to have been remedial caulking, which was also evident at the exterior of Suite 1213. The exterior of Suite 1312 did not show any non-typical deficiencies evident.

In general, the investigation revealed various poor glazing details (described below) and methods creating potential for water ingress and moisture within the walls system. Furthermore, at some locations the caulking was beginning to deteriorate and crack apart from the substrate increasing the likelihood of water penetrating the building envelope. The following sections discuss each of the components of the curtain wall system in more detail.

Glazing

The glazing was a curtain wall system with aluminum mullions and transoms. The sealed units were exterior-glazed. Box-bead stops and vinyl gaskets held in the sealed-units (see Photo 2). The metal cladding on structural columns is caulked to the curtain-wall mullion caps. The weep hole at the bottom of the windows incorporated a fibrous substance intended to inhibit blockage from dirt and debris, and to prevent insect ingress (see Photo 3). This fibrous substance was saturated at every floor level and, although it is water-permeable, it is questionable whether it is performing as intended. A sample was taken from the 21st floor.

A metal glazing stop covers the connection where the vertical mullion meets the sealed units (see Photo 4). Where the mullion caps meet, there is typically a ¾" gap between the outer most metal to allow for thermal movement. This gap has been sealed at the sides with a small dab of caulking.

The operable windows are of a reverse-hopper type (see Photo 5), that opens in from the top. This type of operable window relies entirely on a vinyl gasket between the outer sash and the opener unit to resist water entry. If this gasket is not functioning as intended, water can freely enter onto the inside of the frame. If the transom and mullion mitre joints are not sealed, it is possible for any water penetrating the vents to travel downward.

Caulking

In general, the caulking appeared weathered (see Photos 2 and 6), and is beginning to deteriorate in several locations, although it still appears to be adhering. The sides of the caps covering the vertical mullions are not caulked to the mullions in most locations (see Photo 7), except where some remedial work appears to have been done wherever the caps do not fit tightly (see Photos 8 and 9). This caulking was not originally required, but has been added afterward, probably in an attempt to control leaks.

There was no visible caulking bead where the different components of the flashing system met over the structural column, but these components may have been back-caulked. There is also a local caulking failure at the cap flashing over the parapet on the roof.

Photo 10, taken at the 19th floor, shows poorly applied caulking over the joint between two mullion caps. This appears to have been a remedial measure, intended to cover a large gap (of more than 1") between the mullion caps. This photo also demonstrates that the vinyl exterior glazing gasket did not extend to the corner of the window, which is a detail that was evident in several areas.

Photo 11, taken at the 9th floor, shows a gum-lip flashing, which is not typical of this assembly. It is not clear why such a detail would be used here, although it does not appear to have caused any problems.

Annex

The exterior of the Annex (see Photo 12), which uses the same glazing design, was also examined. The metal cap on the vertical mullion was removed, allowing a substantial amount of water to leak out (see Photo 13). The water is probably allowed to accumulate because the weep holes are blocked. The glazing stops were removed to examine the sealant details, and the mitre joints were not sealed (see Photos 1 and 14: again, note the extensive water staining and efflorescence, indicating long-term water leakage from the curtain-wall mullions).

One of the ventilation grilles at the base of the tower adjacent to the Annex uses a caulking bead rather than a flashing to prevent water from getting in from the top (see Photo 15). The caulking is beginning to deteriorate, creating a potential water-infiltration problem at this location. The flashing at the corner of the roof (see Photo 16) is a poor detail, in that it relies heavily on caulking to prevent water ingress, although it does not appear to have caused any problems to date.

4. DISCUSSION AND RECOMMENDATIONS

The nature of an aluminum-framed curtain wall is that there are many open channels that can permit water to travel extensive distances within the framing system. Therefore, while some of the water leaks could be correlated to a deficiency on the exterior of the suite reporting the leak, others could not, as the exterior source of the leak could be quite distant from its point of ingress on the interior of the building. Nevertheless, there are several details on the exterior that are likely to have contributed to the problem.

The curtain-wall assembly may have originally been intended as a rainscreen design, but has been remediated to be a face-sealed system, which relies heavily on exterior gaskets and caulking to prevent water ingress. The best solution (based on performance) would be to return this system to a rainscreen design (which allows for water ingress and is designed to drain the water away before it causes problems). An optional approach, which would be less expensive but also not as effective, would be for a maintenance program to be implemented, including some repairs that could be done immediately. The options are discussed in more detail below, but a complete system design is beyond the scope of this investigation.

Whether rainscreen or face-seal is chosen, the weep-hole screens are interfering with the drainage function of the weep holes. As they are currently used, the screens require extensive maintenance to be kept clear of dirt and debris, or they will continue to prevent water from draining. Either such a maintenance program should be carried out on a regular basis, or the screens should be removed or re-designed to prevent clogging. For example, rather than using a foamed polymer, insect screen might be less likely to become clogged.

OPTION A: RAINSCREEN

Converting the glazing system to a rainscreen would involve removal of interior mullion covers to ensure a continuous air barrier on the interior side of the framing system. The hollow framing system itself would provide the rainscreen cavity, and the existing exterior mullion cover and gaskets would provide the weather barrier and baffle. Before this approach could be developed in detail, however, some additional investigation would be required to ascertain whether the as-built system is the same as shown in the drawings, and to determine how details at corners, ceilings and floor slabs would be done.

OPTION B: FACE-SEAL

The caulking should be removed and re-applied at several locations, which would be done by removing the mullion caps and caulking on the inside of the framing, rather than caulking the exterior: the latter approach is less expensive, but exposes the caulking to weather and reduces its durability. The idea of using caulking as a stopgap over poorly sealed mullion caps should be reconsidered in favour of repairing the mullion caps themselves, if necessary: caulking should not be visible from the exterior.

Second, the exterior glazing gaskets do not fully seal the windows into the corners. The existing gaskets should be replaced with gaskets of proper length as required. Unfortunately, it is difficult to determine the extent of this deficiency, as the entire building was not investigated, and a statistical record of gasket deficiencies was not recorded. It would be possible to document

the extent of this deficiency during a caulking and weep-hole-screen remediation, however, or to simply assume that all gaskets require some remediation. Once this is determined, all glazing gaskets that are too short would be replaced, and the mitred joints inside the glazing stops of all the windows would be sealed at the same time.

LEVELTON
Engineering Solutions

November 30, 1999

Atlific Property Management, Inc.
1110 Howe Street
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Attention: Lauren Russell

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Construction Materials
Building Science
Geotechnical
Metallurgy and Corrosion
Environmental
Analytical Chemistry
Physical Testing

Dear Ms. Russell:

Re: Proposal for Building Envelope Assessment, The Electra Condominum

Levelton Engineering Ltd. is pleased to provide this proposal for the building envelope condition assessment at 989 Nelson Street, Vancouver. Our focus will be on the performance of the building envelope in preventing water ingress and the current condition of the building envelope, in particular the curtain wall systems on the north face of the Tower and on the east face of the Annex.

Levelton investigators have visited this site on previous occasions and are familiar with some of the previous problems associated with this property. Recent reports from the tenants indicate water ingress in several suites. It will be important to determine whether there is a common cause that can be identified and corrected with a minimum of effort and expense, or whether the water ingress is the result of several unrelated defects in the envelope.

SCOPE OF WORK

- Review the pattern of leaks reported by tenants to identify possible correlations. If the Strata Council deems it appropriate, we could conduct a tenant survey, but it is assumed that such a survey is not necessary at this time, and this proposal does not reflect the cost of a tenant survey.
- Undertake an on-site visual review of the building enclosure elements, including eight suites where problems have been reported. This examination will identify the nature of the leakage paths on the interior of these suites (note that several suites have already been inspected, and may not require further access). In all cases, access to suites will be done through the residential manager. If additional suites report problems, these can be addressed *ad hoc*, but the cost of additional inspections is not reflected in this proposal.
- The pattern of climatic variables (prevailing winds and precipitation) will be investigated, to determine a possible correlation between meteorological events and reported water ingress.

APPENDIX A

Proposal

LEVELTON
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- Perform one boatswain's chair drop to assess the external condition of the curtain wall system. The tenant survey indicates that the suites on the west side of the north face of the Tower are experiencing the worst problems, so these are the most likely candidates for this exterior survey. We will be able to inspect four of the suites reporting problems (1511, 1413, 1312 and 1213); if additional drops are required, these would not proceed with such testing without prior approval of the Strata Council. Please note that this proposal reflects the costs for one exterior inspection.
- We do not feel that cut tests, moisture probes or spray tests would be required; however, we may discover conditions during our site visits that would necessitate such testing. We would advise you as appropriate, and would not proceed with such testing without prior approval of the Strata Council. Please note that the costs for these tests are not included in this proposal.
- Develop conceptual remedial work recommendation for each element of the building envelope that is likely to require remediation. Note that these recommendations will be preliminary, and will not constitute a "specification"-type document.
- Assess the priority of the remedial work recommendations (e.g., identify areas which may constitute immediate health and safety hazards, as opposed to those which will cause long-term structural damage).
- Prepare and submit a report which summarizes our assessment work, describes the longer term prognosis for the performance of the envelope and presents our recommendations for remedial work, as well as our recommendations for further investigation work as required.
- Meet with the Strata Council on one occasion to discuss the findings outlines in the report, and outline the plan for remediation (including development of tender documents and supervision of remediation, which is not included in this price estimate).

TENDER DOCUMENTS AND SPECIFICATION

If remedial work is to be conducted, we can prepare tender documents and a complete technical specification for the remedial work that contractors can bid on. We will tender the work to at least three [3] contractors, review their bids, and prepare a contract between the Strata and the selected contractor. This contract will be based on the Standard Construction Document CCDC #2, 1994 *Stipulated Price Contract*. Levelton will not provide services associated with preparation of tender documents and specification unless they are assured that they are to also provide field review and contract administration services.

FIELD REVIEW AND CONTRACT ADMINISTRATION

We can provide periodic field reviews while the remedial work is being conducted to ascertain that the work is being completed in general accordance with our specification and good construction practice. For every field review, a report will be completed that describes the progress of the work, suggested modifications to the work, weather, scheduling, and/or any other pertinent information.

Ms. Lauren Russell
Atlific Property Management/ 3

November 30, 1999
File:

LEVELTON
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We will also perform the duties of contract administration for the project. This includes writing change orders when necessary and reviewing the contractor's progress claims for general conformity with the work before forwarding them to the Strata for payment.

FEES

Levelton bases fees on the following rates:

Senior Engineer	$125.00 per hour;
Project Engineer	$100.00 per hour;
Professional Engineer	$85.00 per hour;
Senior Building Science Technologist/Engineer-in-Training	$60.00 per hour;
Technician	$55.00 per hour,
Travel	$0.32 per kilometer.

Based on these rates, our proposed fees are:

• Building Envelope Review	$4,850.00
• Tender Documents and Specification	Cost can only be determined following the Building Envelope Review
• Field Review and Project Management	**10 - 12%** of the cost of the remedial work

The above fees are exclusive of GST and expenses incurred by Levelton Engineering Ltd. These expenses may include travel, photography, long distance telephone calls, facsimiles, courier services, postage and reproduction of documents. All expenses, except travel, will be charged at cost plus 10% administration fee. Testing included is not considered a disbursement.

All fees assume that suitable architectural drawings will be made available to us. If Levelton is required to obtain copies of architectural drawings from the City archives, all time associated with this activity will be charged as an extra service.

This proposal is open for acceptance until December 31st, 1999.

PERSONNEL AND EXPERIENCE

Levelton was established in 1966 and is a multi-disciplinary consulting engineering firm. With over 100 employees providing professional services in five divisions, we are able to draw from a vast array of experience and skills. Fully equipped chemistry, metallurgical, and materials laboratories are available in-house to provide prompt testing and analysis when required.

Building envelope review services will be provided by Levelton's Building Science Division at our head office in Richmond, B.C.

Ms. Lauren Russell
Atlific Property Management/ 4

December 6, 1999
File: P99-196

We kindly request that you confirm your acceptance of this proposal and our authorization to proceed by countersigning and returning this sheet to our office. This will be required before any work is performed.

Yours truly,

LEVELTON ENGINEERING LTD.

Alex McGowan, P.Eng.

Enclosure

Acceptance

L. Russell as agent for
Strata Plan LMS 1866

Date JAN 26/00

ATLIFIC PROPERTY MANAGEMENT
Title

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APPENDIX B

Photographs

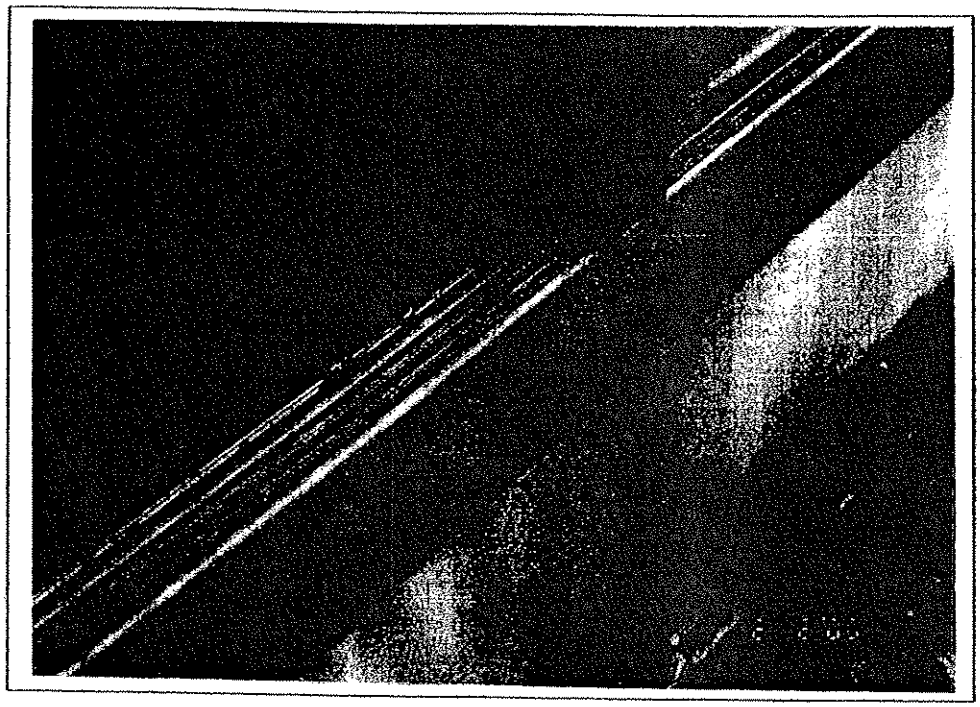


PHOTO 1: Base of curtain wall at Annex.

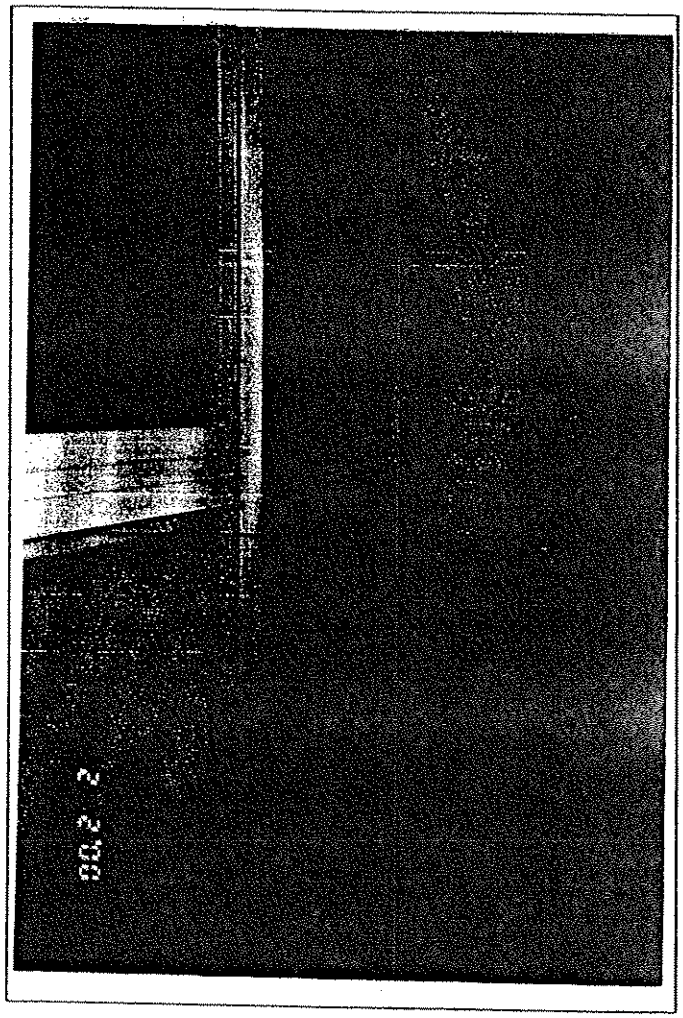


PHOTO 2:

Typical detail, inside corner of metal-clad column.

PHOTO 3: Typical curtain-wall weep hole.

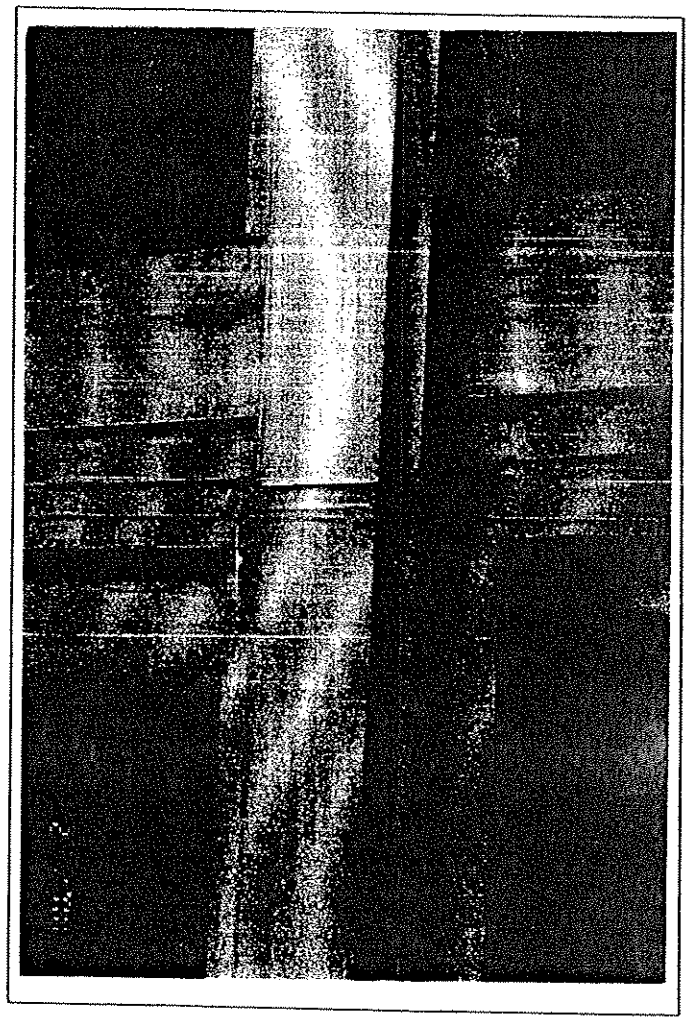


PHOTO 4:

Joint between vertical mullion caps.

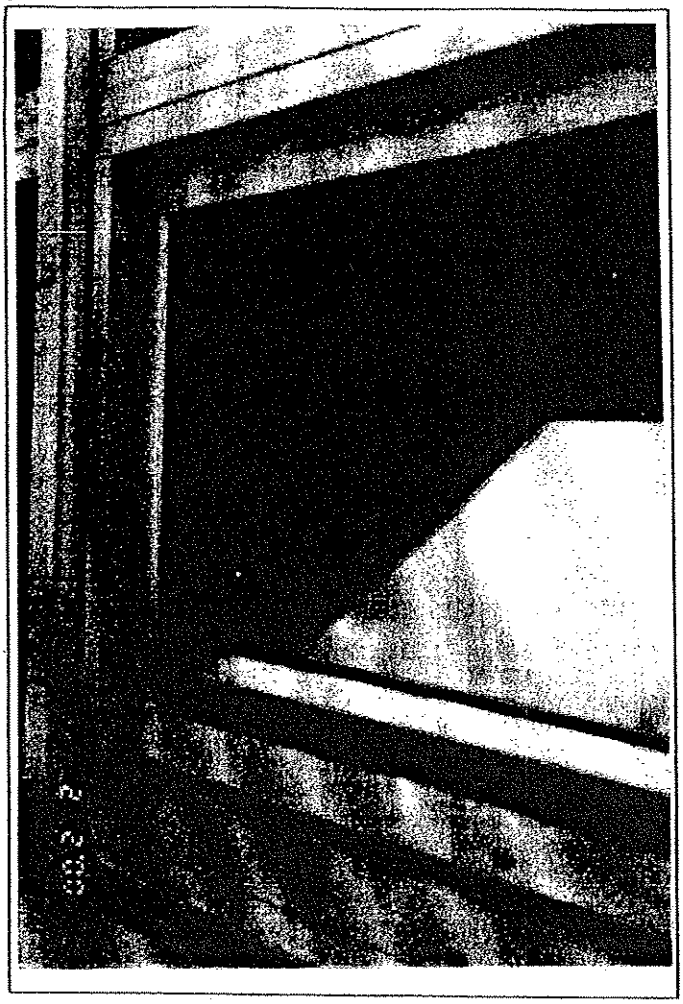
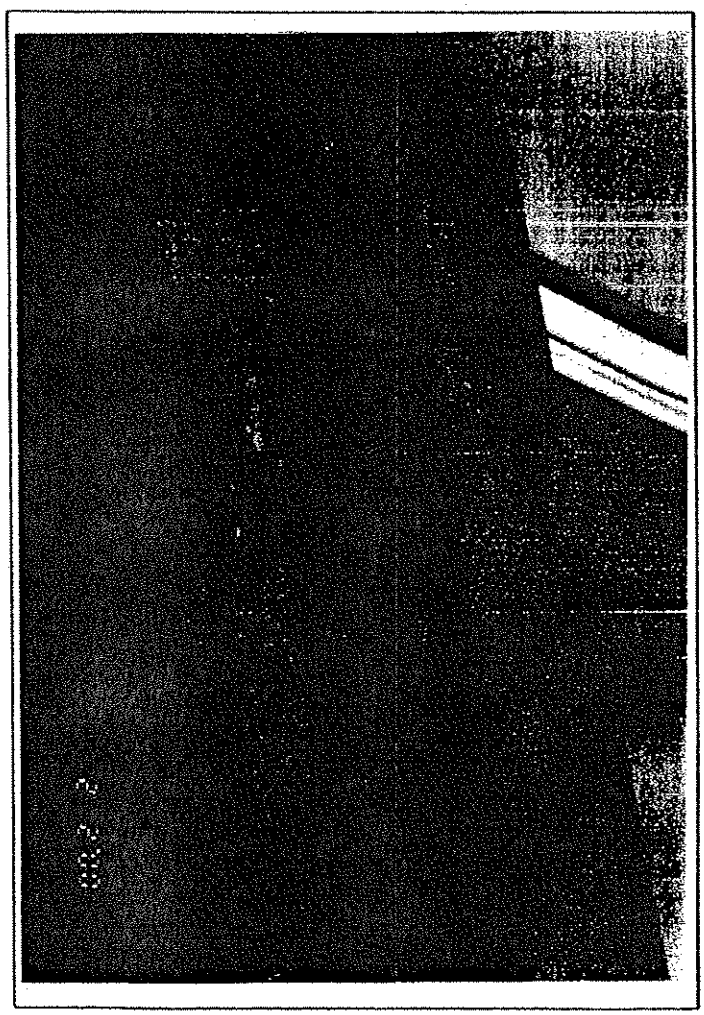


PHOTO 5:

Operable window sash.

PHOTO 6: Caulking on metal-clad column.



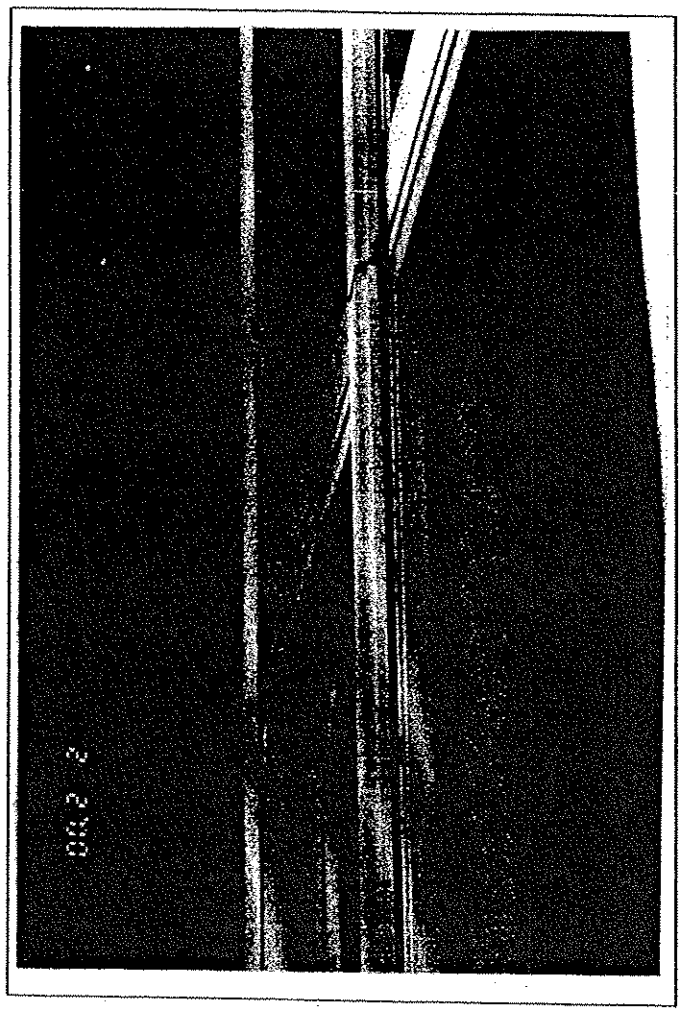


PHOTO 7:

Separation between vertical mullion cap and facade.

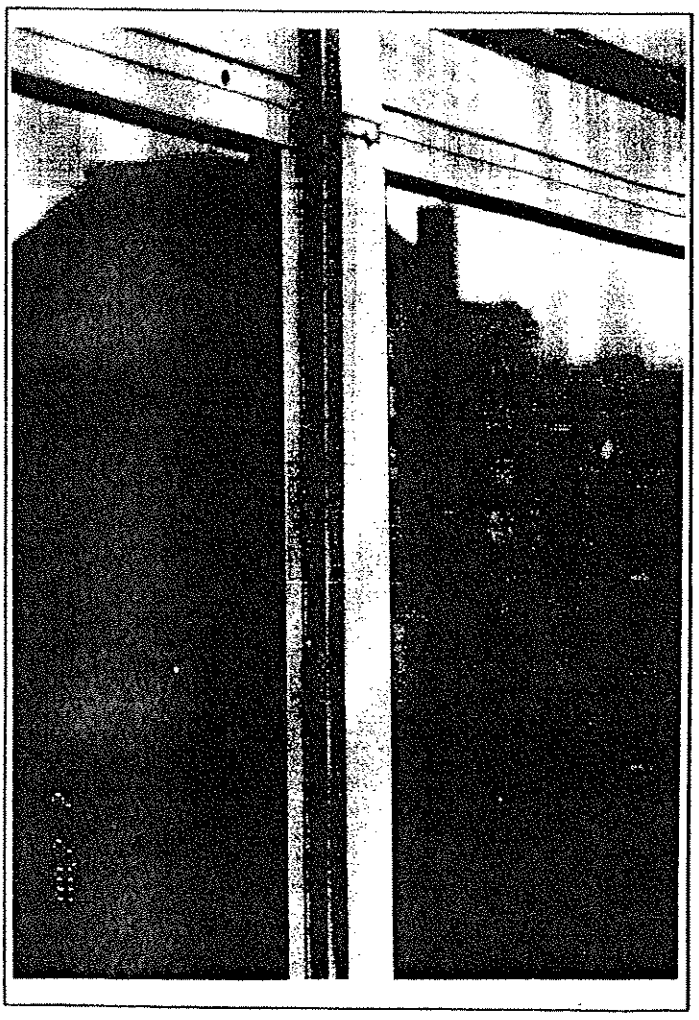


PHOTO 8: Remedial caulking on vertical mullion cap.

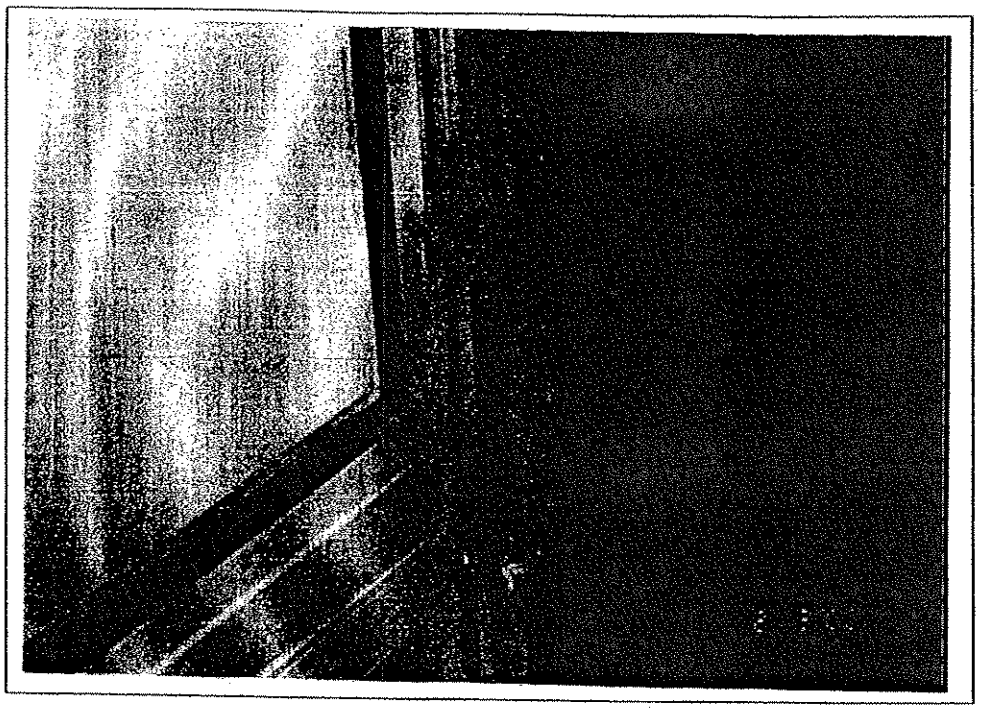


PHOTO 9: Remedial caulking on vertical mullion cap and metal-clad column.

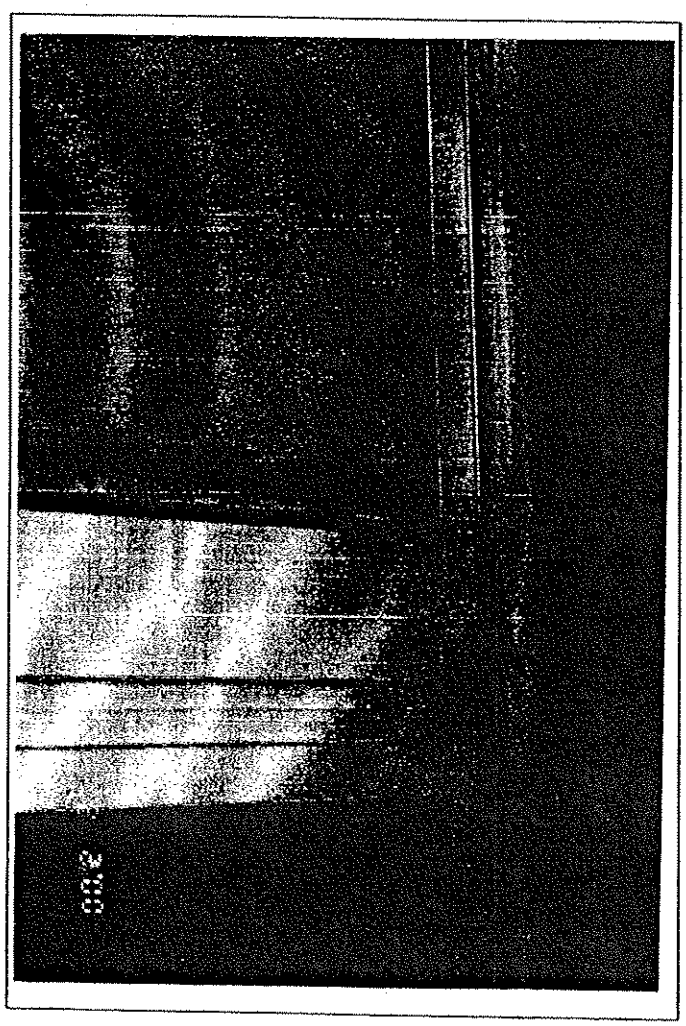


PHOTO 10:

Remedial caulking between vertical mullion caps.

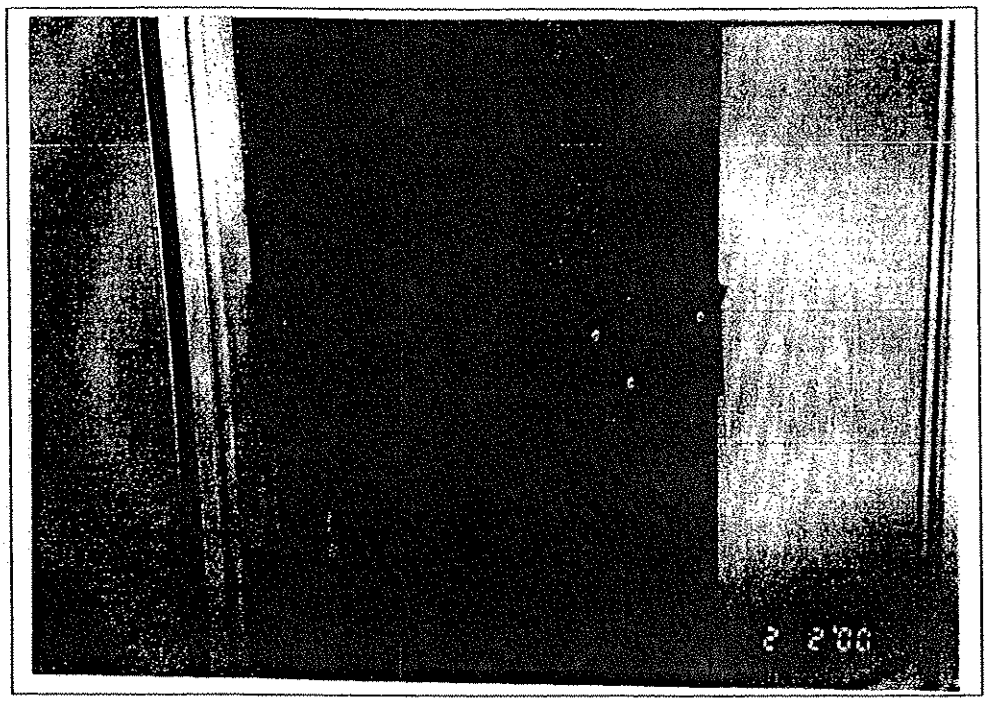


PHOTO 11: Gum-lip flashing on metal-clad column.

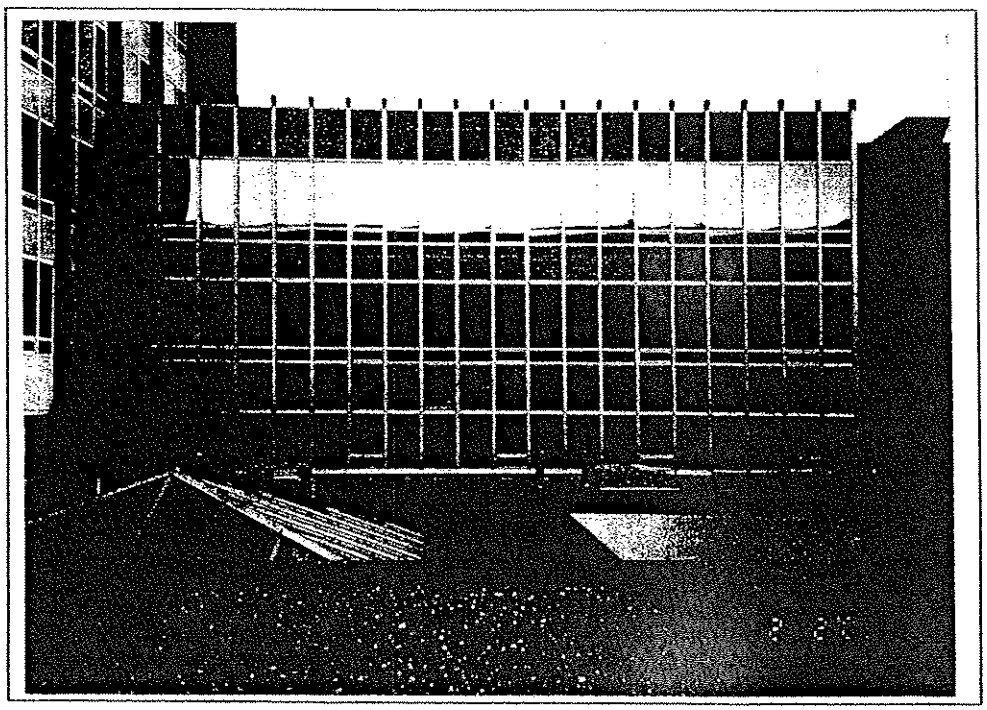


PHOTO 12: East facade of Annex.

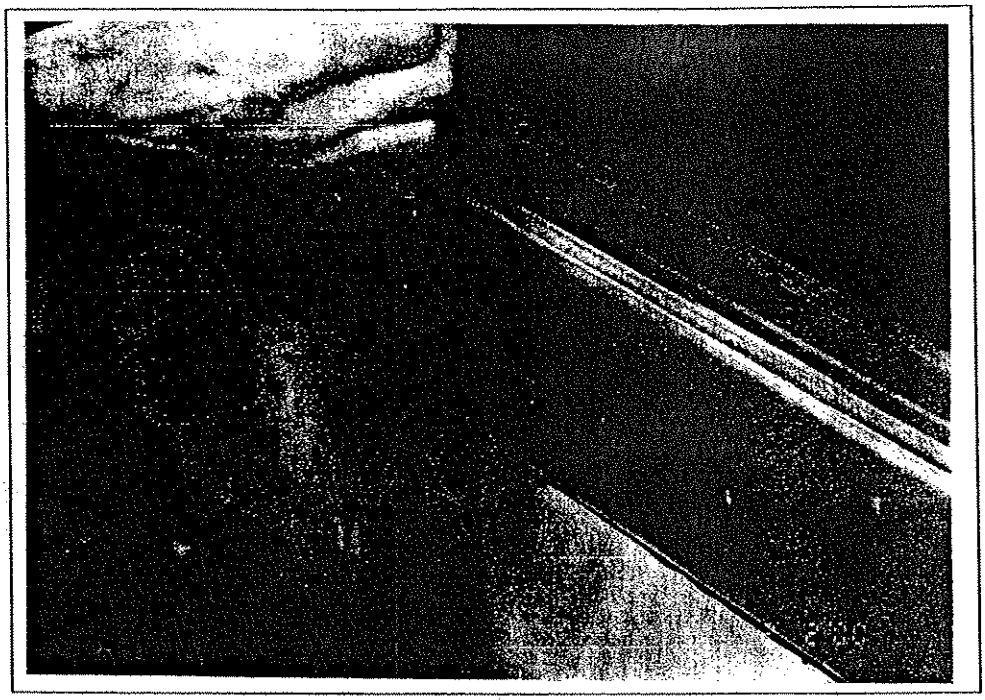


PHOTO 13: Water leaking from base of vertical mullion at Annex.

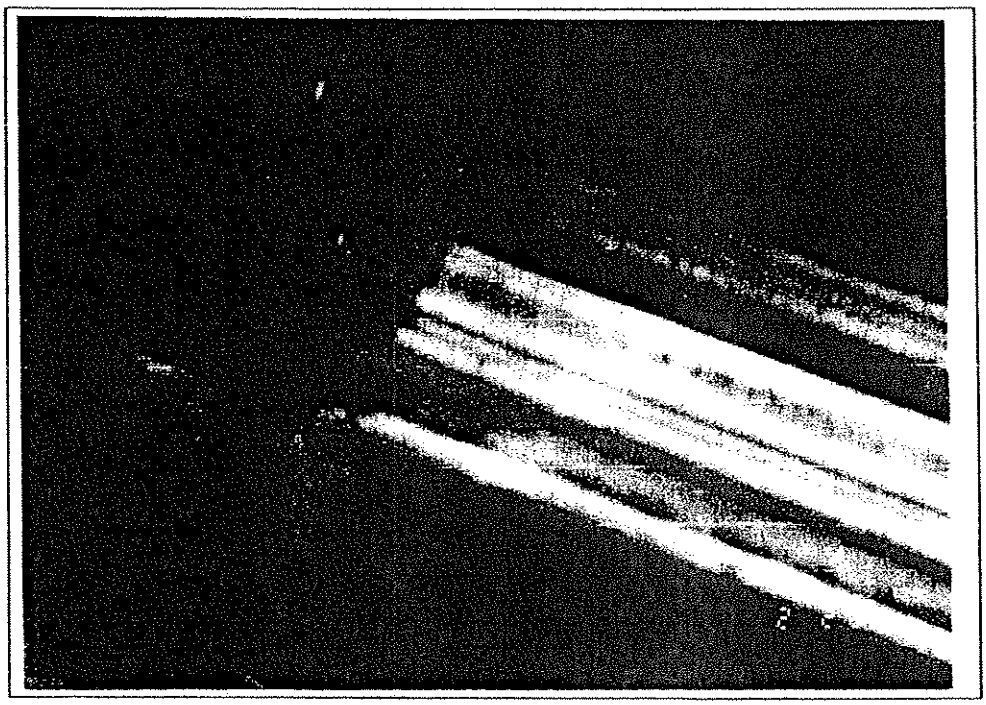


PHOTO 14: Corner of fixed window with glazing stops removed, at Annex.

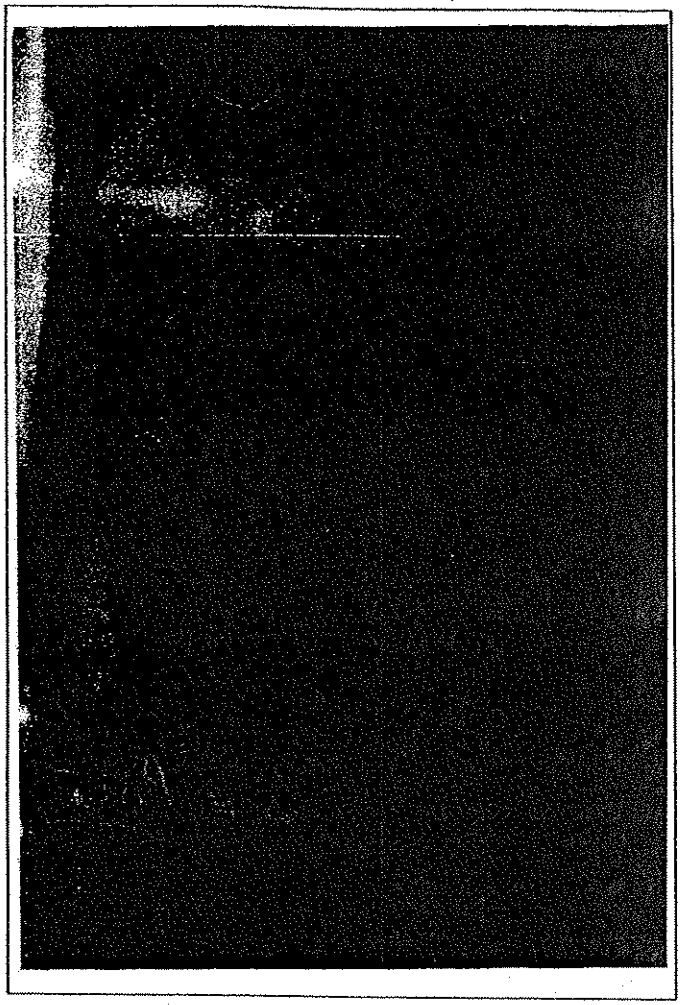


PHOTO 15: Lack of flashing on ventilation grille next to Annex at roof level.

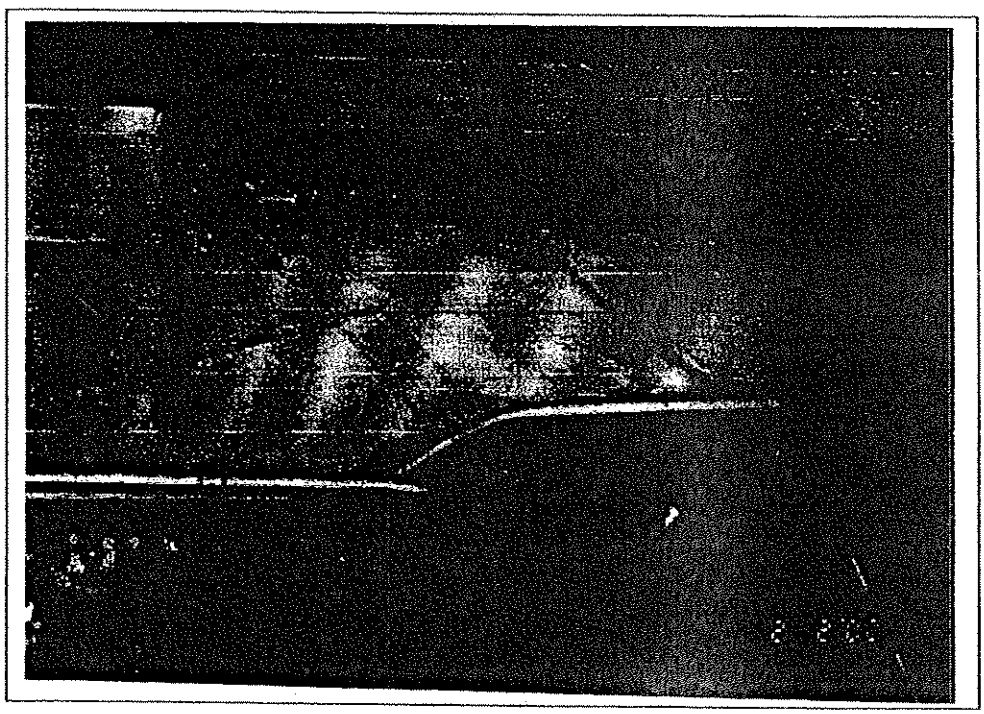


PHOTO 16: Poorly detailed flashing at edge of roof facing Annex.