APPENDICES

APPENDIX A – BC BUILDING SCIENCE EXTERIOR TEST AREA OBSERVATIONS

- Lists the number, location, and observations from the exterior building envelope cut tests conducted by Appleton Contracting Ltd. The observations indicate the envelope component removed and findings therein.

APPENDIX B – BAILEY METAL PRODUCTS STEEL STUD DETAILING BULLETIN

- Shows detail options from steel stud manufacturer for required deflection track with steel stud / light steel framing.

APPENDIX C – PHOTOGRAPHS

- Displays photographs taken during the course of the on-site investigation. All photographs include a number and a brief description.

APPENDIX D – REVIEW ANALYSIS OF RDH REPORT

- Copy of previous analysis review of RDH report prepared by BC Building Science & Engineering Ltd..

APPENDIX E – BUILDING ENVELOPE DEFINITIONS

- Identifies building envelope terms and definitions.

APPENDIX F – APPLETON CONTRACTING LTD. BUDGET PROPOSAL

- Budget proposals from Appleton Contracting Ltd..

APPENDIX A – BC BUILDING SCIENCE EXTERIOR TEST AREA OBSERVATIONS

Observations from the building envelope cut tests made by Appleton Contracting Ltd. are as follows:
* Please note there is no Test Opening #12.

#	Location	Observation	Corrosion:
A1	▪ West Wall, North end. ▪ Approximate 16LFx10LF area. ▪ Northwest corner, Unit 203 encompassing the West wall of the dining and living rooms.	▪ North facing window installed upside down and new weeps drilled at bottom track. ▪ Exterior gypsum sheathing stained at most locations, more noticeable at bottom corners of windows. Gypsum saturated and crumbling above windows. ▪ Sheathing paper reverse laps up onto bottom flange of windows. ▪ Corrosion evident at bottom corners of windows. ▪ Extensive corrosion evident at tops of windows and seems to worsen at higher areas. ▪ No allowance for deflection of steel stud framing at bottom side of 3rd floor concrete slab.	✓
A2	▪ Middle of West wall outside kitchen of Unit 203. ▪ In middle of wall field area, not adjacent to any interfaces or windows	▪ Gypsum stained and soft throughout opening. ▪ Steel studs partially corroded throughout opening.	✓
A3	▪ South end of West wall, at angled wall outside bedroom of Unit 203.	▪ Gypsum sheathing stained and deteriorated. ▪ Steel studs partially corroded, mostly concentrated at corner.	✓
A4	▪ South end of West wall at balcony of Unit 204	▪ Gypsum stained and saturated but not deteriorated. ▪ Steel studs partially corroded, mostly concentrated at balcony parapet where cap flashing not installed and at saddle interfaces.	✓
A5	▪ South wall, West end, adjacent to concrete column build-out, outside kitchen of Unit 204.	▪ Gypsum sheathing deteriorated and crumbled apart at most locations once stucco removed. ▪ Steel studs and steel furring at concrete column extensively corroded to the point that some screws could be pulled out by hand. ▪ Ant nest at 2 floors above grade.	✓
A6	▪ South wall directly above awning at South entry and below South facing bedroom window of 204	▪ Gypsum generally dry and in satisfactory condition. ▪ Steel studs in good condition with no corrosion noted, except for some minor spot rusting at screw head locations.	
A7	▪ Southeast corner outside kitchen of Unit 201.	▪ Gypsum sheathing badly saturated and deteriorated at most area of the opening. ▪ 1" horizontal overlap on sheathing paper recorded. ▪ Steel studs corroded throughout opening. Corrosion worse at outside corner away from window.	✓
A8	▪ South end of East wall at balcony of Unit 201	▪ Gypsum stained and soft at front edge, but fairly stable under areas with cap flashing. ▪ Extensive corrosion of steel studs at front edge of balcony. ▪ Corrosion noted at both inside and outside face of steel studs. ▪ Steel studs and plates only partially corroded at areas below metal cap flashing.	✓

A9	▪ Middle of East wall at ground level outside bedroom of Unit 101.	▪ Gypsum sheathing deteriorated and crumbled apart once stucco removed. ▪ Steel studs and plates extensively corroded. ▪ Landscaping / grade even with interior space, no concrete curb provided. ▪ Waterproof membrane sealed to bottomside of stucco and was easily punctured and torn away from wall structure. ▪ Bottom plate completely corroded where waterproof membrane has failed.	✓
A10	▪ East Wall, North end. ▪ Northeast corner, Unit 202 encompassing the East wall of the dining and living rooms. ▪ Similar test area to West wall.	▪ Sheathing paper partially bonded to stucco. ▪ Exterior gypsum sheathing stained and saturated throughout opening and crumbled apart at many areas once stucco removed. ▪ Fairly extensive corrosion of steel framing evident both below and above windows as well in field area of walls. Corrosion appears to worsen above windows.	✓
A11	▪ North Wall above entry. ▪ At West side, a fairly large area at both North wall and interface to East facing balcony parapet of 203.	▪ Below and around the North facing windows in the wall area, the gypsum appears in satisfactory condition. ▪ Corrosion at the exterior (heated) wall areas limited with only some spot corrosion at fastener locations noted. The corrosion does appear to be worse at the 3rd floor than the 2nd floor. ▪ Horizontal stucco control joint completely corroded through. ▪ Corrosion worsens around balcony interface and is extensively corroded at East facing column wall and balcony parapet. ▪ No allowance for deflection of steel stud framing at bottom side of 3rd floor concrete slab.	✓
A13	▪ Small opening at middle of South wall, ground level beside South exit door.	▪ Gypsum sheathing deteriorated and crumbled apart once stucco removed. ▪ Steel studs and plates extensively corroded. Bottom plate disintegrated to approximately ½" of width. ▪ Landscaping / grade even with interior space, no concrete curb provided. ▪ Waterproof membrane sealed to bottomside of stucco and was easily punctured and torn away from wall structure.	✓
A14	▪ Below 2nd level window to East side of South exit awning outside bedroom window. (directly above TA #13)	▪ Steel studs below window extensively corroded as well as out in field of stucco (approx 1.5' away from stucco).	✓
A15	▪ North Wall above entry. ▪ At East side, a series of small openings below and above North facing windows in exterior (heated) wall and at West facing balcony parapet of 202.	▪ Below and around the North facing windows in the wall area, the gypsum appears in stable condition. ▪ No corrosion at the exterior (heated) wall areas noted. ▪ Some corrosion noted at opening in West facing balcony parapet, however not to the same extent as other balcony openings.	✓
A16	▪ Roof Level: East wall, North end at roof parapet to exterior wall saddle interface outside 1002.	▪ Gypsum saturated and crumbly when stucco removed. ▪ Sheathing paper bonded to stucco. ▪ Studs in exterior wall badly corroded. ▪ Roof parapet fabricated of steel studs and gypsum with stucco finish on both sides. ▪ Steel framing in parapet also corroded.	✓

A17	▪ Roof Level: West end of East wall, above door to deck of Unit 1001. ▪ Test opening located at concrete shear wall.	▪ Wood framed door badly deteriorated. ▪ No corrosion of metal furring noted.	
A18	▪ Roof Level: Middle of East wall, directly beside roof access door.	▪ Gypsum sheathing totally saturated. ▪ Extensive corrosion of the steel studs noted.	✓
A19	▪ Roof Level: West wall beside deck door to Unit 1003 at curved stair wall.	▪ Gypsum has a few minor moisture stains, but in generally stable condition. ▪ No signs of corrosion activity on steel framing.	
A20	▪ Roof Level: Middle of West wall, directly beside roof access door.	▪ Gypsum in good condition. ▪ No corrosion activity evident on steel framing.	
A21	▪ Roof Level: West wall, North end at roof parapet to exterior wall saddle interface at West roof deck of Unit 1002.	▪ Gypsum stained and slightly soft. ▪ Studs in exterior parapet wall fairly corroded. ▪ Opening located at concrete column / shear wall. No steel furring evident at wall location. ▪ Steel framing at front (North facing wall) badly corroded.	✓
A22	▪ Roof Level: Middle of West wall, at saddle interface to roof deck parapet of 1001 beside roof access door.	▪ Saddle flashing caulked to stucco cladding. No upturn visible on metal cap flashing. ▪ Steel studs fairly corroded, appears to worsen above saddle interface connection. ▪ Gypsum on inside face of roof deck parapet stained and soft.	✓

APPENDIX B – BAILEY METAL PRODUCTS STEEL STUD DETAILING BULLETIN

BAILEY
BAILEY METAL PRODUCTS LIMITED
ONE CALDARI ROAD
CONCORD, ONTARIO L4K 3Z9
(416) 738-6738
FAX: (416) 738-6712
1-800-668-2154
TORONTO LINE: (416) 324-3230

LIGHTWEIGHT STEEL FRAMING ACCESSORIES

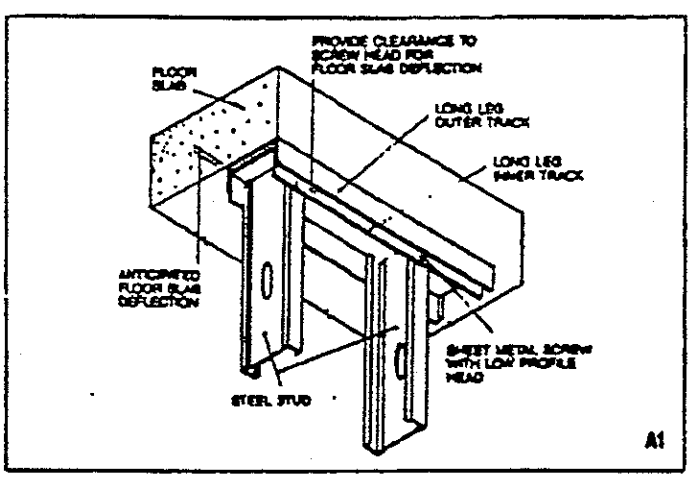
DEFLECTION TRACKS (DETAILS A1 - A4)

When using Bailey wind bearing steel studs, a deflection detail must be used. This detail allows for floor slab deflection and building frame shrinkage, without axially loading the stud themselves.

For infill applications, details A1 - A4 are appropriate. For applications where the studs bypass the floor slab, see details A8 & A9.

Another benefit realized through the use of deflection details is their ability to accommodate a certain amount of variance in floor to floor heights.

All these sections are available in 20 - 12 gauge (.036" - .105"), full galvanized G60 (Z180) steel and sized to fit 3-5/8", 4", 6" and 8" studs.

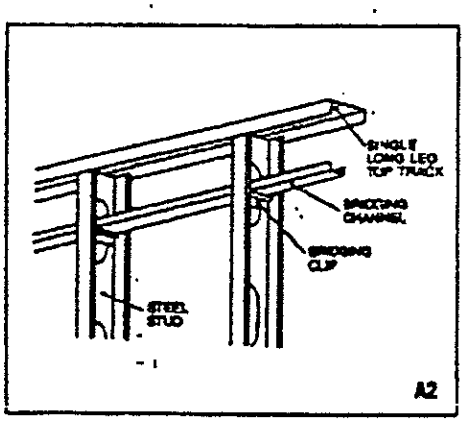


TELESCOPING TRACK

This detail has an inner and outer top track with the inner top track connected only to the studs and the outer top track connected only to the structure. Deflection gaps up to 1-1/2" can be engineered.

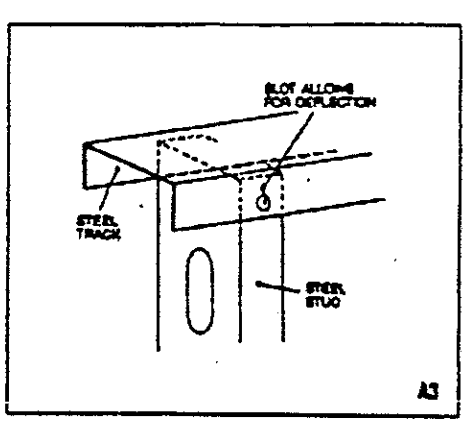
Because the inner top track provides perimeter support to wall sheathings, this detail is particularly suitable for accommodating an air barrier (such as the interior layer of drywall) when the air barrier is attached to the studs.

Specify the stud size, leg length and gauge for the inner and outer tracks when ordering. The tracks are available in 10'-0" lengths.



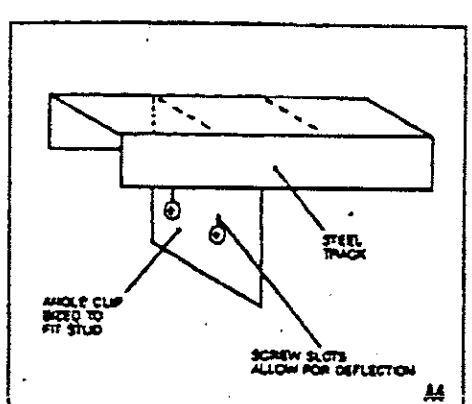
SINGLE TRACK WITH BRIDGING

Available in 10'-0" lengths. Specify stud size, leg length and gauge (thickness) for track when ordering. A top row of bridging is required with this detail; therefore, specify hole locations on studs if through the knock-out bridging is to be used.



SLOTTED LEG TRACK

Available in 10'-0" lengths. Specify stud size, leg length and gauge (thickness) for track when ordering. Indicate length of the 1/4" slot and position of the slot on the track leg along with 12", 16" or 24" spacing. The location of the studs are restricted to the position of the slots on the track. This system is best suited to walls with few openings.



SLOTTED ANGLE OR OTTAWA CLIP

This angle can be engineered to work with or without reliance on the top track and with or without a top row of bridging. At the time of ordering, supply a sketch showing all dimensions and gauges (thicknesses).

APPENDIX C - PHOTOGRAPHS

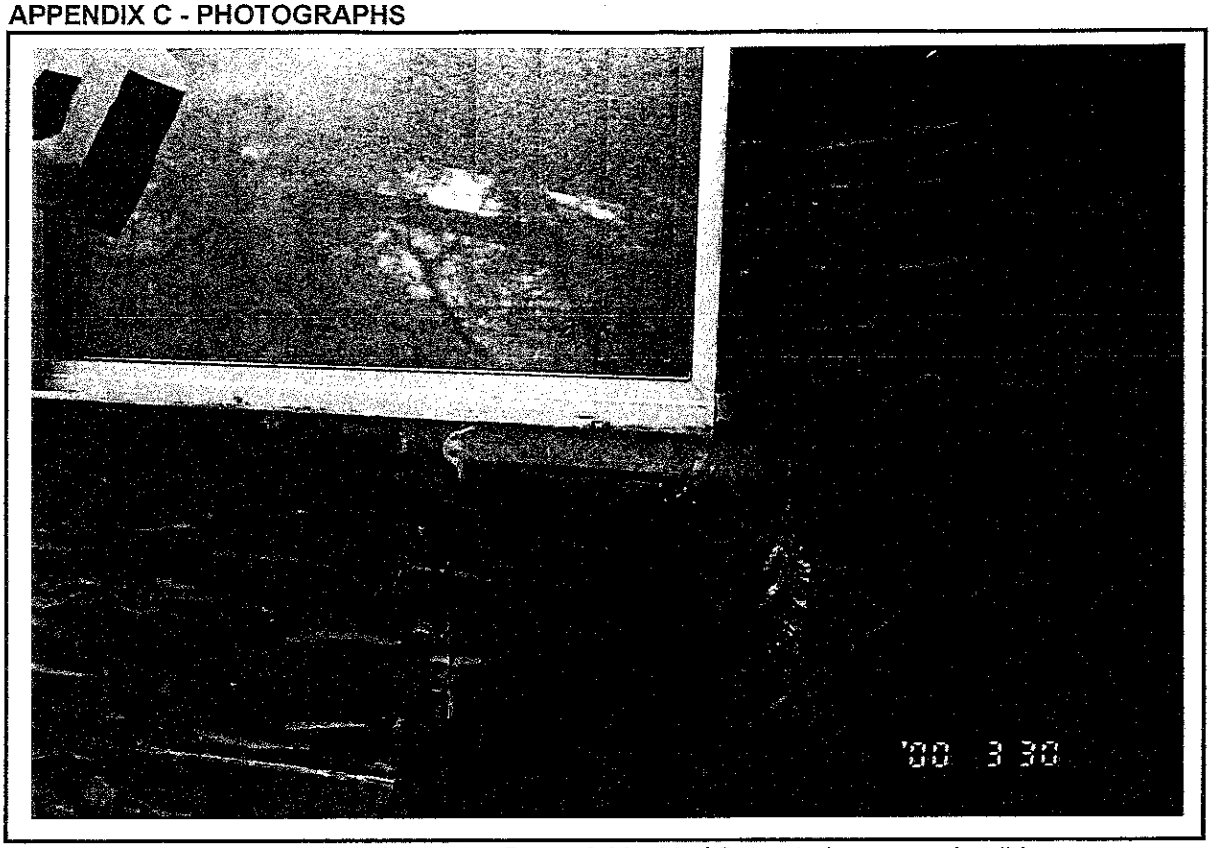


Photo #1 – Test Opening #1 – Sheathing Paper & Mouldy / Saturated gypsum sheathing

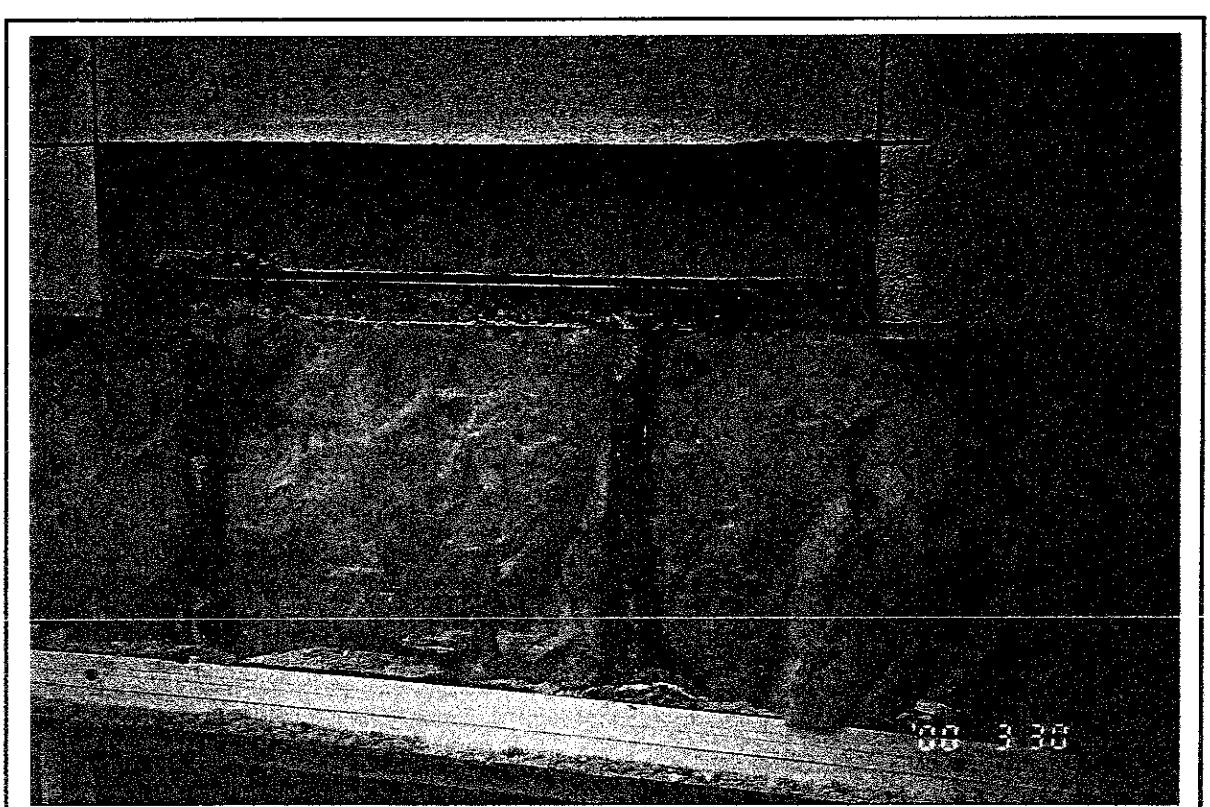


Photo #2 – Test Opening #1 – Corrosion of steel studs above West facing window

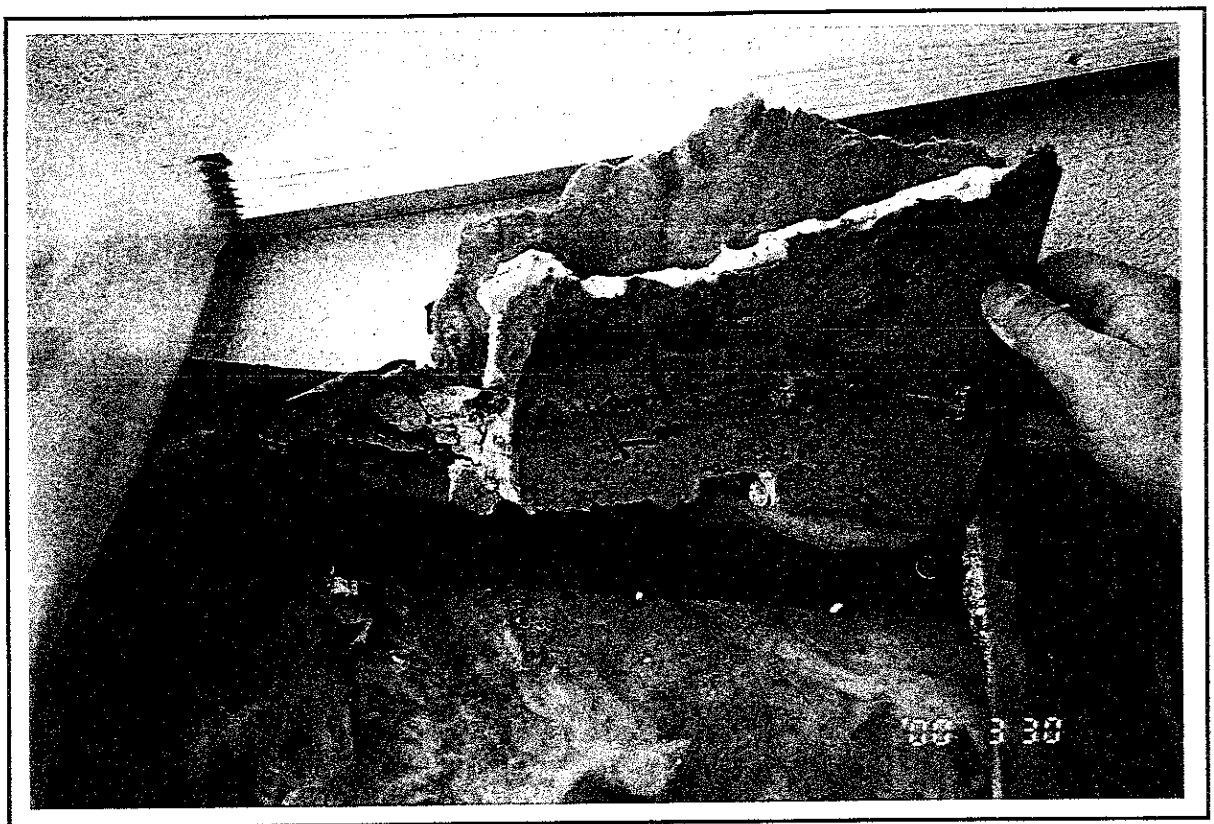


Photo #3 – Test Area #2 – Mouldy gypsum sheathing & corroded steel studs

Photo #4 – Test Area #3 – Corroded steel studs

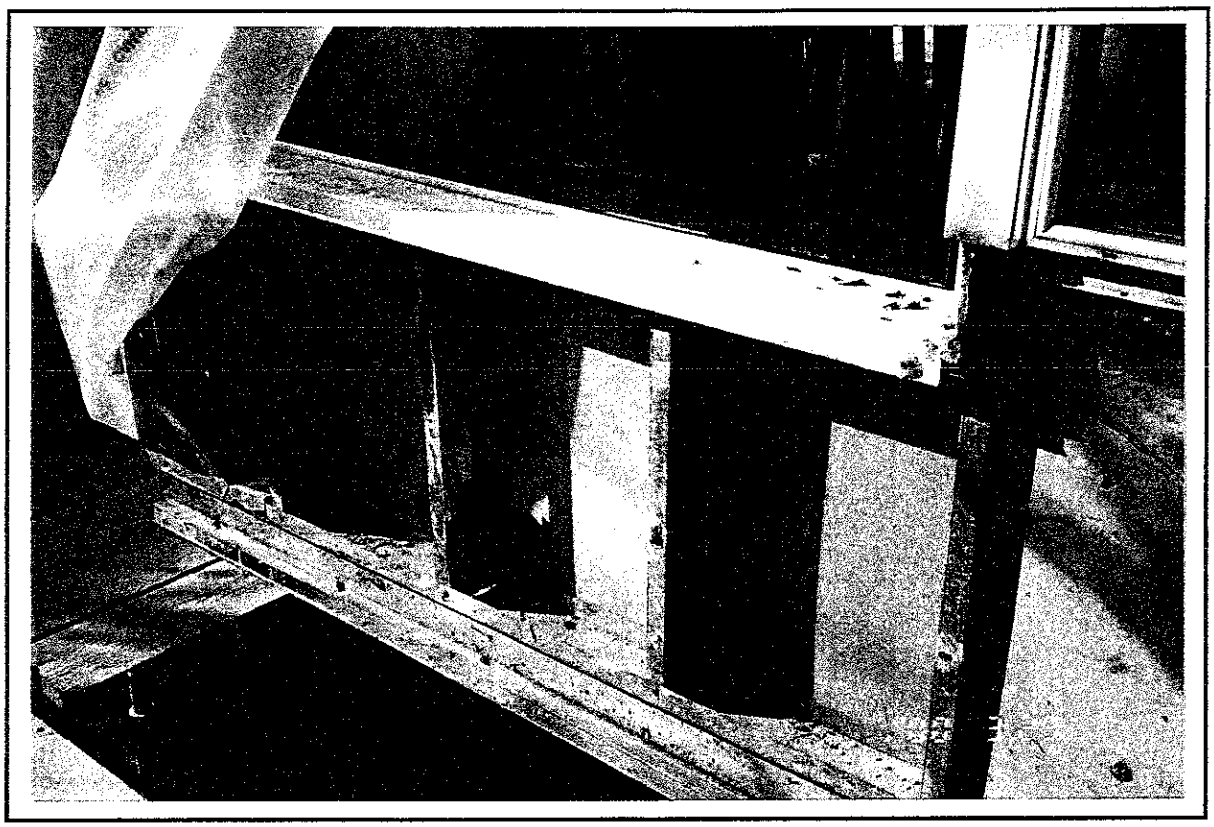


Photo #5 – Test Area #4 – Balcony of 204

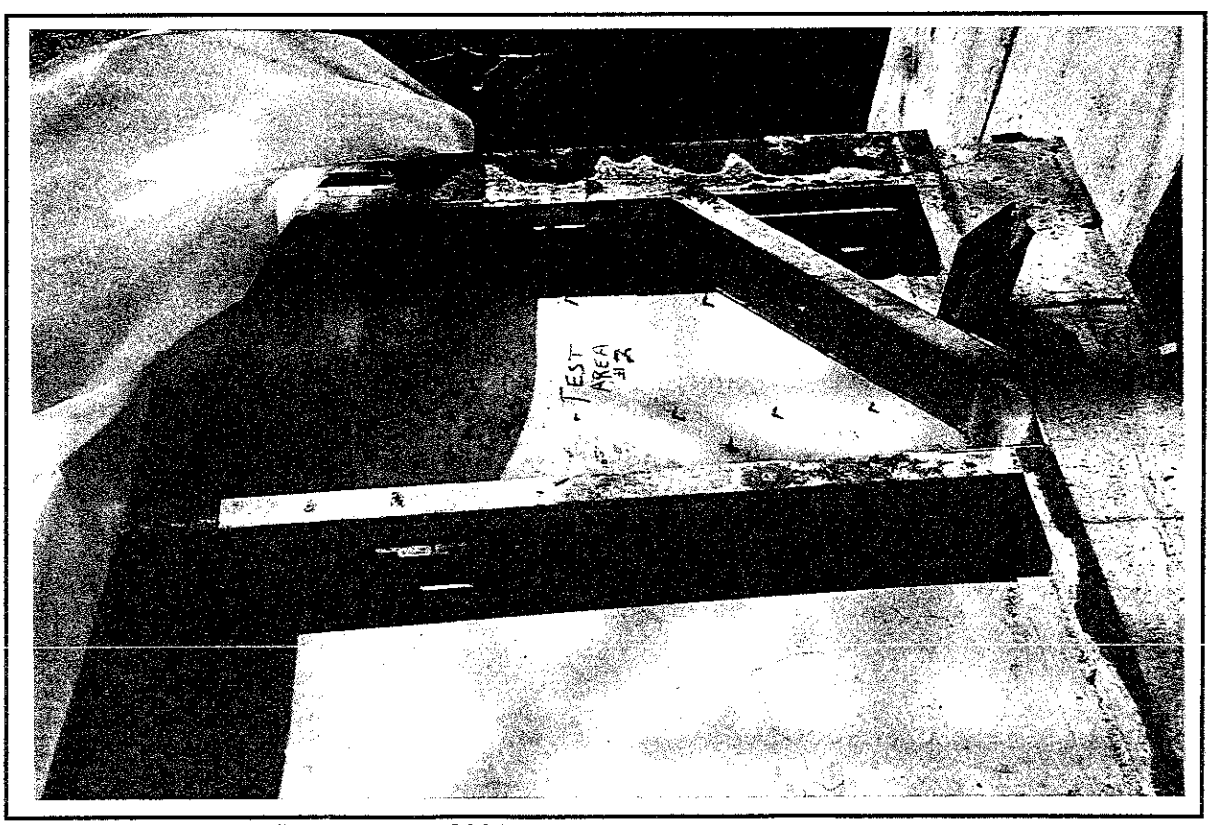


Photo #6 – Test Area #4 – Balcony of 204

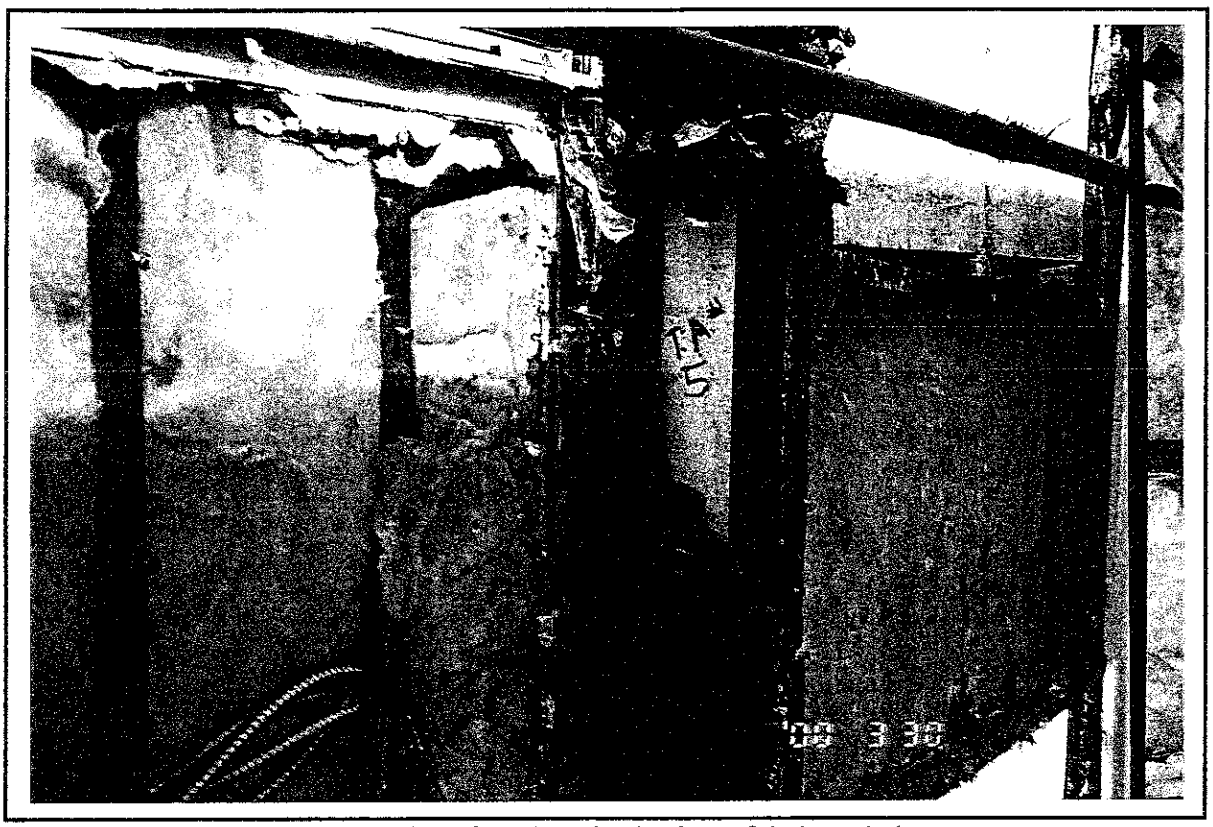


Photo #7 – Test Area #5 – Corrosion of steel studs at column & below window

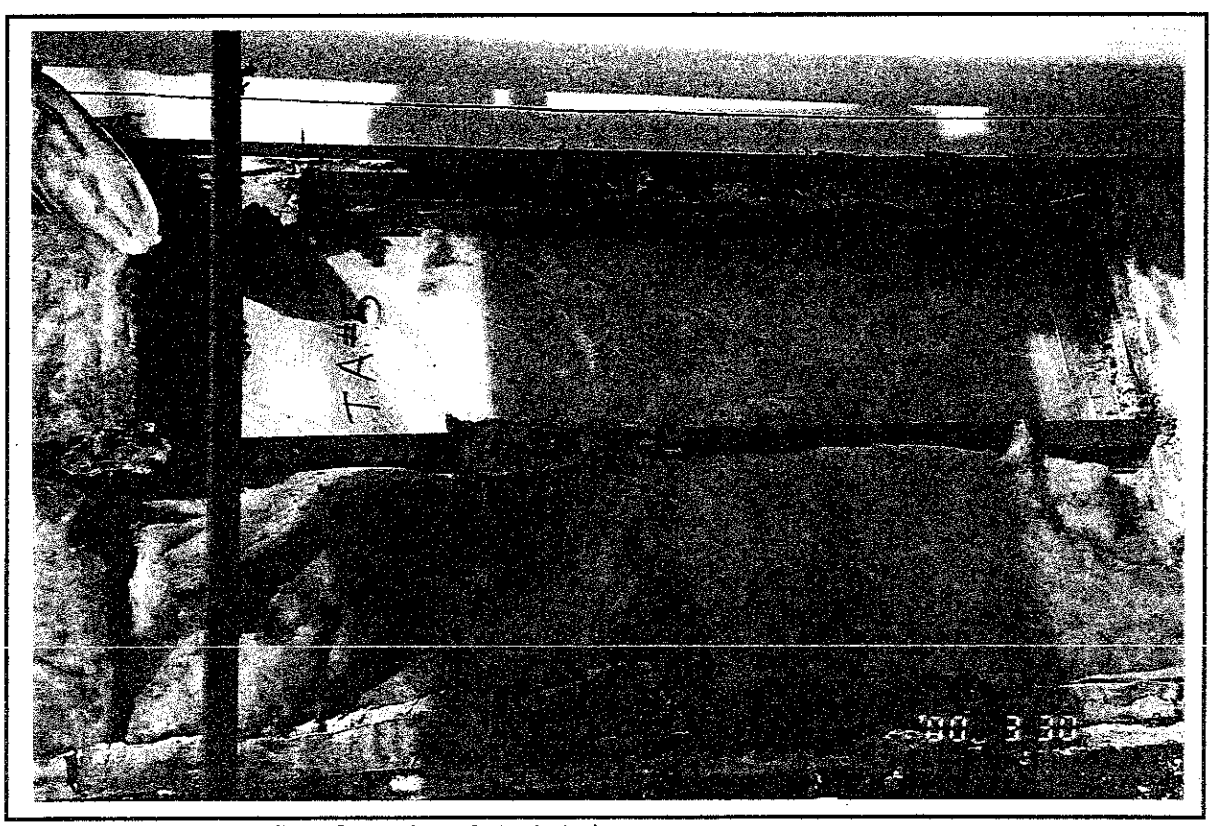


Photo #8 – Test Area #5 – Corrosion of steel studs

Photo #9 – Test Area #6 – steel studs in good condition

Photo # 10 – Test Area #7 – poor installation of sheathing paper

Photo #11 – Test Area #7 – Corroded steel studs

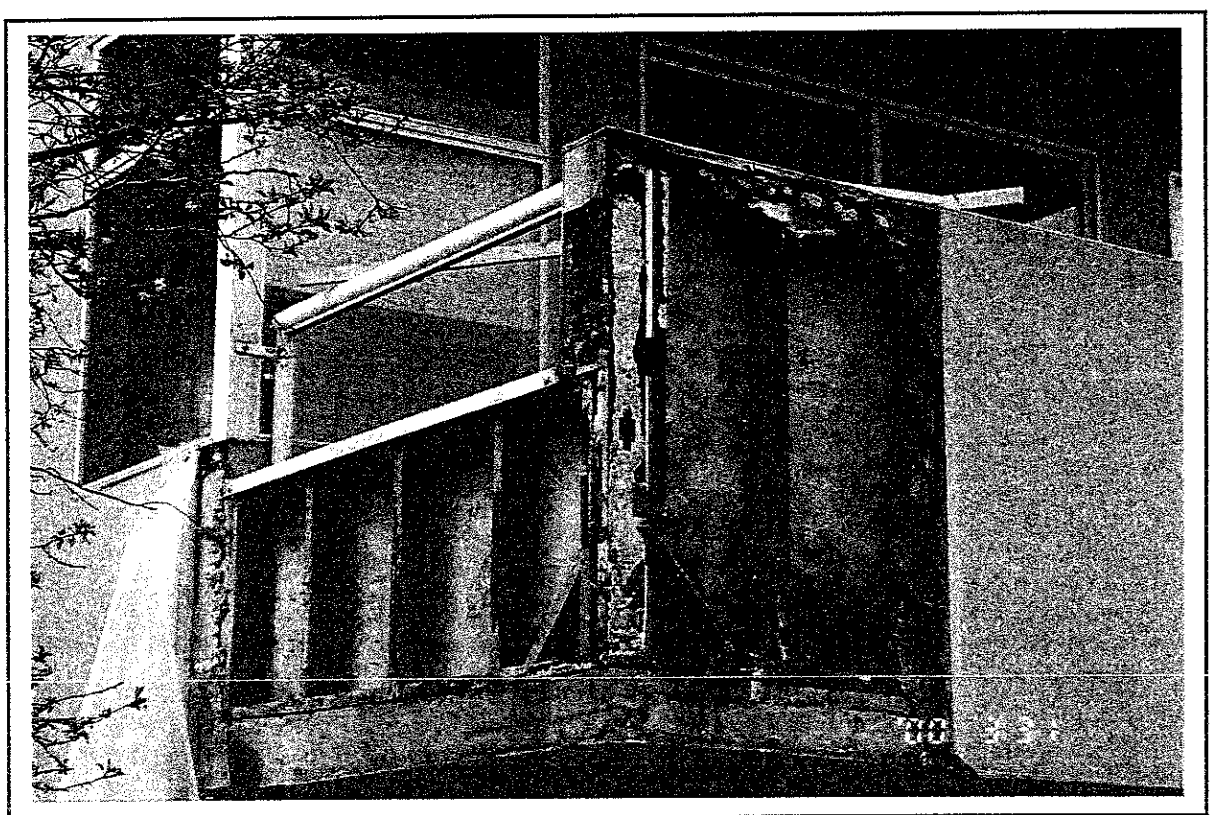


Photo #12 – Test Area #8 – Balcony of 201

Photo #13 – Test Area #8 – Close-up of corroded steel studs at balcony parapet

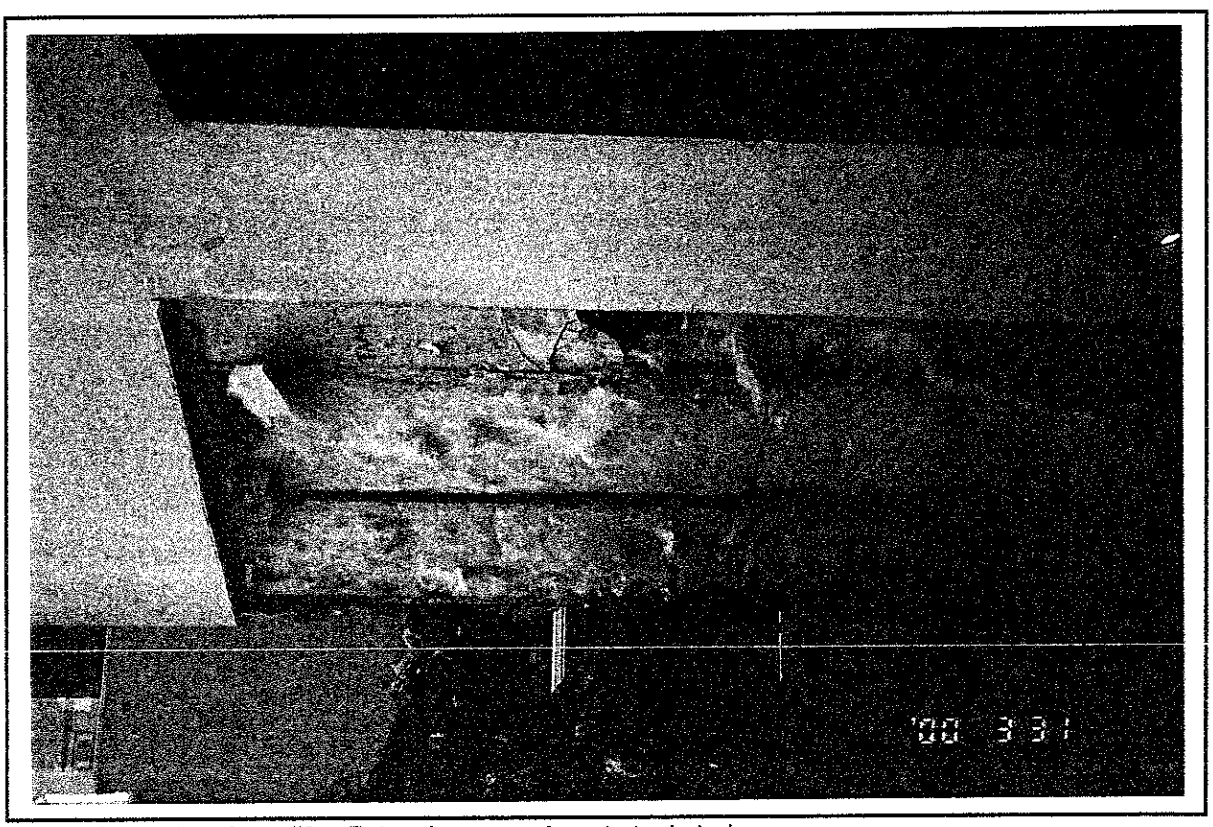


Photo #14 – Test Area #9 – Extensive corrosion at steel studs

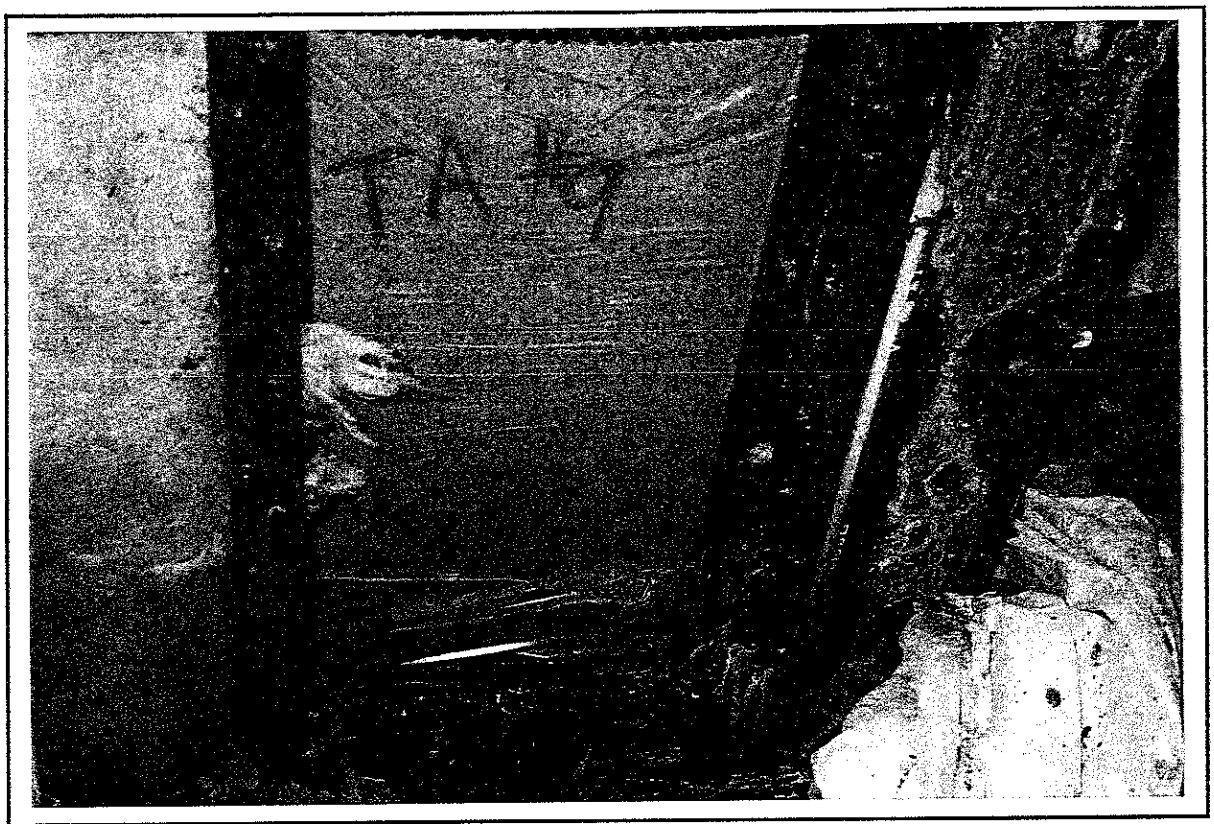


Photo #15 – Test Area #9 – Close-up of corroded steel studs and bottom plate

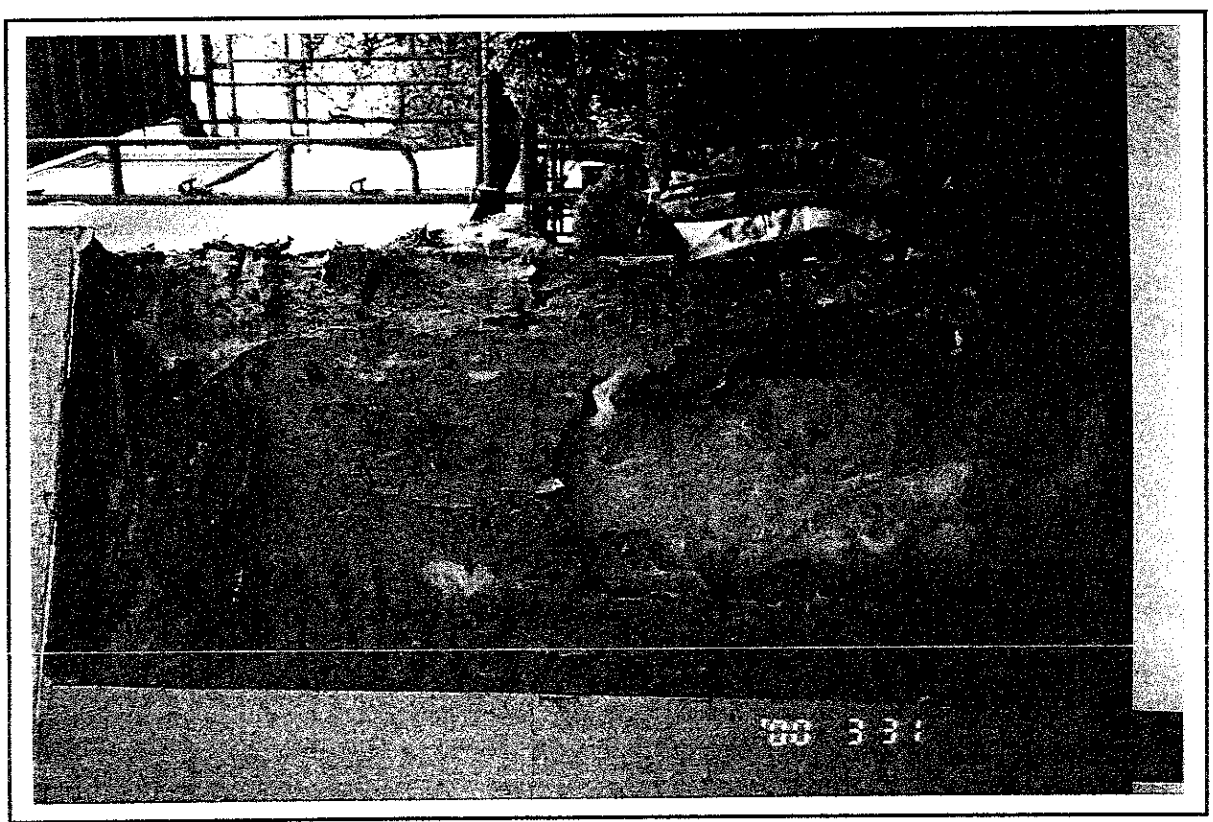


Photo #16 – Test Area #9 – Completely saturated and deteriorated gypsum sheathing

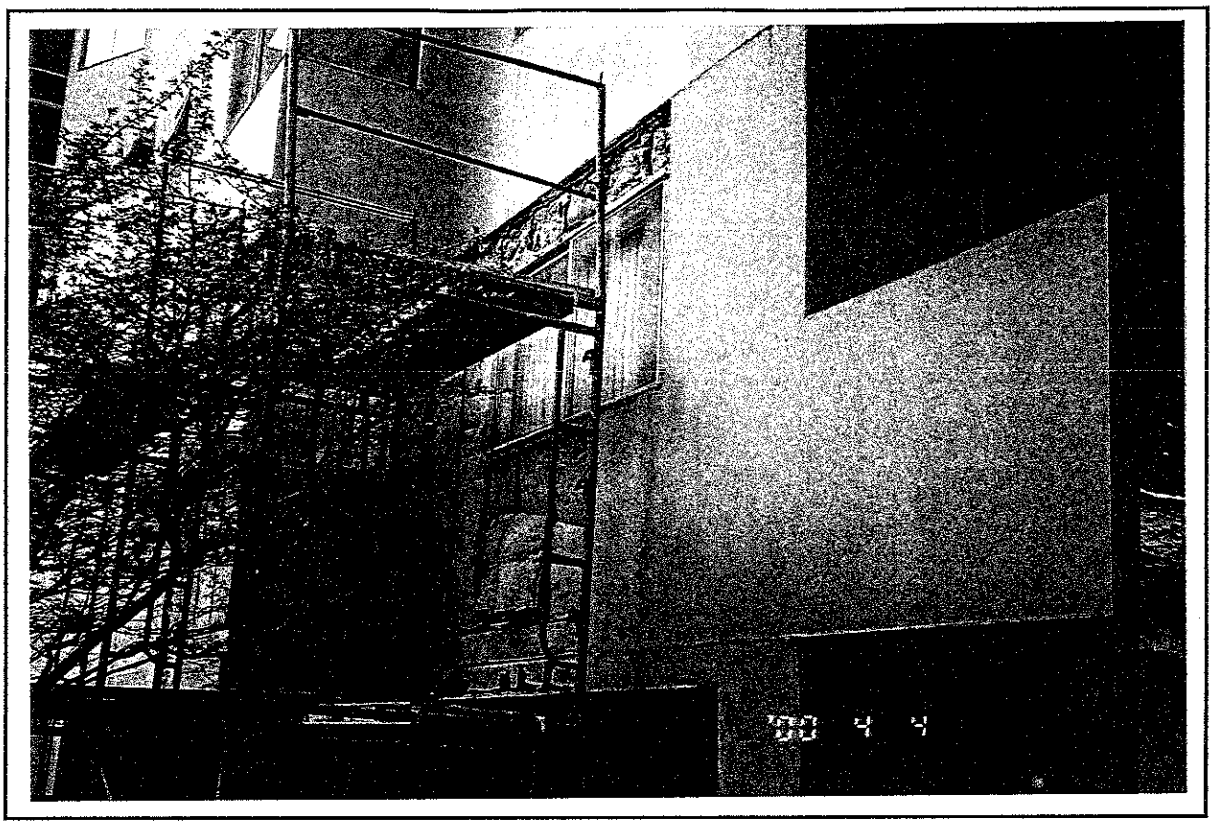


Photo #17 – Test Area #10 – Far-off view of test opening

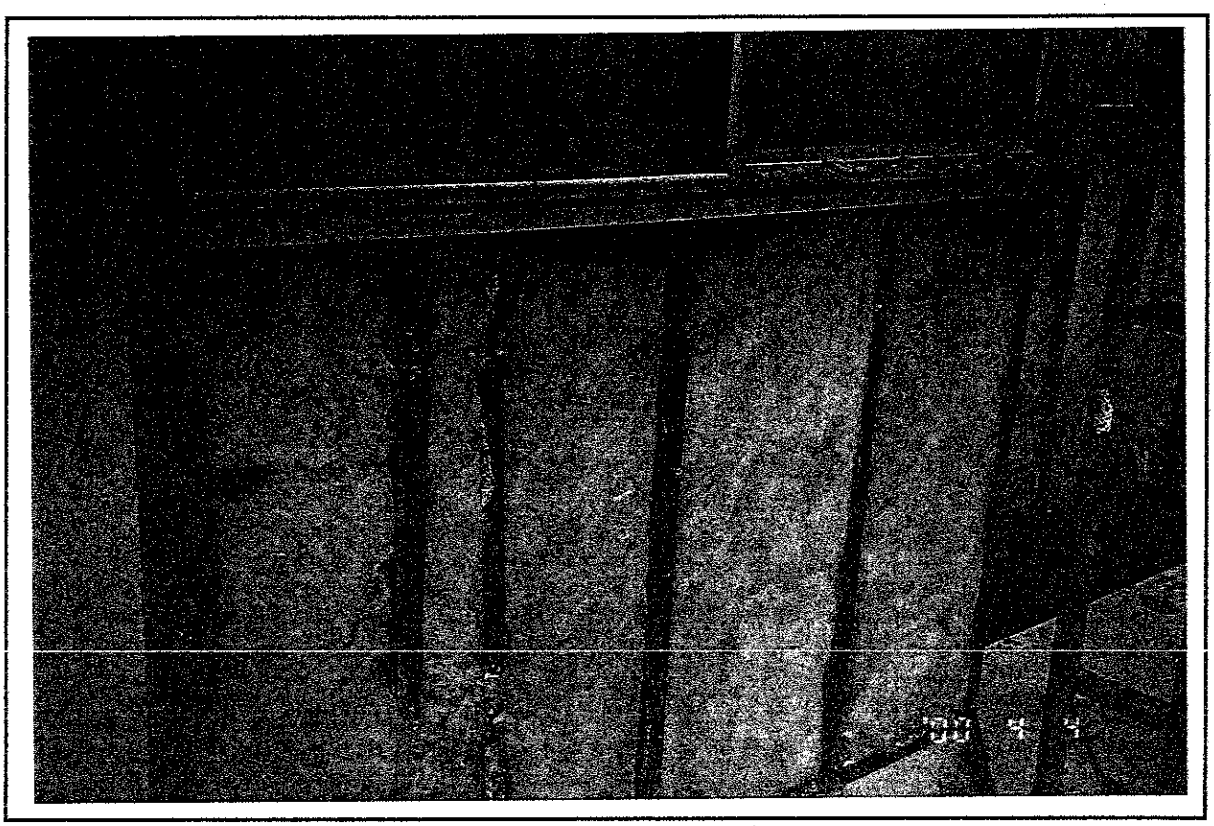


Photo #18 – Test Area #10 – Close-up of corrosion below windows

Photo #19 – Test Area #10 – Sheathing paper bonded to backside of stucco

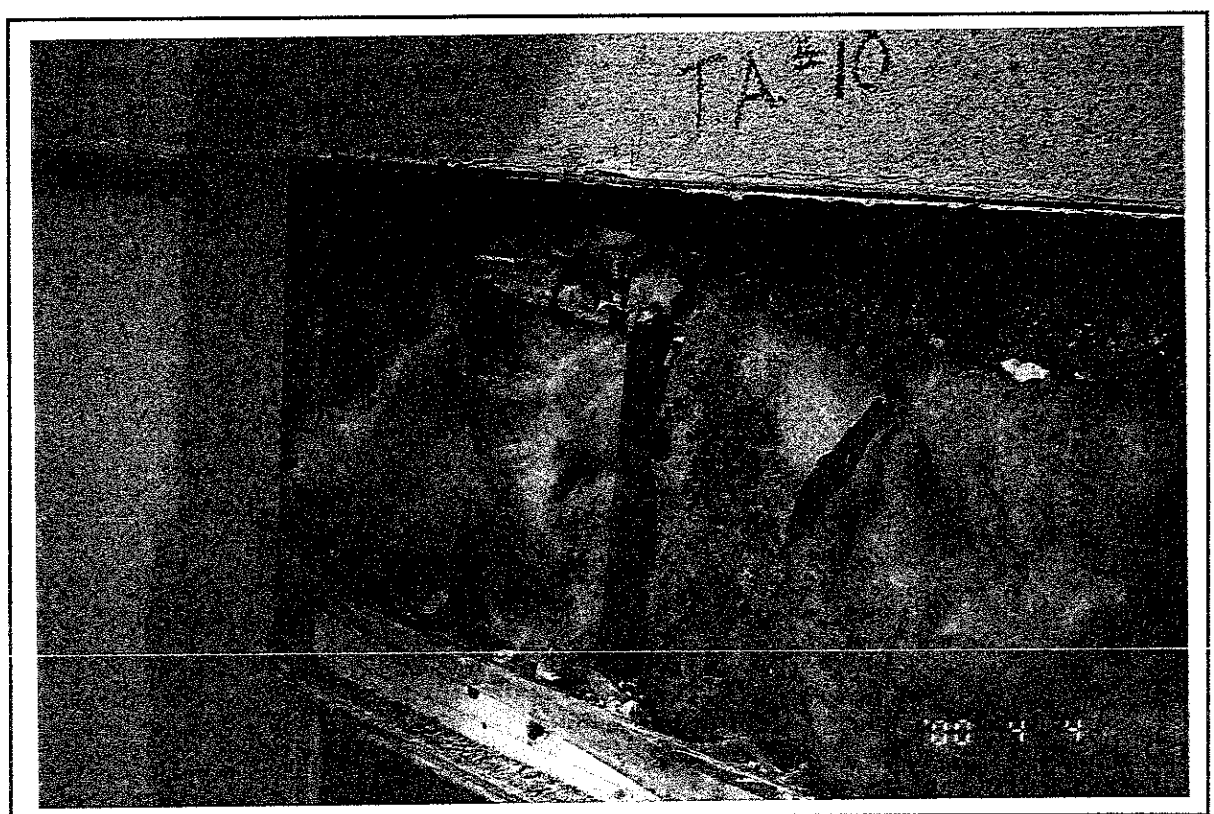


Photo #20 – Test Area #10 – Extensive corrosion above window

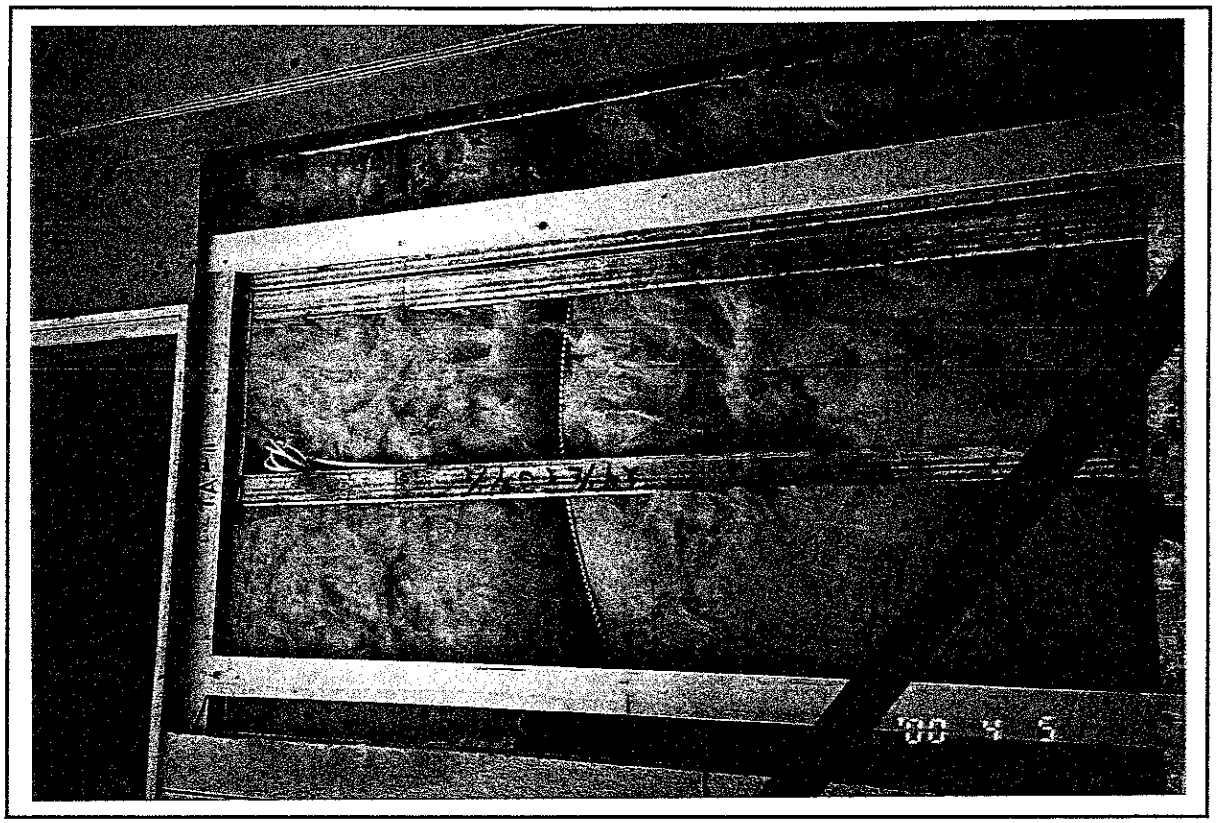


Photo #21 – Test Area #11 – Opening at North wall, West of entry

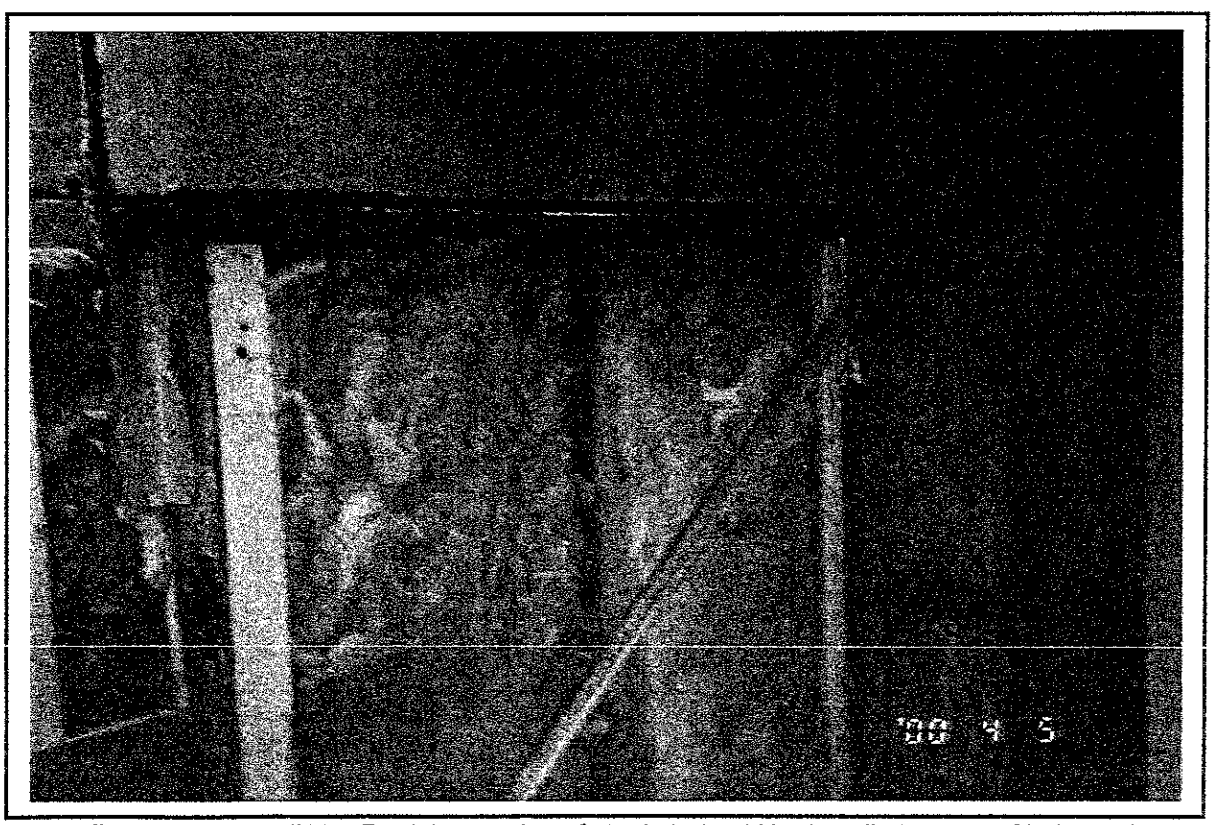


Photo #22 – Test Area #11 – Partial corrosion of steel studs at North wall at corner of balcony 203

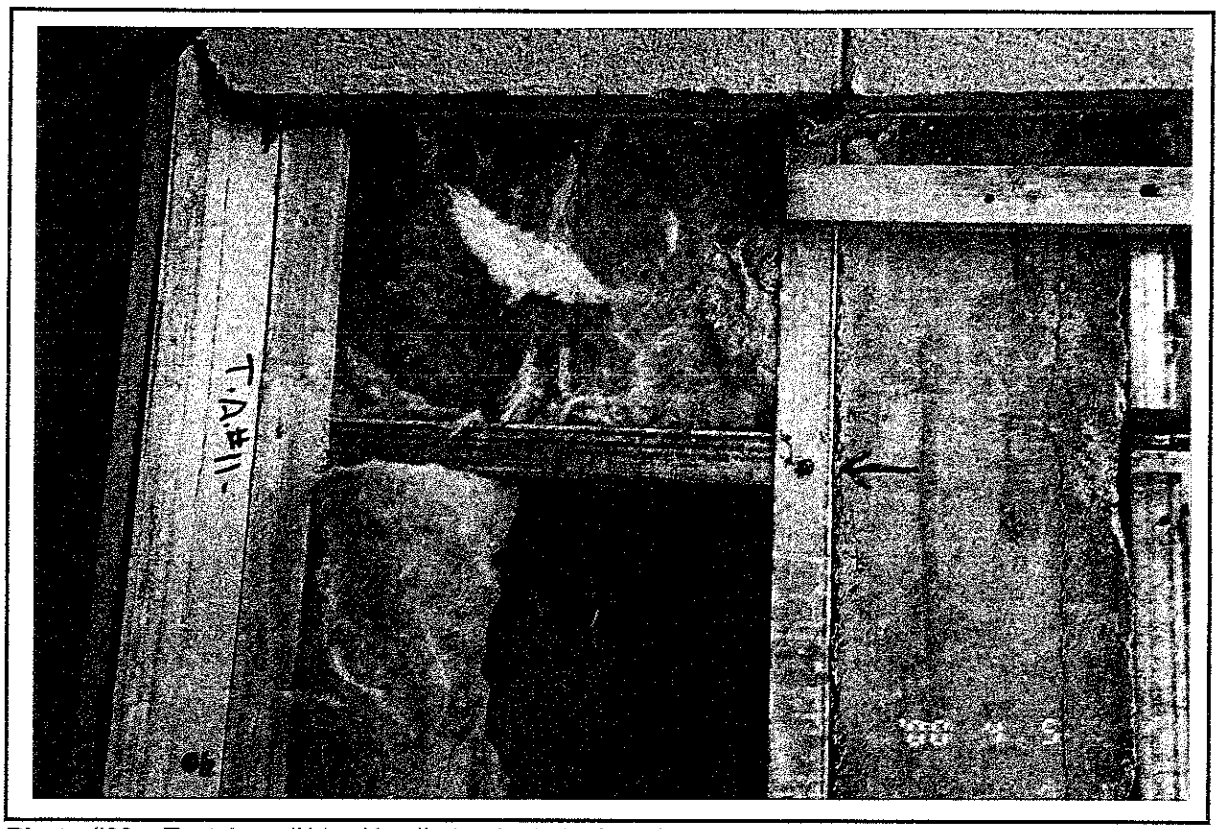


Photo #23 – Test Area #11 – No slip track at steel studs

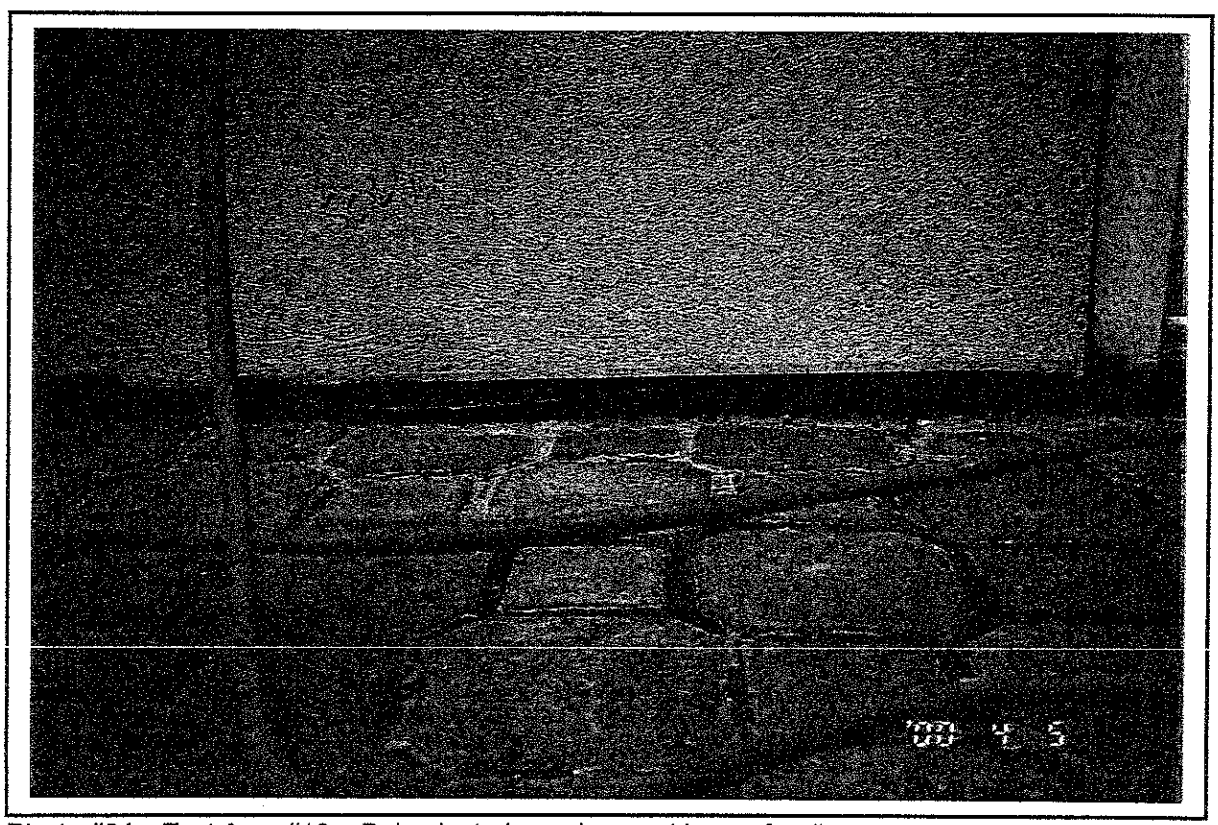


Photo #24 – Test Area #13 – Delaminated membrane at base of wall

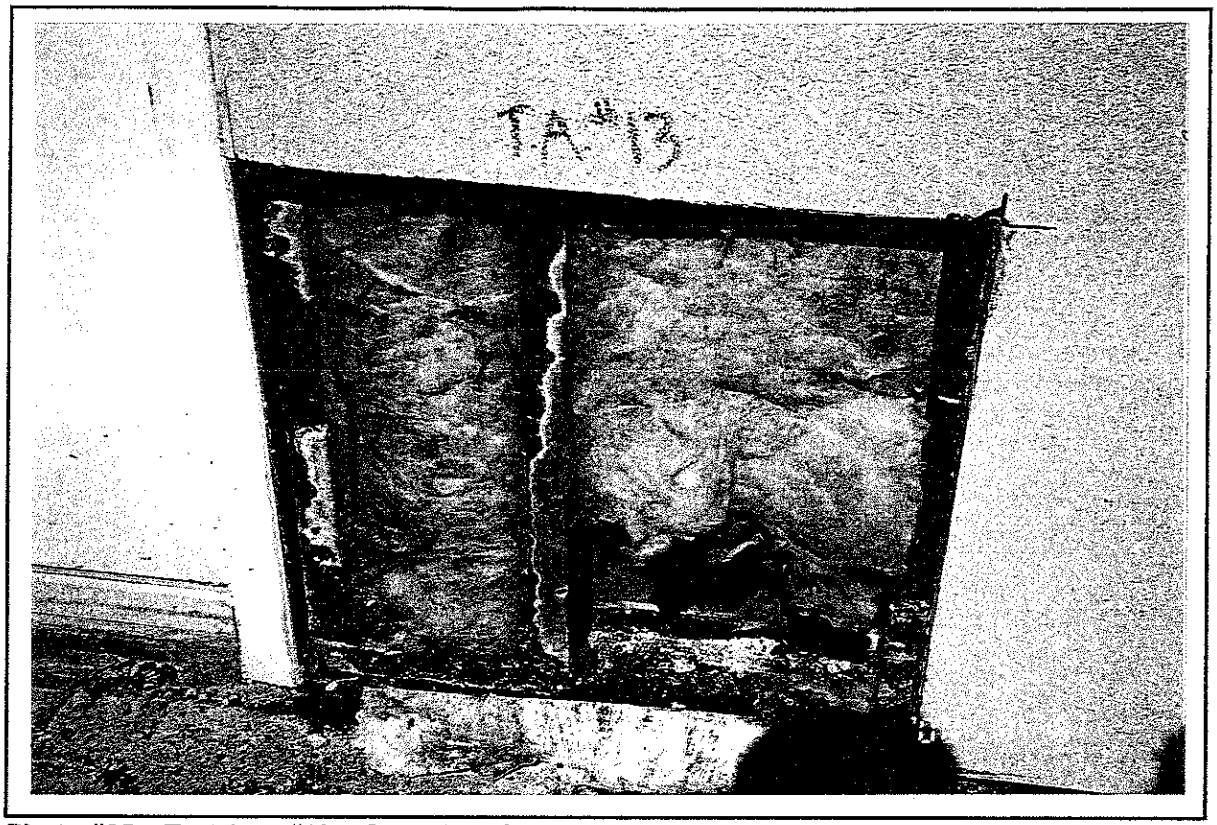


Photo #25 – Test Area #13 – Corrosion of steel studs at base of wall

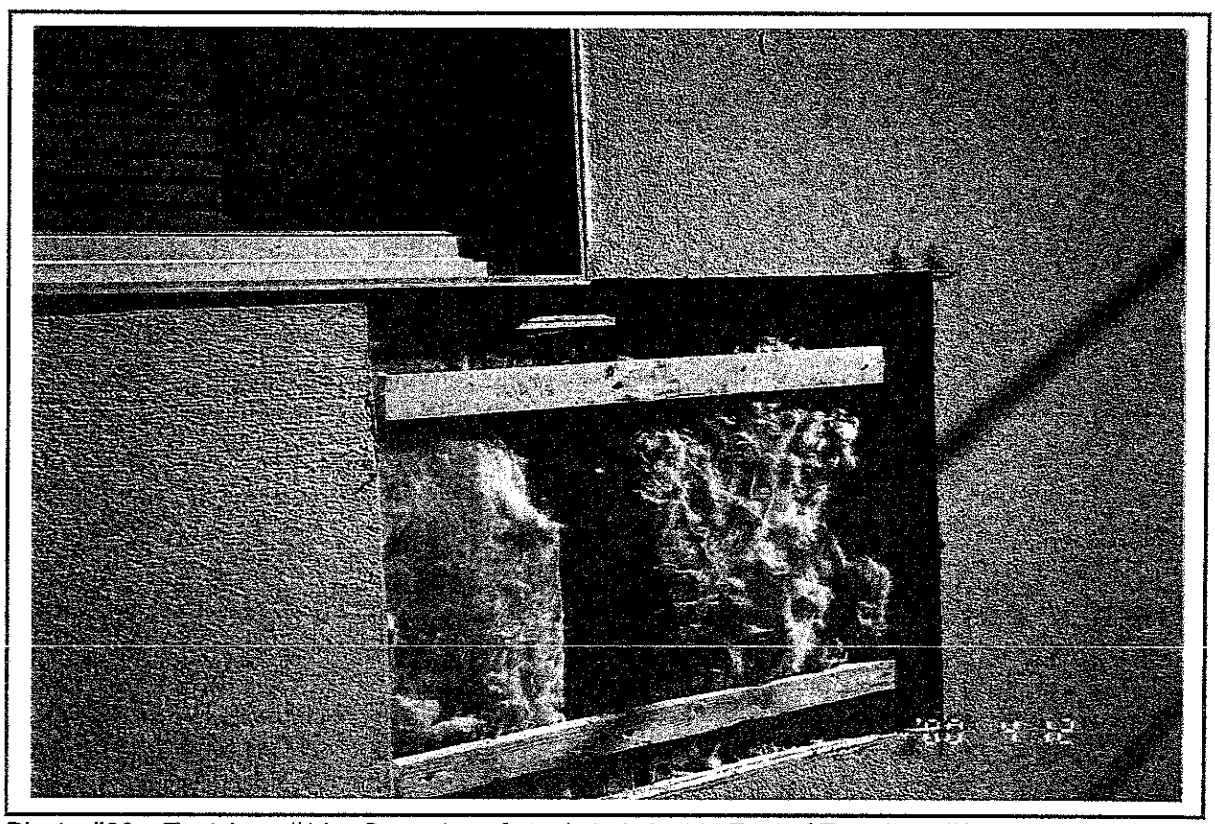


Photo #26 – Test Area #14 – Corrosion of steel studs just to East of Test Area #6

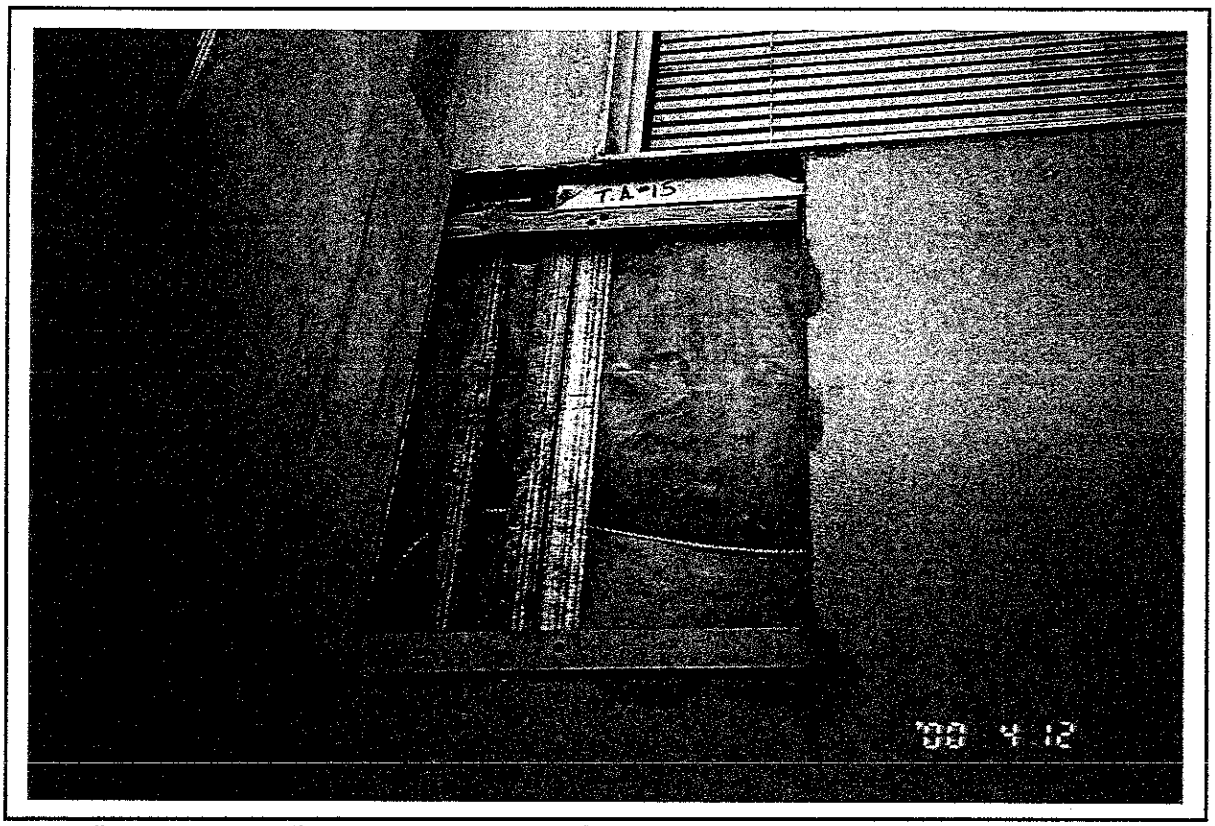


Photo #27 – Test Area #15 – North wall, West of entry

Photo #28 – Test Area #16 – Mouldy / saturated gypsum sheathing

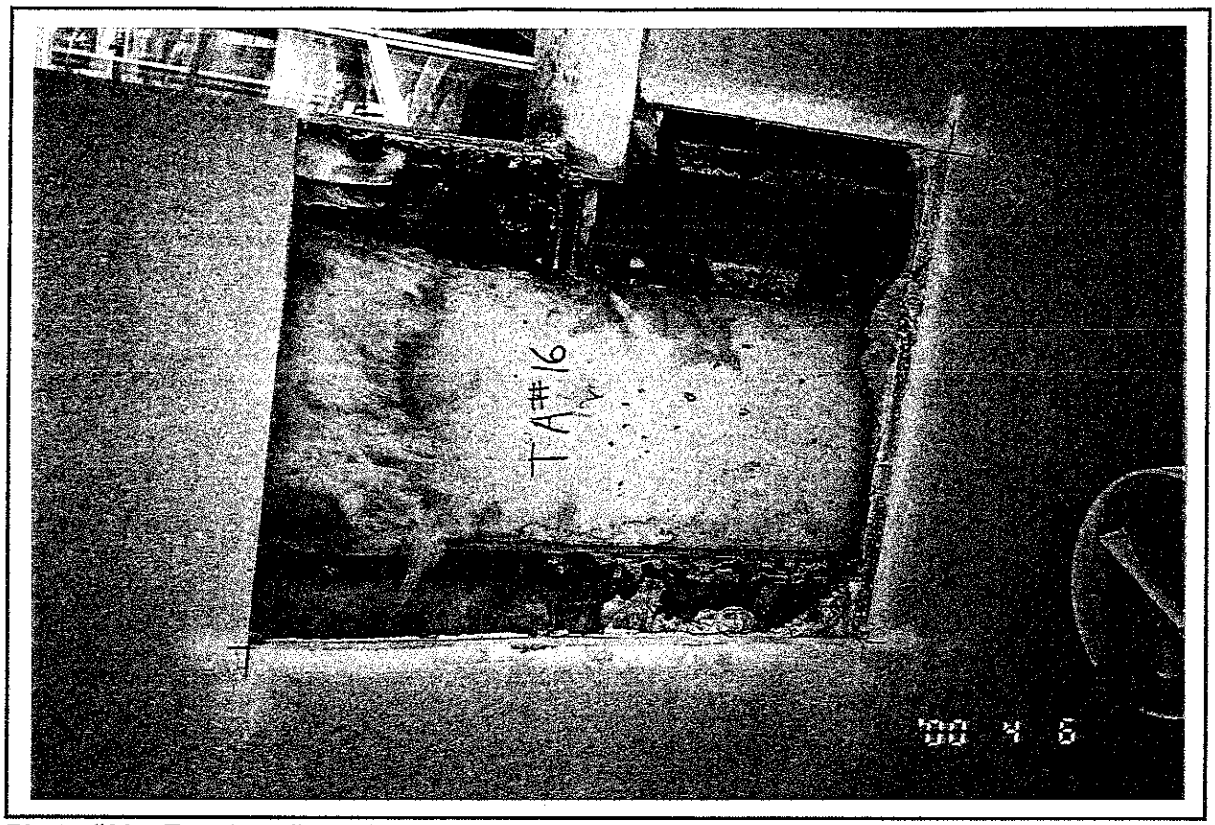


Photo #29 – Test Area #16 – Corroded steel studs

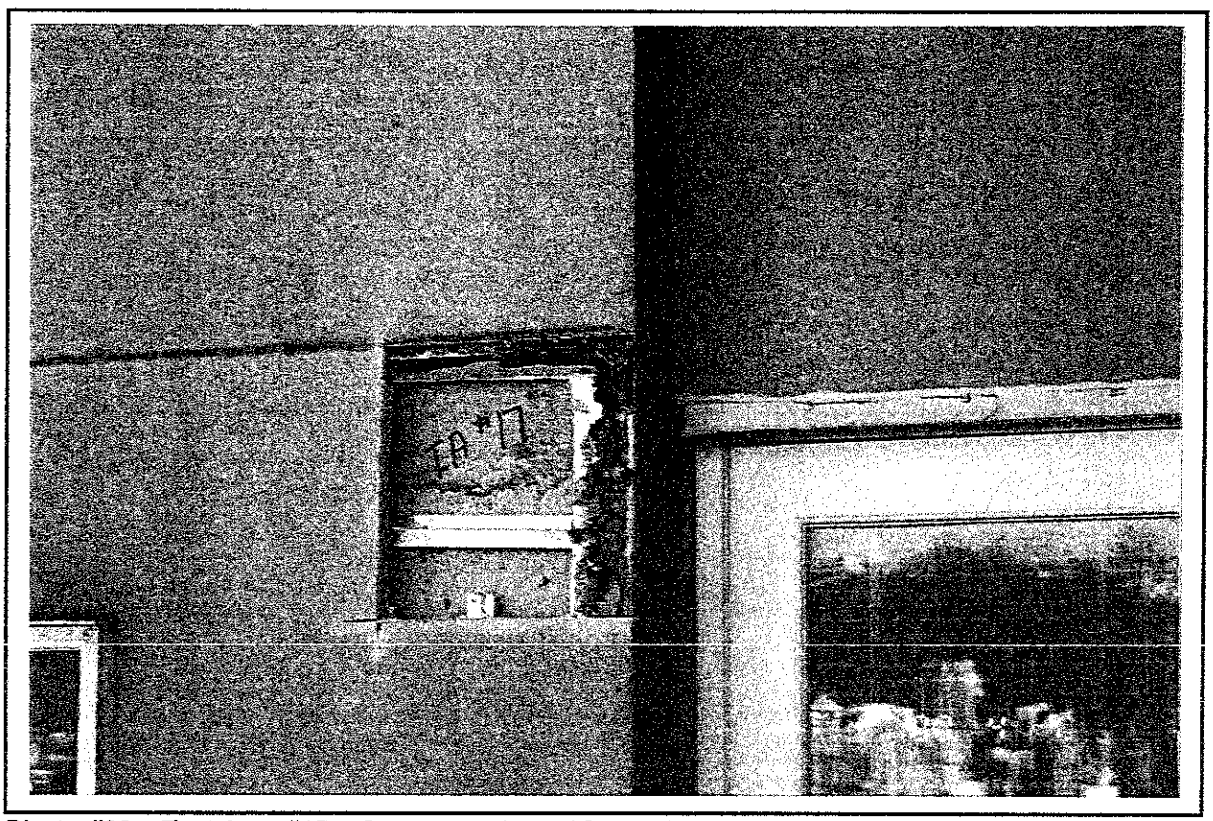


Photo #30 – Test Area #17 – Concrete column / furring in good condition

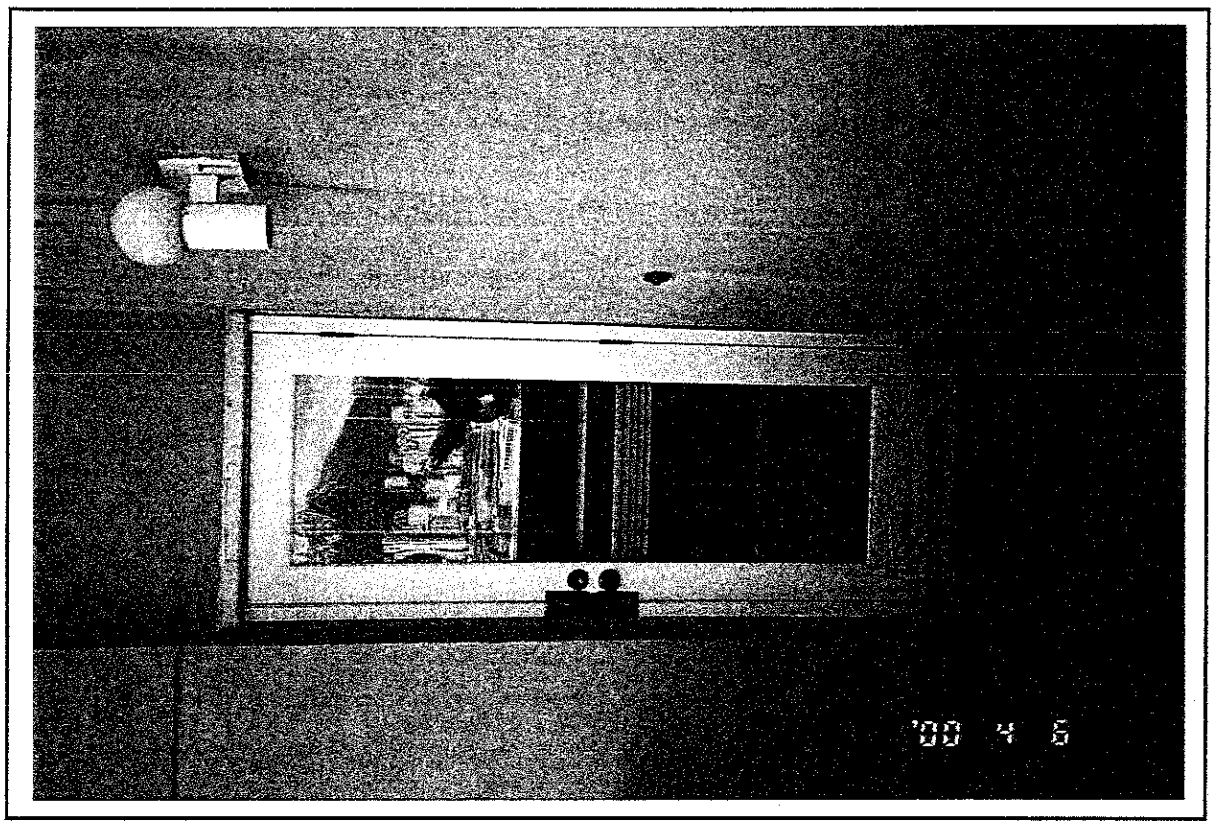


Photo #31 – Test Area #17 – Deteriorated wood door at deck of 1001

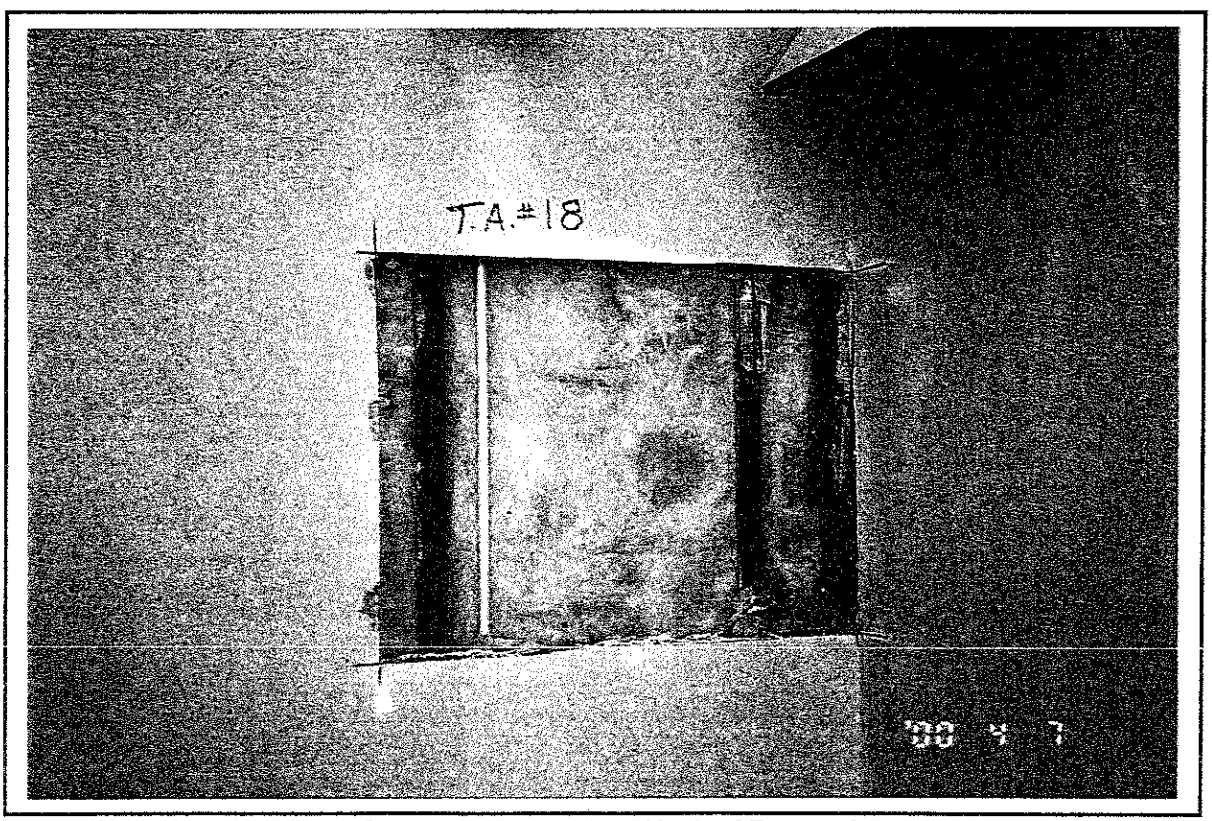


Photo #32 – Test Area #18 – Corroded steel studs to North of East roof access door

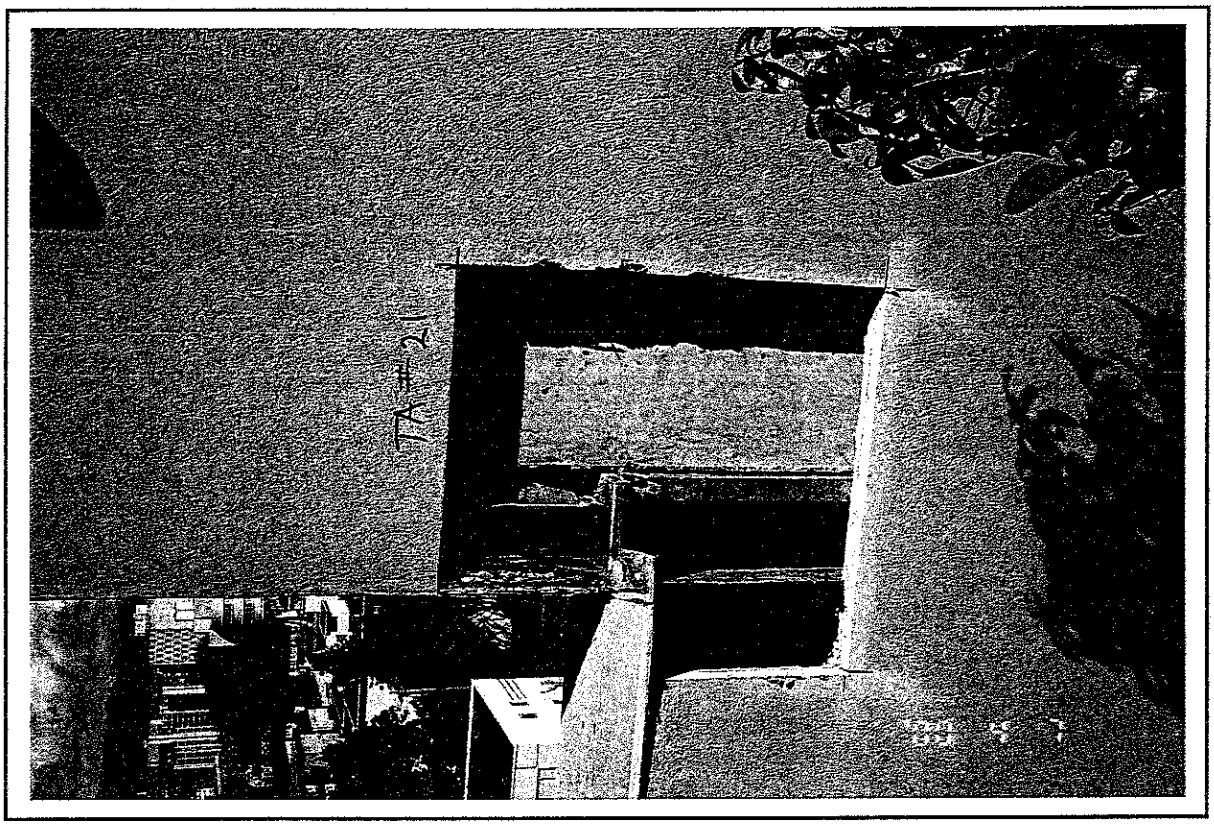


Photo #33 – Test Area #21 – Corrosion at saddle interface of 1003

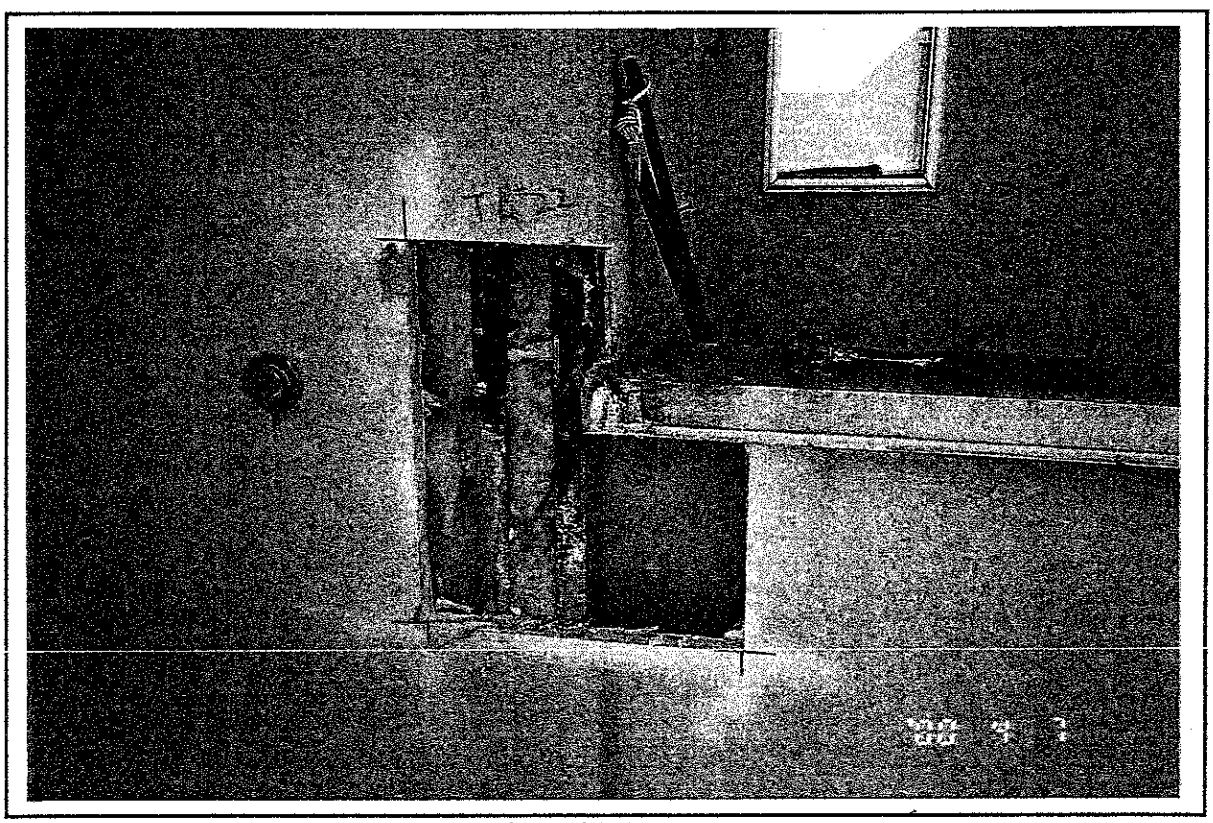


Photo #34 – Mild corrosion at saddle interface of 1002

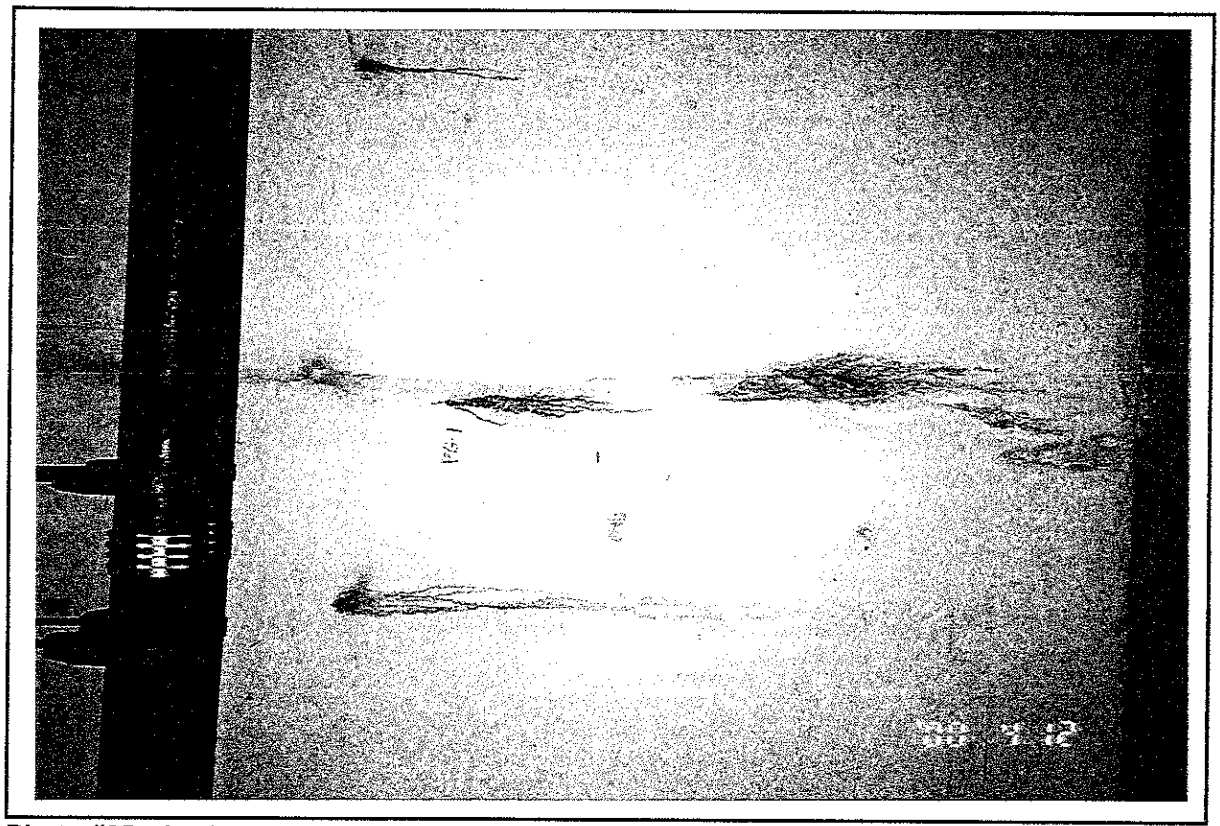


Photo #35 – Leakage at parking garage, West wall

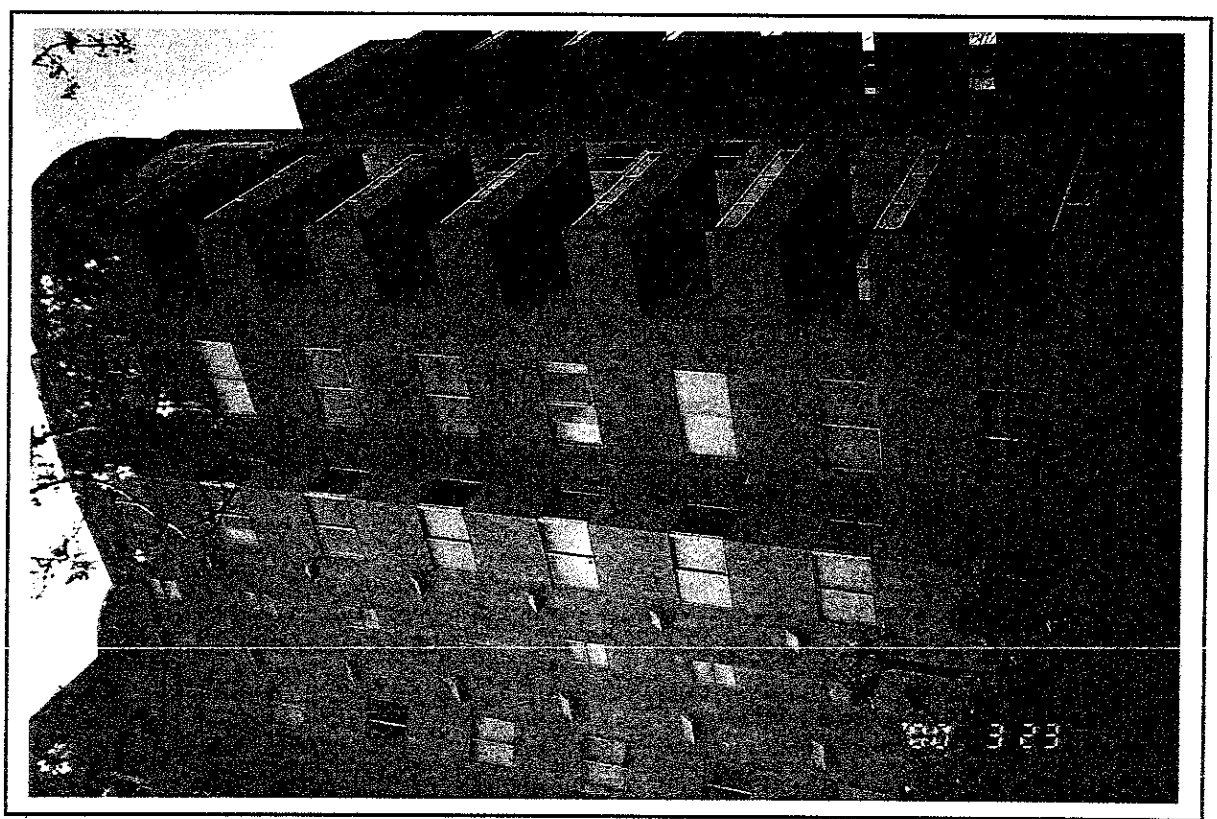


Photo #36 – Typical view of East elevation

APPENDIX D – REVIEW ANALYSIS OF RDH REPORT

- Copy of BC Building Science & Engineering Ltd.'s review analysis of the RDH Building Engineering Building Envelope Condition Assessment.

BC BUILDING SCIENCE
8368-16TH AVENUE, BURNABY, BC, V3N 1S1, TEL: (604) 520-6456, FAX: (604) 520-6496
PROFESSIONAL BUILDING ENVELOPE DESIGN, CONSULTING, & INSPECTION SERVICES

ANALYSIS REVIEW	REPORT OF:	DATE:
	RDH Exterior Wall Condition Evaluation	March 22/00
PROJECT:	ADDRESS:	PAGE:
Westview Place	1166 West 11th Avenue, Vancouver	1 of 6
REPORTED TO:		
Strata VR 1934	Dr. T. Boulton	737-7953

As requested, BC Building Science and Engineering Ltd. (BCBSE) have reviewed the RDH Building Engineering Limited; *Exterior Wall Condition Evaluation* report dated May 25, 1998. We were not provided with any other additional documentation.

The exact site location of this building actually cuts across the North, therefore the front elevation is correctly pointing in a Northeast direction, the East elevation in a Southeast direction, and on around the building. This is important because three of the walls (North, South and East) are exposed to the higher Driving Rain Wind Pressures, which occur at the highest degree from the East. For the purpose of this review, the walls are identified in a North (front entry), South, West and East manner.

The intent of this evaluation is to review the findings and method of evaluation used by RDH Building Engineering in order to determine appropriate remedial measures to resolve the reported water ingress. We have also been asked to provide our recommendations as to how further investigation and remediation of the exterior wall systems and balconies can proceed.

EVALUATION PROCESS:

As described in the RDH report, the general process of investigation and evaluation appeared to consist of:

- Questionnaires to the suite occupants,
- Visually review the interior of selected suites,
- Remove interior drywall at one suite to assist in determining the condition of the exterior wall components,
- Visual review of the building from the exterior,
- Determine the relative moisture content of the exterior drywall (through the stucco).

In general, it is agreed that the evaluation processes described above will identify the critical performance factors that will influence the long-term performance of the building envelope as well as the key processes leading to localized and / or overall failure of the existing wall systems.

The observations reported in the RDH Evaluation appear to support the conclusions and recommendations. However, we also feel that a more thorough undertaking of investigative openings is needed to properly identify the extent of damage to the existing wall systems, and to identify the ideal scope and method of repair.

We note specifically that:

MOISTURE PROBE READINGS:

- 45 moisture readings were taken: 21 at the East wall, and only 7 at the West, 5 at the North and 12 at the South walls. Moisture levels in the 50% range and higher are expected to indicate potential saturation of the exterior gypsum sheathing. Moisture levels from 25% to 50% are noted for potential concern, but water retention is not expected to the same degree as above 50%. The following table summarizes the moisture readings from the RDH report on a wall to wall basis:

Table 1: # Of Probes Versus # Of Probes Taken (Data from RDH Evaluation Report)

	East	West	North	South
Total Probes	21	7	5	12
# >50%MC	18	6	5	3
# <50%MC	3	1	0	9

TEST HOLES:

- 5 test holes were made: 3 at the East wall (2 at Unit 202 & 1 at Unit 702). Additional test holes were made at the balcony parapet of 302. The _02 suites are located at the East wall and have reported the highest level of water ingress based on the occupant surveys.

The findings of the moisture probe readings do indicate the potential for some moisture related concerns at the remaining elevations, however the extent of probes and test cuts do not identify the potential extent.

CONCLUSIONS:

Exterior Wall Assemblies:

The East wall is expected to be in the worst condition (due to local climatic factors), therefore the results are not surprising. However, based on the minimum number of moisture probes taken, it is hard to fully determine the potential condition of the other walls. The observed condition of the East wall (which is based on a number of test holes) should not necessarily be expanded to include the other walls without further investigation.

Visually the exterior stucco finish is showing signs of stress and deterioration at the outside face in the form of extensive cracking, stains at windows and vents, and rusting of control joints. Although this does not necessarily indicate the condition of the underlying assemblies, it is significant enough to show the need for further investigation. Also, these factors may be hard to overcome from an aesthetic and architectural perspective.

The extent of corrosion uncovered at the East wall also does lead to concerns with the condition at the remaining wall areas. Although the light steel framing does is not part of the structural frame of the building, continuing corrosion of the steel framing and fasteners may lead to ultimate delamination of the exterior cladding from the structure. It is expected that continuing corrosion of the steel stud framing will be arrested once water penetration into the wall assembly is stopped. However, the extent of

corrosion to the steel framing needs to be identified to determine its ability to perform its function of supporting the exterior wall systems and finishes.

Windows:
As described in the RDH report, the existing windows are not of a typical standard for a high-rise application. The water penetration testing and leakage conducted and observed by RDH appears to confirm that the windows do not provide the required water tightness and do not appear to meet current Code requirements for thermal or water tightness aspects. The Owners' can also consider having this confirmed through additional testing of the existing windows, prior to undertaking a remedial program.

Balconies:
Based on visual review of the building, the exterior balconies throughout the remainder of the building are expected to be in similar condition to the findings of the test holes at 302. The balconies are generally exposed to precipitation at all times. The lack of a proper cap flashing detail at the topsides and the other noted deficiencies will ultimately lead to continued water penetration.

RECOMMENDATIONS:
Exterior Wall Systems – Test Area:
In order to proceed with the remedial program, while also identifying the optimal methods of repair, we recommend undertaking a thorough investigation of the exterior wall systems at all elevations, including balconies. It appears the ideal method of conducting this investigation is to remove the existing stucco cladding system at the entire 2nd floor perimeter. Depending on the Strata's requirements, this investigation / initial repair areas can be expanded to include the full height of the East wall of all _02 suites, as identified in the RDH report.

Initially the stucco is removed to review the condition of the exterior gypsum sheathing. The sheathing is then removed for review of the steel framing. This will allow for determining the expected condition of the exterior wall systems at all building elevations, rather than only the obvious concerns at the East wall. Based on the findings, the optimum repair scope, extent and methods can be determined.

Localized / Maintenance Repairs:
Depending on the findings of the test opening, there may be a potential to provide some localized repair procedures and maintenance activities that may improve the immediate performance to the existing wall systems. These alternative repair procedures can only be determined once the test area is opened up and extent of problems is identified. Without undertaking a thorough investigative review, it becomes harder to predict the potential performance of localized repairs. As described in the RDH report, previous repair efforts have been undertaken and do not appear to have been successful.

The nature of these repairs however needs to be carefully considered. It has been our experience that localized repairs, such as adding through-wall flashings at each floor level, although providing possible immediate relief of water penetration does not provide predictable long-term performance. The aesthetics of completing localized repairs is also hard to overcome. Adding sealants, coatings and cutting in flashings are not easily adapted to an exterior cladding system of this type. The long-term

maintenance requirements for this approach also become fairly stringent and rigorous. Localized repairs will also not necessarily provide for re-capturing re-sale and property value.

Phasing Of Repairs:

As discussed in the RDH report, there may be a potential that repairs can be deferred or phased. The potential and likelihood for phasing repairs can be determined once the initial investigative portion recommended above is completed. In addition to the cost factors, other ramifications of completing phased repairs need to be considered. Re-capture of the property and re-sale value may be affected by phasing repairs. The Owners will also be subjected to a long-term construction process.

Exterior Wall Re-design and Repair Options:

For all wall areas where the existing cladding must be removed to complete the repairs, we agree with RDH's recommendations that the existing wall design is not sufficient and should be up-graded. It is our experience that the most efficient means of upgrading the drainage and drying potential for the exterior wall system is to remove the existing cladding and replace it with an improved design installed to current rainscreen standards. Although the wall system proposed by RDH (one continuous membrane to act as air, vapour and moisture barrier) is an option that should be considered, there are other alternative options that can also be considered. The new wall design should provide enhanced protection for the exterior wall assembly, including drainage, drying, and deflection, and should also include a designated air barrier in accordance with current Building Code requirements.

There are various options available for upgrading the existing wall design. All options have variance in pricing, and the optimal choice should be based on:

- Findings of the investigative test openings, and extent of water penetration and resultant damage that is uncovered,
- Cost considerations versus benefits gained,
- Long-term performance requirements and considerations, and
- Potential for re-capturing resale and property value.

Enhanced wall design options that may be considered include:

Standard ¾" Rainscreen System with Air Barrier:

- Existing interior gypsum wallboard and finish (repaired as required)
- Existing polyethylene vapour barrier (repaired as required)
- Existing batt insulation (replace as required)
- Existing light steel framing (remediate as required to repair corrosion)
- New moisture resistant Dens Glass Gold gypsum sheathing
- New air barrier system, Bakor – Air Bloc 07 or Insul-mastic 21
- New vertical light duty, 20 gauge, 7/8" galvanized channel shaped "hat-track" at 16" o/c (secured into studs) to create a drainage / ventilation cavity
- New 3-coat stucco system applied onto paper-backed lath (*Stucco-Rite K-Lath* or *standard wire mesh on HAL - Breather Board)*

Outsulation Rainscreen System with Fully Adhered Membrane:

- Existing interior gypsum wallboard and finish (repaired as required)
- Cut out and remove existing polyethylene vapour barrier
- Remove existing batt insulation
- Existing light steel framing (remediated as required to repair corrosion)
- New moisture resistant Dens Glass Gold gypsum sheathing
- New fully-adhered membrane air, moisture and vapour barrier system (self-adhered membrane or liquid-applied, Green Stuff),
- New vertical 18 gauge 3", galvanized Z-bars at 16" o/c (secured into studs) to create a drainage / ventilation cavity
- 2" mechanically fastened semi-rigid, exterior grade, insulation
- New 3-coat stucco system applied onto paper-backed lath (*Stucco-Rite K-Lath* or *standard wire mesh on HAL - Breather Board)*

Outsulation Rainscreen System with Polyurethane Spray-applied Air Barrier:

- Existing interior gypsum wallboard and finish (repair as required)
- Remove existing polyethylene vapour barrier
- Remove existing batt insulation
- Existing light steel framing (remediated as required to repair corrosion)
- New moisture resistant Dens Glass Gold gypsum sheathing
- New vertical 18 gauge 3", galvanized Z-bars at 16" o/c (secured into studs) to create a drainage / ventilation cavity
- 2" spray-applied polyurethane air, vapour and thermal barrier insulation applied directly onto the new Dens Glass Gold gypsum sheathing (BASF – Wall-Tite Air Barrier System)
- New 3-coat stucco system applied onto paper-backed lath (*Stucco-Rite K-Lath* or *standard wire mesh on HAL - Breather Board)*

Outsulation Rainscreen Proprietary Exterior Insulation Finish System:

- Existing interior gypsum wallboard and finish (repair as required)
- Remove existing polyethylene vapour barrier
- Remove existing batt insulation
- Existing light steel framing (remediated as required to repair corrosion)
- New moisture resistant Dens Glass Gold gypsum sheathing
- New trowel-applied air, moisture and vapour barrier (Dryvit – Dryflex, Preswitt - Flexcoat)
- New proprietary Pressure Equalized Rainscreen system

Regarding all systems, the designs are intended to meet the latest standards prescribed by the Building By-law of Vancouver. There is also a potential for using alternate systems depending on exposure. For example, a higher performance system could be used at the East wall, and the standard rainscreen system could be implemented at the remaining walls, or portions thereof. The preferred repair system would be determined based on the findings of the test area and the extent of damage uncovered.

Windows:

At minimum replacing the existing horizontal sliding windows to an upgraded window design should be considered. Additional testing of the existing windows can also be considered in conjunction with the test openings, in order to confirm the water tightness of the windows.

Where a full remedial program to the exterior cladding is undertaken, the costs of replacing the windows is limited to the material only as the labour is already accounted for in the repair process (the windows are removed, waterproofed and re-installed). Also, the risk of leaving the existing windows may outweigh the cost savings, especially when leakage through the windows may compromise the long-term performance of the new wall design. In terms of comfort level and performance it is prudent to consider replacing the windows at areas where a full remedial program is to be undertaken.

Balconies:

The deterioration observed at the balconies can be expected at the majority of the remaining balconies. The design of the exterior balcony parapets is not adequate to provide long-term performance and a re-design of the parapets should be considered at all balconies. Recommendations that need to be investigated:

- Remove existing balcony parapets and replace with a guardrail system. In order to maintain the privacy aspect of the existing parapets, etched or smoked glazing can be considered at the bottom portions of the guardrails.
- Re-build the existing parapets with the addition of a metal cap flashing and waterproof membrane at the topsides.
- The existing balconies should be checked further to determine the needed extent and scope of repairs. It is expected, however that, based on the RDH report and visual observations at the site that all balconies will require a full remedial program.

For all exterior investigations and wall repairs, we recommend the Strata retain the services of a qualified Building Envelope Consulting firm and accredited Building Envelope Professional.

Andrew Creighton, AScT.
Steven Moskalyk, P. Eng., BEP

APPENDIX E – BUILDING ENVELOPE DEFINITIONS

BUILDING SCIENCE DEFINITIONS

Definitions with * have specific meanings as per the Vancouver By-law and the BC Building Code

***Access** or accessible means that a person with disabilities is, without assistance, able to approach, enter, pass to and from, and make use of an area and its facilities, or either of them.

***Air barrier** system means the assembly installed to provide a continuous barrier to the movement of air.

***Attic** of roof space means the space between the roof and the ceiling of the top storey or between a dwarf wall and a sloping roof.

Balcony means a horizontal surface or projection exposed to the exterior.

Base Coat means

a) (Stucco) means the field mixed plaster consisting of the first (scratch coat) or second (brown coat)

b) (EIFS) means the factory or field-mixed basecoat adhesive used to encapsulate the glass fibre reinforced mesh.

***Basement** means a storey or storeys of a building located below the first storey.

***Building** means any structure used or intended for supporting or sheltering any use or occupancy.

Building Envelope means building materials that separate environmentally dissimilar interior space, or, building materials exposed to exterior space or the ground.

***Building Envelope Professional** means a member of the Architectural Institute of British Columbia of the Association of Professional Engineers and Geoscientists of British Columbia who has completed a recognized program in building envelope studies and has met all of the requirements for listing as a Building Envelope Professional with the Institute or Association.

Building Paper means a breather-type asphalt sheathing paper rated in minutes based on preventing water flow at saturation in accordance with a standard test.

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

***Cavity wall** means a construction of masonry units laid with cavity between the wythes. The wythes are tied together with metal ties or bonding units, and are relied on to act together in resisting lateral loads.

***Certified Professional** means a Certified Professional as defined in the Certification of Professionals By-law.

***Chimney** means a primarily vertical shaft enclosing at least one flue for conducting flue gases to the outdoors.

Cladding means a material or assembly that forms the exterior skin of the wall. Cladding types include; stucco, EIFS, metal panels, brick/stone veneer, various siding materials .

***Combustible Construction** means that type of construction that does not meet the requirements for noncombustible construction.

***Contractor** means a person who contracts with an owner or an authorized agent of an owner to undertake a project, and includes an owner who contracts with more than one person for the work on a project or undertakes the work on a project or any part thereof.

Control Joint means a joint in a structure, usually applicable to stucco cladding used to regulate the amount and location of cracking.

***Coordinating Registered Professional** means a registered professional retained pursuant to clause 2.6.2.1. (1)(a) to coordinate all design work and field reviews of the registered professionals required for the project.

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

Drained Cavity (Rainscreen) means a wall design providing a drainage plane behind the exterior cladding material. Allows incidental water entering the wall system to drain by gravity and allows venting and drying of underlying wall assemblies.

Drip Edge means a projection detailed to direct water run-off to the exterior.

Dry glazing means a flexible vinyl seal or other acceptable materials that do not have adhesive properties.

***Dwelling Unit** means a suite operated as a housekeeping unit, used or intended to be used as a domicile by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

EIFS means Exterior Insulated Finish System. It is a type of cladding for exterior building walls providing an exterior surface and insulation.

EPDM (Ethylene Propylene Diene Monomer) means a waterproofing sheet membrane made of vulcanized rubber.

***Excavation** means the space created by the removal of soil, rock or fill for the purpose of construction.

***Exhaust Duct** means a duct through which air is conveyed from a room or space to the outdoors.

Face-Seal means a wall assembly where the performance of the wall dependents on the ability of the exterior surface and associated sealants to shed water and prevent any water infiltration. This system has no drainage plane as provided by a rainscreen wall assembly.
***Field Review** means a review of the work
a) at a project site of a development to which a building permit relates, and
b) where applicable, at fabrication locations where building components are fabricated for use at the project site that a registered professional in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the registered professional for which the building permit is issued.
Finger Joint means a glued joint consisting of a series of interlocking fingers, precision-machined on the ends of two pieces of wood to be jointed.
Finish Coat means the final material, which provides a colored coating for stucco or EIFS claddings.
***Fire-Protection Rating** means the time in minutes or hours that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed.
Fire-Resistance Rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information.
***Fire-Retardant Treated Wood** means wood or a wood product that has had its surface-burning characteristics, such as flame spread, rate of fuel contribution and density of smoke developed, reduced by impregnation with fire-retardant chemicals.
***Firewall** means a type of fire separation of noncombustible construction which subdivides a building or separates adjoining buildings to resist the spread of fire and which has a fire-resistance rating as prescribed, and has structural stability to remain intact under fire conditions for the required fire-rated time.
Fishmouth refers to a deficiency in the installation of peel and stick (self-adhering membranes) or waterproofing membrane which results in a fold in the leading edge which can allow water penetration.
***Flame-Spread Rating** means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test.
Flashing means a sheet metal or other material used in roof or wall construction designed to direct or shed water, typical type include
1. Cap or parapet flashing: top of walls, roof parapets
2. Head or sill flashing: Top or bottom of windows or other penetrations.
3. Cross-cavity: sheds water from the weather barrier to the exterior, across the cavity and cladding.
4. Through-wall: flashing spanning across the entire wall assembly.
5. Saddle flashing: Three dimensional flashing used at wall to horizontal planes.
6. Base flashing: used at the bottom edge of wall surfaces or edges of soffits.

Frame means the associated head, jamb, sill, and, where applicable, mullion and muntin that, when assembled, house the sash or fixed glazing.
***Frost Action** means the phenomenon that occurs when water in soil is subjected to freezing which, because of the water / ice phase change or ice lens growth, results in a total volume increase or the build-up of expansive forces under confined conditions or both, and the subsequent thawing that leads to loss of soil strength and increased compressibility.
***Guard** means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such barrier may or may not have openings through it.
Gum Lip means a method of sealing a flashing to a wall surface whereby the top edge of the flashing is bent outwards to provide a location for a sealant bead.
Head means horizontal member forming the top of the frame.
Housewrap means a sheet plastic material which is used as a sheathing paper, usually a spun-bonded polyolefin material. This material has a low liquid material air leakage rate and a high water vapour diffusion rate.
Insulating Glass Unit (IGU) means two or more panes spaced apart and hermetically sealed in a factory
Jamb means the upright or vertical members forming the side of the frame.
***Leader** means a pipe that is installed to carry storm water from a roof to a storm building drain or sewer or other place of disposal.
***Load-Bearing** (as applying to a building element) means subjected to or designed to carry loads in addition to its own dead load, excepting a wall element subjected only to wind or earthquake loads in addition to its own dead load.

Mullion means a vertical or horizontal frame member that separates two of more lights within a sash.
***Non-Combustible Construction** means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.
***Partition** means an interior wall 1 storey or part-storey in height that is not load-bearing.
***Party Wall** means a wall jointly owned and jointly used by 2 parties under easement agreement or by right in law, and erected at or upon a line separating 2 parcels of land each of which is, or is capable of being, a separate real-estate entity.
Punch Window means a single window frame and glass assembly surrounded by cladding as opposed to a number of frames coupled horizontally or vertically (window wall assembly).
Registered Professional means
a) a person who is registered or licensed to practice as an architect under the Architect Act, or b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.
Removable Double Glazing means a sheet of glazing framed with metal, vinyl, or any other suitable material. The panel formed is designed to be installed on either the inside or the outside of the prime sash or window.
Roof Deck means a horizontal surface exposed to the outdoors, located over a living space.
***Roof Drain** means a fitting or device that is installed in the roof to permit storm water to discharge into a leader.
***Roof gutter** means an exterior channel installed at the base of a sloped roof to convey storm water.
Sash means a unit assembly of stiles and rails for holding glass with or without dividing bars and muntins.
Sash Crack means the sum of all perimeters of all operable of fixed lights. Where two such movable parts meet, the two adjacent lengths shall be considered to be only one length.
Scupper means a metal pipe or trough section which directs water to the exterior from a roof or balcony.
Sheathing means a panel material used to provide stiffness to the wall framing and /or provide backing for the cladding .
Sheathing Paper means a material in an wall assembly whose purpose is to protect under wire and materials from water penetration.
Spall means a piece of material, which has delaminated due to mechanical damage, or weather action (usually as a result of freeze/ thaw condition).
Strapping means strips of wood or metal to form a cavity in a rainscreen wall assembly.
Surfactant means an agent (usually a soap or detergent) when mixed with water allows absorption of water through a material.
UV means ultra-violet radiation (from the sun), which has a degrading effect on many membrane and sealing materials (asphalt based) unless protected by an appropriate shielding layer.
***Vapour Barrier** means the elements installed to control the diffusion of water vapour.
Weep Hole means an opening in a wall or window assembly which allows incidental water to drain to the exterior. Weep holes also act as vents allowing air movement and drying of cavity wall assemblies

APPENDIX F – APPLETON CONTRACTING LTD. BUDGET PROPOSAL