

ATTACHMENT: TWO

Project: EXTERIOR FACADE RESTORATION
Milwaukee Public Museum
800 West Wells Street
Milwaukee, WI 53233-1478

Project Number: O114-11436

Subject: **Visual Façade Evaluation Report**
By
GRAEF, Inc.
November, 2010

Milwaukee Public Museum

800 West Wells Street

Milwaukee, Wisconsin

AST-60

Visual Façade Evaluation Report

November 10, 2010



Prepared for:

Milwaukee County

Department of Transportation and Public Works

Prepared by:

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Part I. Recommendations

Action Items

See Part V for full discussions of the following items.

1. Signs of possible deterioration of the stone panel steel supports were noted at multiple locations around the building. We recommend that an investigation of the condition of the supports be completed within one year. This investigation should provide a timeframe for any repairs based on the findings at that time.
2. The stone panels at the parapet elevation have shifted a small amount in various areas around the building. Some of the parapets have been enclosed with metal siding and cap flashing. Others have exposed brick on the roof-side elevation. We recommend additional research into the construction of the parapets and the possible sources of movement of the stone panels within 6 months.
3. The sealant joints in the stone panels are in poor condition. The sealant is no longer flexible and in some areas is losing adhesion to the stone. A few joints were observed that appeared as though there may be mortar in the joint behind the sealant. Stone spalls were noted on Elevation 15 that may be related to this issue. We recommend that the sealant be removed in a few of these joints to determine their construction within 3 months and that the spalled stone pieces be removed within 1 month.
4. Deteriorated mortar joints were observed in the area where the garage, Elevation 21, intersects with the north wall of the Museum, Elevation 20. The deterioration appears to be significant and ongoing based on the patches in the stone in this area. It is also possible that this condition is related to Condition 1 previously discussed. We recommend further investigation of this area to determine the source of the deterioration and whether the stone panel supports are deteriorated. This investigation should be done in conjunction with the investigation performed for Condition 1, within one year.
5. A granite panel at the base of the wall at the east end of Elevation 20 has cracked horizontally and is bowing away from the wall slightly. We recommend that this panel either be replaced or stabilized in place with anchors within 3 months.
6. A loose recessed light was noted in the soffit of Elevation 24. It should be secured or removed within 1 month.

Recommendations for General Building Maintenance and Repairs

1. Peeling paint and light corrosion on steel canopies and sign supports (Figure 4-1) should be cleaned, primed and painting within 3 years.
2. Lightly corroded steel door frames (Figure 4-2) should be cleaned, primed and painted. Heavily corroded steel door frames should be replaced. This should be performed within 3 years or sooner if the use of the door is affected by the deterioration.
3. Unusual staining patterns were noted on the stone in various areas of the building (Figures 4-5 and 4-15). Some of these patterns may be due to air flow patterns around the building. However, in some areas, it appears that they may be due to moisture intrusion or possibly vapor drive through the wall. We recommend that the building be reviewed in the noted areas and also as a whole for stone staining to determine whether there is a source that could be causing damage to the building beyond just the surface staining. The review should be performed within 3 years or sooner if damage to the walls is noted within that time.
4. Deteriorated and cracked mortar joints between stone panels (Figure 4-7) should be repointed within 2 years.
5. Sealant joints at stone panels (Figure 4-8) should be replaced within 3 years unless mortar is found below the sealant as discussed in Condition 3 under Action Items above and Part V at the end of this report. Also, if stone spalls continue to occur (Figure 4-9) sealant should be replaced sooner than 3 years as the hardened sealant may be contributing to stone spalls.
6. The lightly corroded metal soffit at the northwest corner (Figure 4-11) should be monitored and replaced when needed. If corrosion worsens, we also recommend removing a section of soffit to determine whether it is the soffit itself or the framing above that is corroding.
7. The shifted granite panel at edge of door at the northwest corner (Figure 4-12) should be replaced or reset within 18 months.
8. The failing sealant at base of wall at the northwest corner (Figure 4-13) should be replaced within 18 months unless additional damage is noted in which case it should be performed at that time.
9. Cracked stone panel on Elevation 17 (Figure 4-14) should be replaced.
10. Minor spalled concrete at the soffit at Elevation 19 (Figure 4-16) should be removed.

11. The cracked granite at base of the wall at Elevation 19 (Figure 4-17) can be replaced. These pieces may remain in place as well, although the cracks may allow a small amount of water into the wall cavity.
12. The sealant joints between the granite panels (Figure 4-18) should be replaced within 2 years.
13. The windows typically do not have sill flashing (Figure 4-20). Flashing should be installed if extensive work is performed at the windows, or if in the future, it is suspected that water is entering the building at these locations.
14. Stone damage on Elevation 20 near the bottom of the stairs (Figure 4-21) should be repaired.
15. The cracked tile near the top of the stairs on Elevation 20 (Figure 4-22) should be replaced.
16. The bent counterflashing around the perimeter of the garage roof (Figure 4-23) should be replaced.
17. The damaged stone panels where the east wall of the garage meets Elevation 20 (Figure 4-25) should be replaced within 2 years.
18. The granite panel on Elevation 20 with the minor crack (Figure 4-28) should be replaced if work is being done with this panel or if the crack grows in size.
19. The spall in the granite panel on Elevation 20 which is exposing a connector (Figure 4-30) should be patched. The steel connector should be cleaned and primed prior to patching the granite.
20. Chips in granite due to impact (Figure 4-31) can be patched if desired.
21. Deterioration and cracking in the wall tile on Elevation 21 (Figures 4-32 and 4-33) could be repaired. It is likely that this sort of deterioration will continue to occur. This area should be monitored regularly for additional damage. When the damage gets to a more critical point, replacement of the façade finish should be considered.
22. Corroded overhead doors (Figure 4-34) should be replaced when corrosion affects the function of the doors, or sooner if desired.
23. The deteriorated joint sealant between buildings and within the IMax building (Figure 4-35) should be replaced within 2 years.
24. The corroded steel railing (Figure 4-36) should be cleaned, primed and painted within 3 years.

- 25. The spall and damage to side of the concrete panel on Elevation 23 (Figure 4-37) can be repaired if desired for aesthetic reasons or if deterioration of the steel begins to cause damage to the concrete panel.

Recommendations for Future Examination Schedule

The building façade should be visually evaluated every 5 years. The issues discussed above in Action Items should be evaluated as discussed in that section. Additional evaluations may be required based on the findings of future visual evaluations.

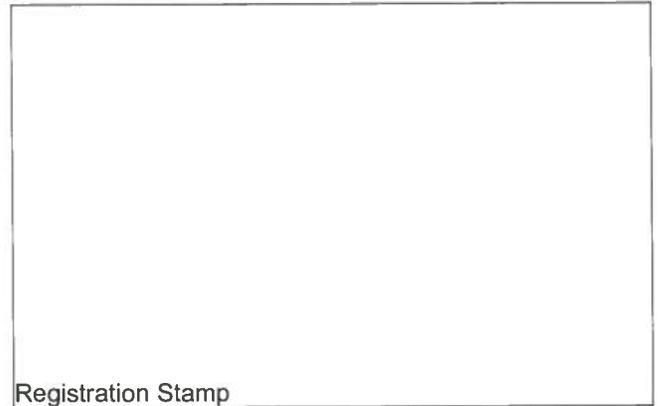


Registration Stamp

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Part II. General Information

Building Description

The Milwaukee Public Museum ranges in height from a single story to eight stories. The majority of the building is clad in stone panels. A portion of the base of the walls is clad with granite panels. There is a garage on the north side of the building that is located such that the roof is nearly even with MacArthur Square. The east elevation of this garage is clad with ceramic tile.

The southeast portion of the building that houses I-Max was an addition to the original building. This portion of the building is clad with precast concrete panels.

The northeast portion of the building that houses Discovery World is not within the scope of this evaluation because it is not owned by Milwaukee County.

The north and south elevations of the eight story section of the building are clad in marble panels. This portion of the façade was not included in the scope of this evaluation because these areas are already under review within a separate study.

Location Plan

Refer to Figure 2-1 for site plan of the building showing adjacent streets, and the relationship of the building to adjacent buildings.

Site Plan

Refer to Figure 2-2 for site plan of the building showing façade locations.

Building Elevations

Refer to Figures 2-3 to 2-27 for overall photographs of the building elevations.

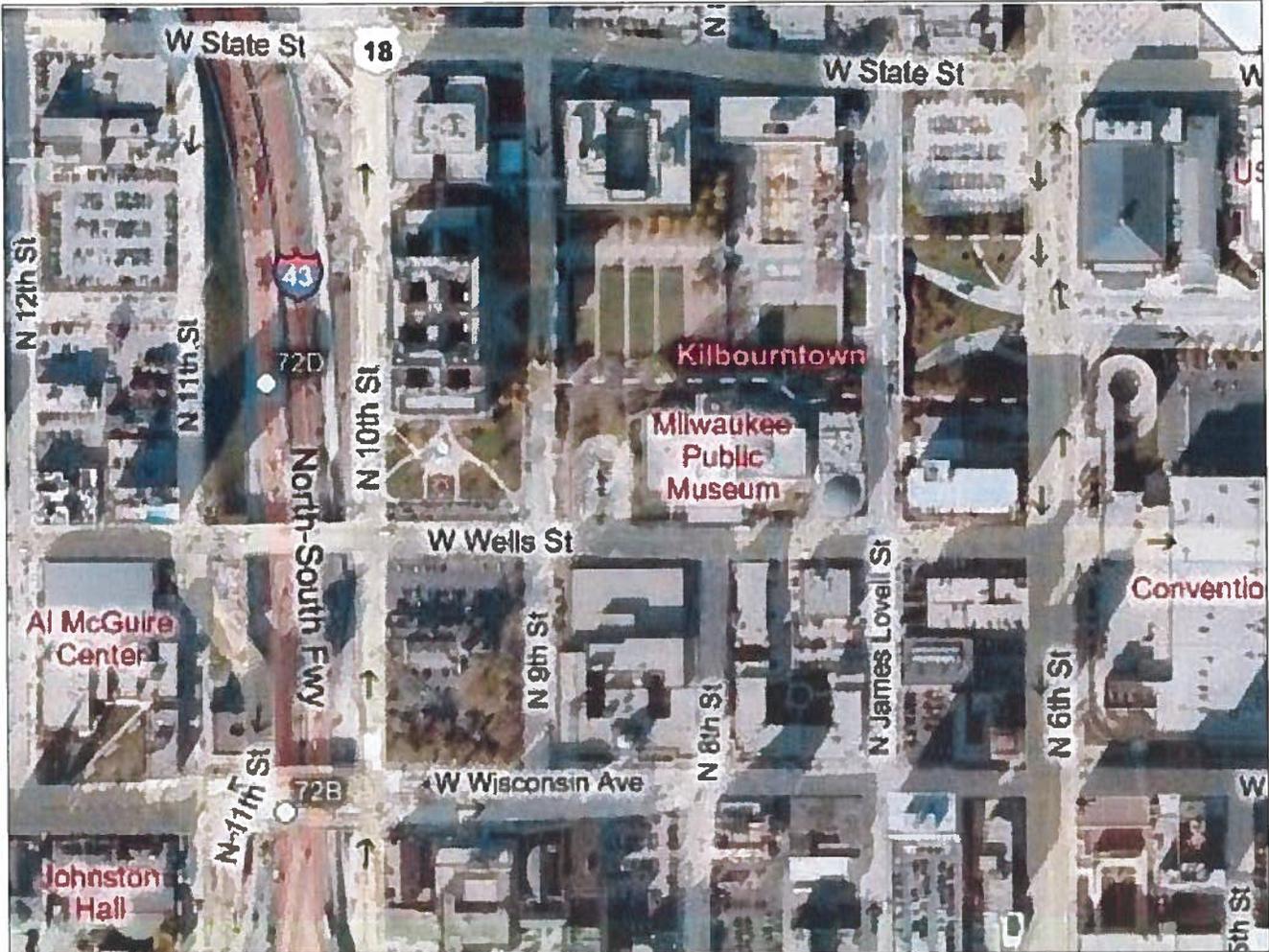


Figure 2-1. Location Plan





Figure 2-1. Site Plan & Elevation Key

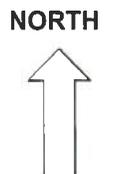




Figure 2-3 Elevation 1



Figure 2-4 Elevation 2



Figure 2-5 Elevation 3



Figure 2-6 Elevation 4



Figure 2-7 Elevation 5



Figure 2-8 Elevation 6



Figure 2-9 Elevation 7

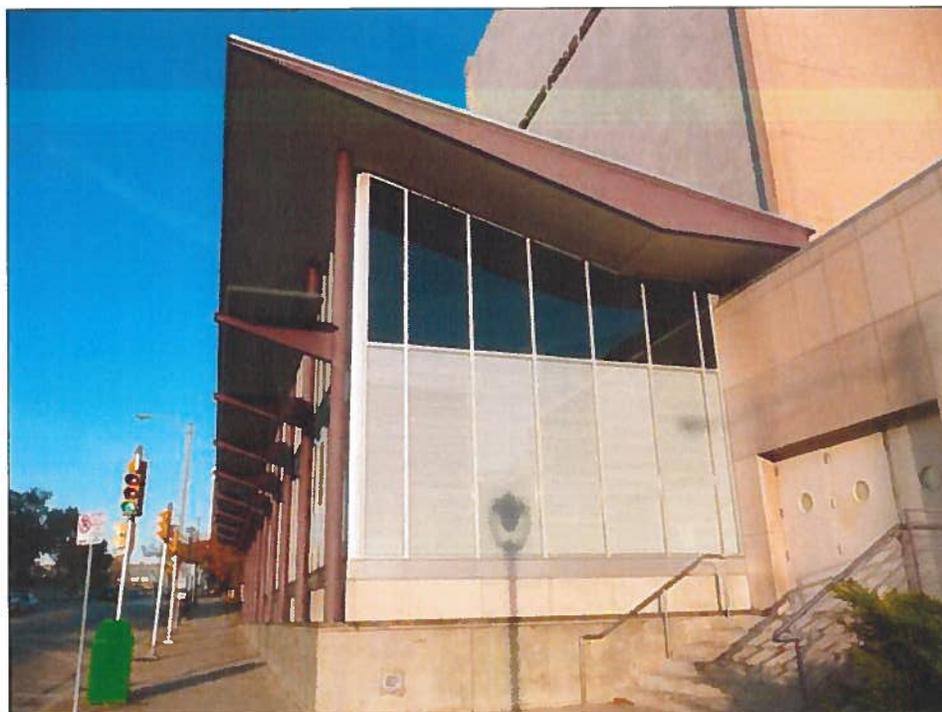


Figure 2-10 Elevation 8



Figure 2-11 Elevation 9



Figure 2-12 Elevation 10



Figure 2-13 Elevation 11



Figure 2-14 Elevation 12

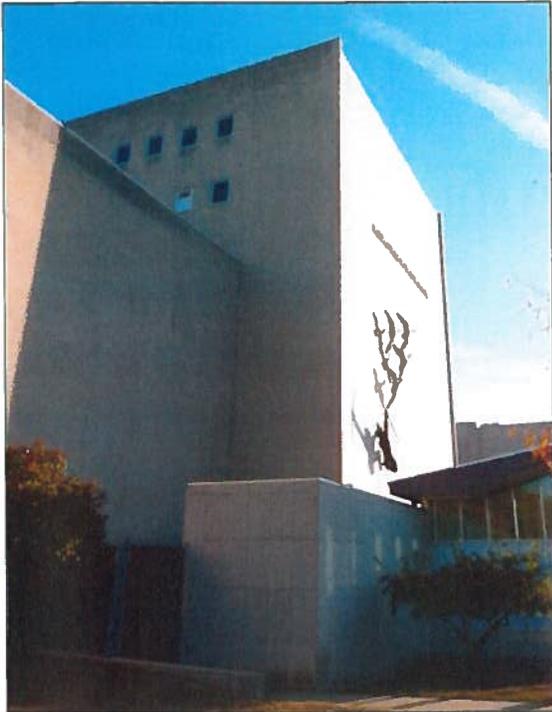


Figure 2-15 Elevation 13

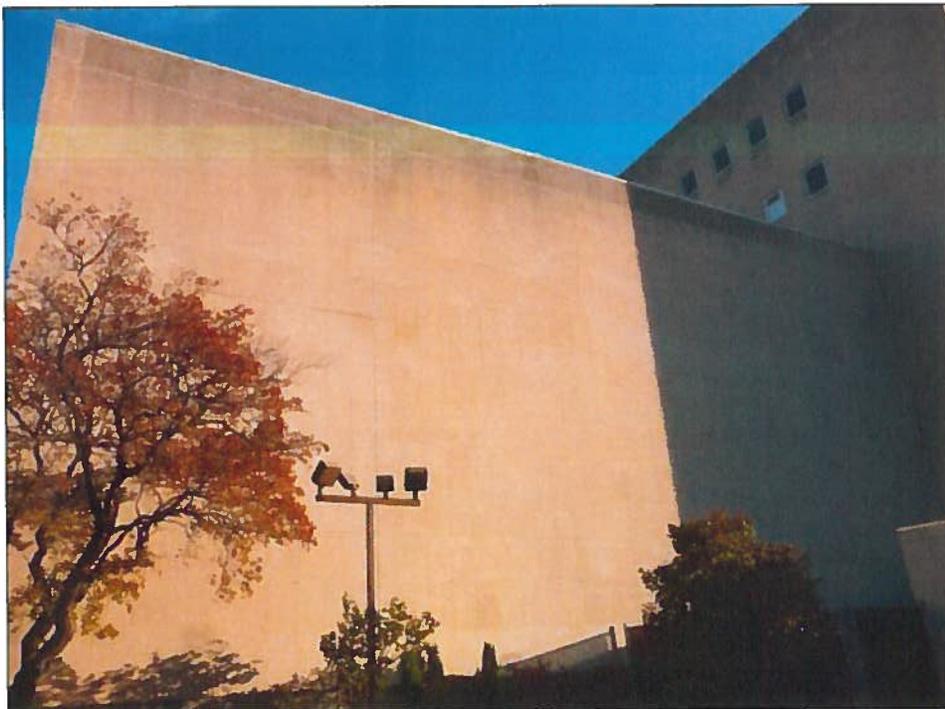


Figure 2-16 Elevation 14



Figure 2-17 Elevation 15



Figure 2-18 Elevation 16



Figure 2-19 Elevation 17



Figure 2-20 Elevation 18

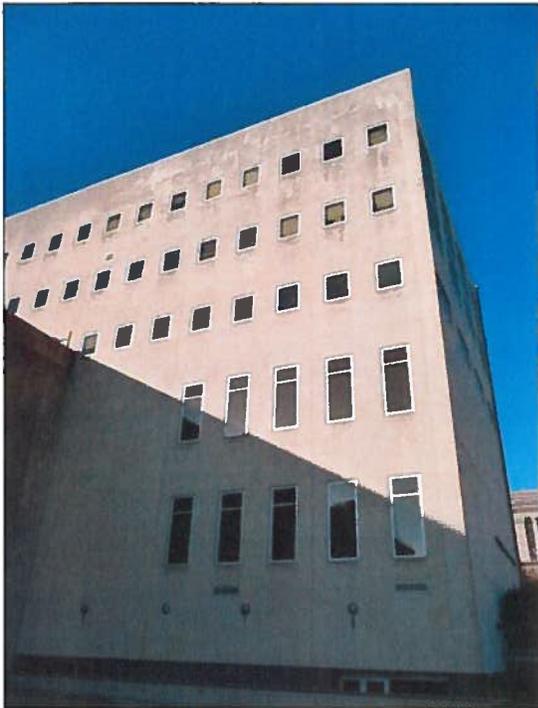


Figure 2-21 Elevation 19

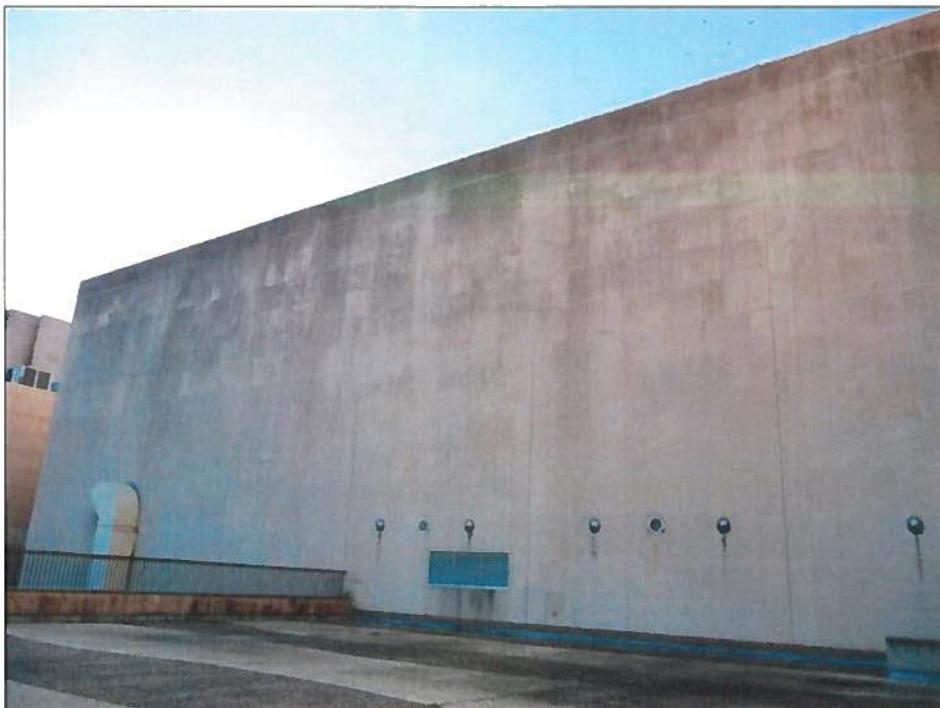


Figure 2-22 Elevation 20



Figure 2-23 Elevation 21

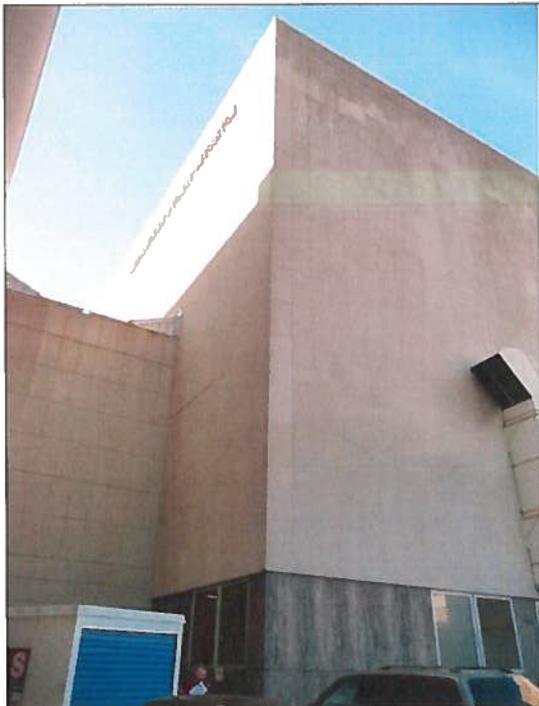


Figure 2-24 Elevation 22



Figure 2-25 Elevation 23



Figure 2-26 Elevation 24



Figure 2-27 Elevation 25

Part III. Description of Visual Evaluation

Visual Evaluations

The facade was visually observed on October 19, 2010. The observation covered all building elevations including all exterior facade components, soffits, and other overhangs and features as applicable. The entire facade was viewed remotely from ground level using binoculars if appropriate. All observations were documented by notes and photographs. Refer to Part IV for general comments and photographs that are representative of typical conditions. Conditions that require further study or are deemed to show significant deterioration or distress are indicated in Part V.

Report Preparation and Use

The observations, findings, and recommendations contained in this report are based on the professional judgment of a qualified professional experienced in this type of work using that degree of skill and care normally exercised by reputable consultants performing similar services under like assignments and circumstances.

This report is provided by a professional with the understanding that, because of the physical properties of the many materials commonly used for constructing facades and the limitations on detecting concealed internal wall distress, a visual evaluation may not find “unsafe and imminently hazardous conditions” in the facade that are not visible from the exterior. Therefore, submittal of the visual evaluation report is not a representation that all “unsafe and imminently hazardous conditions” in the facade have been identified. Additional study may be warranted to fully evaluate conditions of the facade.

The observations noted, were performed without disassembling or damaging the existing exterior wall systems. No calculations have been performed to determine the adequacy of the original facade design, or subsequent alterations or repairs. No physical tests were made, samples taken, or equipment operated to evaluate performance of the existing facade.

Part IV. Conditions of Minor Distress or Deterioration

Areas needing repairs or maintenance as evidenced by minor visible external distress were identified. Potential repairs are required to correct deficiencies that if left uncorrected could result in future façade system failure or a significant escalation of costs to repair. For example, the lack of weather resistance may not initially affect the structural integrity of the facade, but over prolonged periods may cause deterioration that reduces structural performance and significantly escalates repair costs. The lack of weather resistance may also affect the performance of other building components, such as building insulation and interior finishes. These considerations are beyond the scope of this project. Preventative maintenance is recommended to prolong the facade in quality working order through the expected useful life of the building.

Elevation 1

- Peeling paint and light corrosion on steel entry canopy.
- Corrosion of steel door frame. Typical throughout building.
- Cracked and patched stone panels. See Part V for additional discussion.

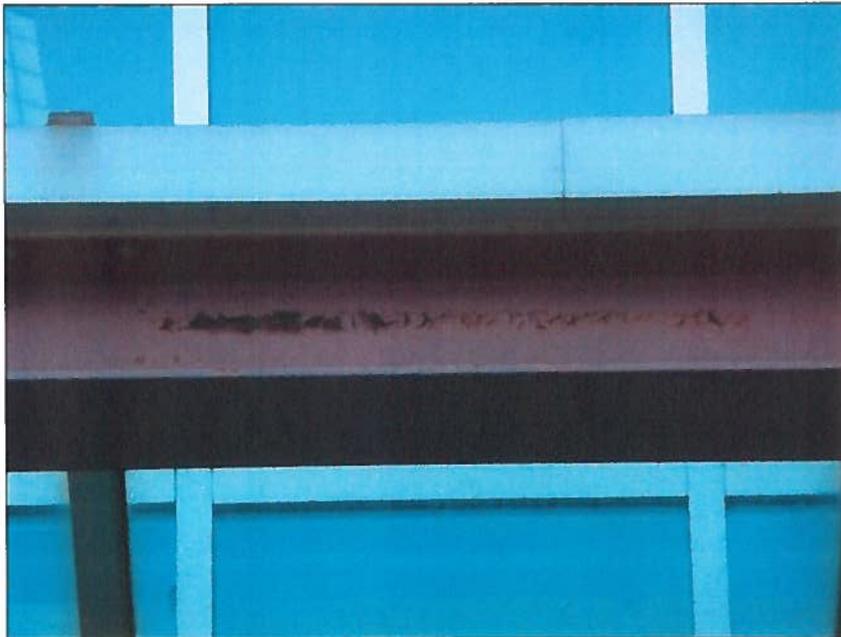


Figure 4-1 Peeling paint and light corrosion on canopy steel



Figure 4-2 Corrosion at base of steel door frame



Figure 4-3 Cracking and patching of stone panels

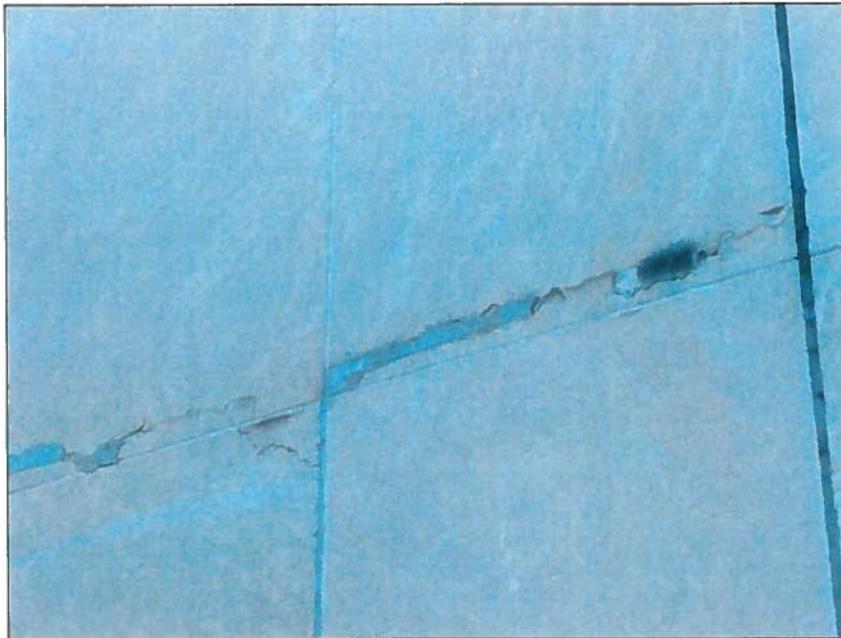


Figure 4-4 Close up of cracked and patched stone panels

Elevation 2

- No conditions of minor distress or deterioration were noted.

Elevation 3

- No conditions of minor distress or deterioration were noted.

Elevation 4

- No conditions of minor distress or deterioration were noted.

Elevation 5

- No conditions of minor distress or deterioration were noted.

Elevation 6

- No conditions of minor distress or deterioration were noted.

Elevation 7

- No conditions of minor distress or deterioration were noted.

Elevation 8

- No conditions of minor distress or deterioration were noted.

Elevation 9

- No conditions of minor distress or deterioration were noted.

Elevation 10

- No conditions of minor distress or deterioration were noted.

Elevation 11

- Staining at base of screen wall may indicate unusual moisture condition.



Figure 4-5 Staining at base of screen wall

Elevation 12

- No conditions of minor distress or deterioration were noted.

Elevation 13

- Stone panels at parapet appear to have shifted slightly. Typical throughout building. See Part V for additional discussion.

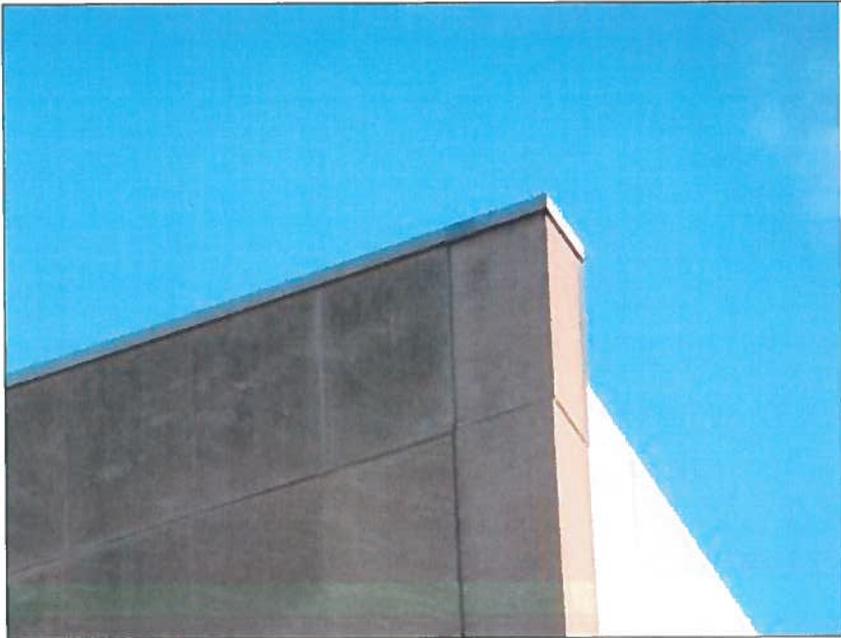


Figure 4-6 Shifted stone panels at parapet

Elevation 14

- Mortar joint deterioration was noted in isolated locations. Typical throughout building.
- Sealant joints at stone panels are hard and cracking. Typical throughout building.



Figure 4-7 Deteriorated Mortar Joints

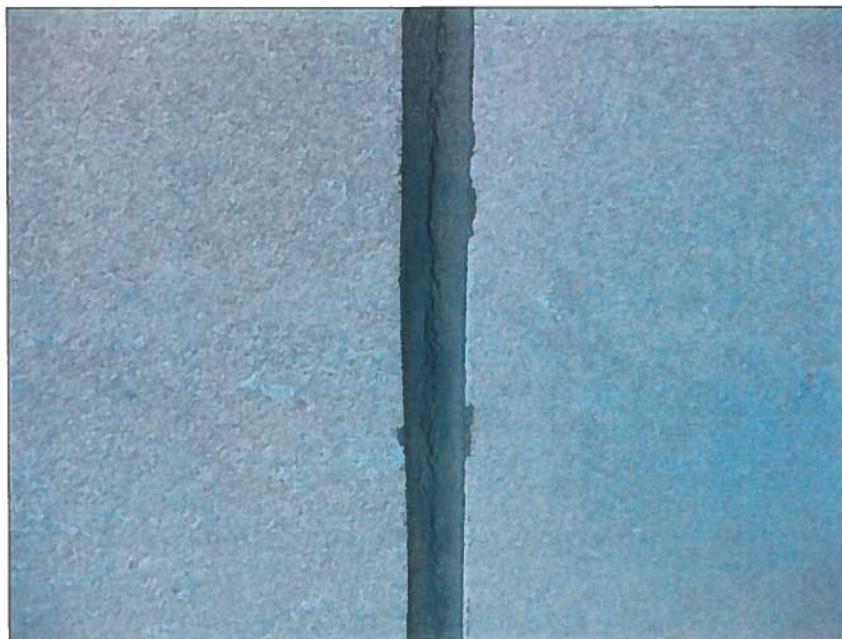


Figure 4-8 Hard and cracking sealant joints at stone panels

Elevation 15

- Spalled stone panels. See Part V for additional discussion.
- Mortar joint deterioration was noted in isolated locations.

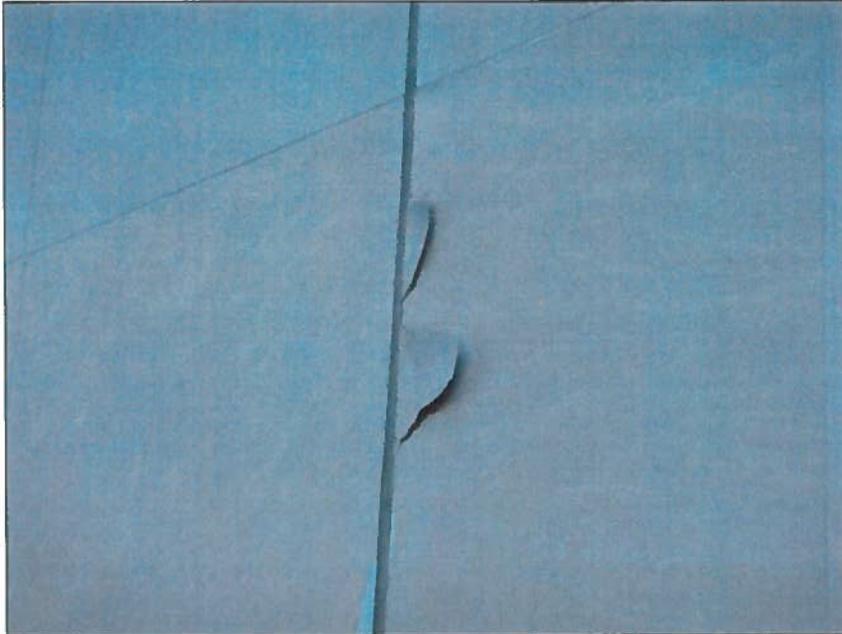


Figure 4-9 Spalled stone panels

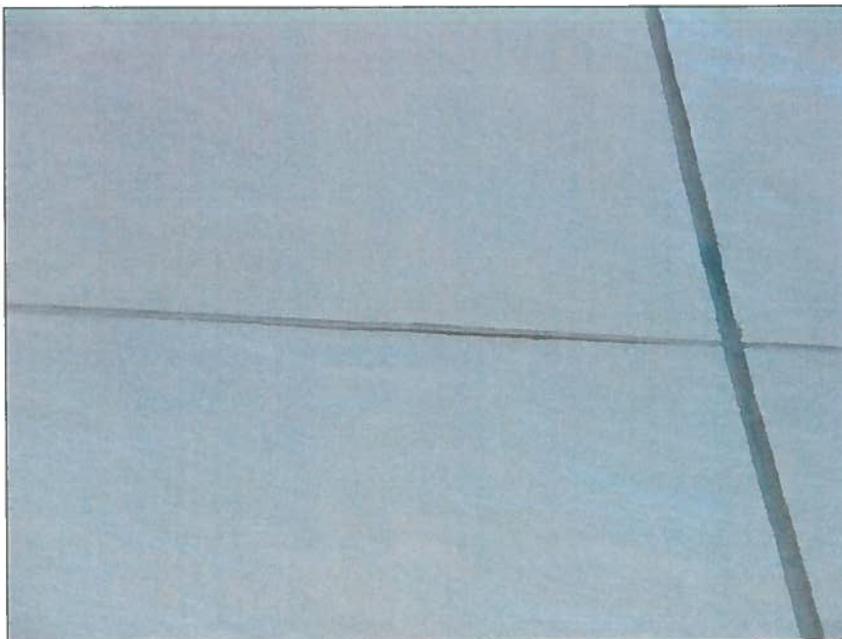


Figure 4-10 Deteriorated mortar joints

Elevation 16

- Light corrosion on metal soffit.
- Shifted granite panel at edge of door.
- Sealant is failing at base of wall.



Figure 4-11 Light corrosion at metal soffit



Figure 4-12 Shifted granite panel



Figure 4-13 Sealant failing at base of wall

Elevation 17

- Cracked stone panel.



Figure 4-14 Cracked stone panel

Elevation 18

- No conditions of minor distress or deterioration were noted.

Elevation 19

- Areas of stone panels are dirty/stained. The stone is not consistently stained throughout the building, but appears to follow certain patterns. It is unclear whether these patterns are due to air circulation around the building, or some other factor. This may be an indication of a moisture condition that may eventually affect the stability of the façade. Typical throughout building. See Part V for additional discussion.
- Minor spalled concrete at soffit.
- Cracked granite at base of wall due to previously installed anchors.
- Sealant joints in granite are losing adhesion to the stones.
- It appears that the stone sealant joints may have mortar behind the sealant. If this is the case at this location, or throughout the building, the joint will not perform as intended. See Part V for additional discussion.
- Windows do not have sill flashing. Typical throughout building.



Figure 4-15 Staining of stone panels



Figure 4-16 Minor spalled concrete at soffit



Figure 4-17 Cracked granite at fastener



Figure 4-18 Failing sealant joint in granite

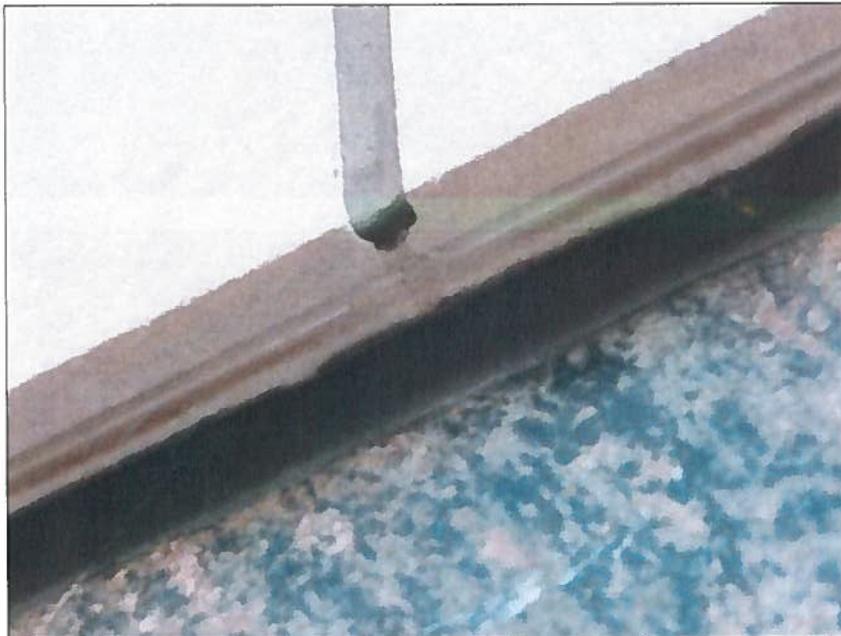


Figure 4-19 Possible mortar in stone sealant joint

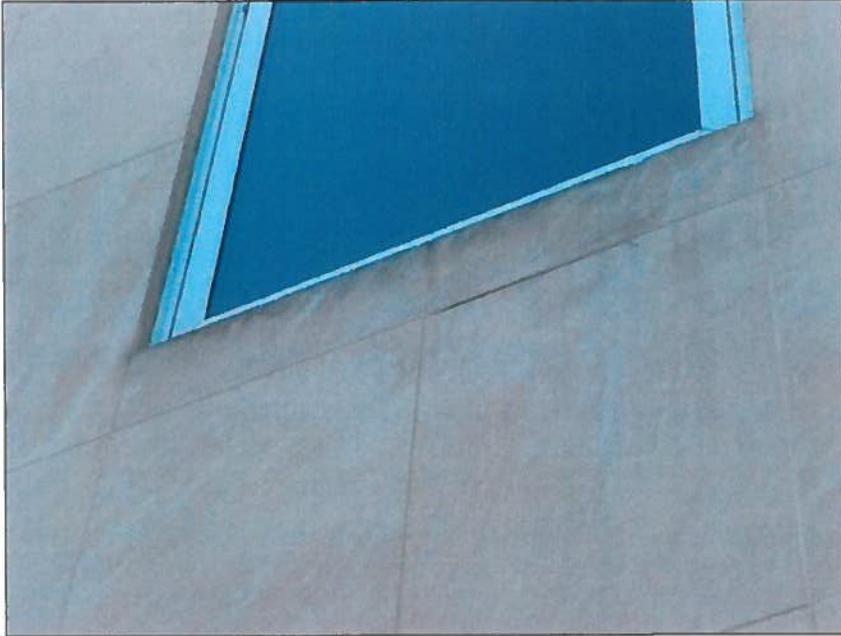


Figure 4-20 No sill flashing at windows

Elevation 20

- It appears that a wall or something similar had been placed against the façade at the stairs. The stone has been damaged in this area.
- The tile has cracked near the top of the stairs.
- The counterflashing around the perimeter of the garage roof is bent at the joints.
- The mortar joint at the base of the stone panels is in poor condition. This may be indicative of deterioration of the steel supports in the wall. See Part V for additional discussion.
- Stone panels have been damaged where the east wall of the garage meets this elevation.
- Mortar joints at stone panels are severely deteriorated where the east wall of the garage meets this elevation. The panels have also been patched in the past. This may be an indication of water intrusion at this location. See Part V for additional discussion.
- Rust staining at the base of the granite wall. It appears that this rust may be coming from the steel supporting the stone above the granite. See Part V for additional discussion.
- Minor cracked granite panel.
- Horizontal crack in granite panel. Panel is pushed away from the building slightly at the crack. See Part V for additional discussion.
- Spall in granite exposing a connector.
- Chips in granite due to impact.



Figure 4-21 Stone damage near stairs



Figure 4-22 Cracked tiles at top of stairs



Figure 4-23 Bent counterflashing



Figure 4-24 Deteriorated mortar joint at base of stone panels



Figure 4-25 Damaged stone at garage wall intersection

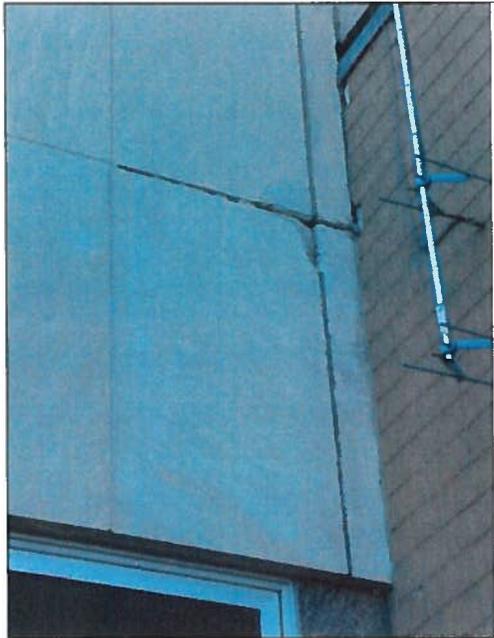


Figure 4-26 Deteriorated mortar joint at garage wall intersection



Figure 4-27 Rust staining on ground



Figure 4-28 Minor crack in granite panel



Figure 4-29 Horizontal crack in granite with bulge at crack



Figure 4-30 Spalled panel exposing connector



Figure 4-31 Chipped panel due to impact

Elevation 21

- Deterioration and cracking in wall tile.
- Corrosion of overhead doors.



Figure 4-32 Water damage to wall tile



Figure 4-33 Cracking in wall tile



Figure 4-34 Corrosion of overhead doors

Elevation 22

- Joint sealant deterioration between buildings.
- Corrosion of steel railing.



Figure 4-35 Deteriorated joint sealant



Figure 4-36 Corrosion of railing

Elevation 23

- Spall/damage to side of concrete panel.



Figure 4-37 Damaged concrete panel

Elevation 24

- Minor corrosion of steel sign brackets.
- Failing joint sealant.
- Loose recessed light in soffit. See Part V for additional discussion.



Figure 4-38 Minor corrosion of steel sign supports

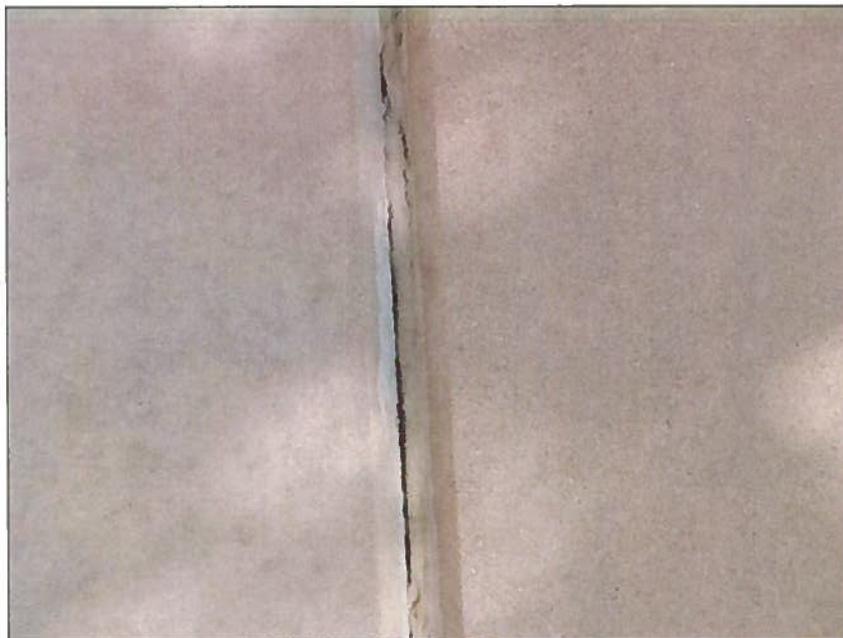


Figure 4-39 Failing joint sealant

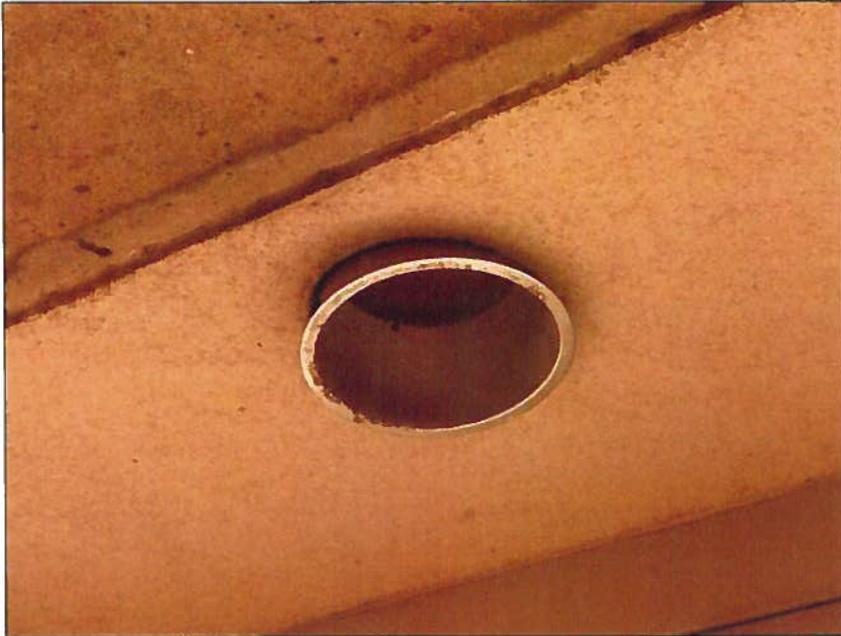


Figure 4-40 Loose recessed light in soffit

Elevation 25

- No conditions of minor distress or deterioration were noted.

Part V. Conditions of Significant Distress or Deterioration

Conditions of significant distress and deterioration that affect the integrity of the facade on each elevation are summarized below. Representative photographs are included of the conditions that require additional examinations, studies or require corrective action. Recommendations for additional studies, plan reviews, close up inspection, stabilization or repairs are discussed here and summarized in Part I.

Condition 1

Some initial signs of possible deterioration of the stone panel steel supports were noted. Such signs include cracking of the panels near the horizontal joints (see Photo 5-1), deteriorated mortar joints near the base of the wall (see Photo 5-2), rust staining at the base of the granite wall that may be from the support angle above the granite (see Photo 5-3). None of these indicate that there is an immediate concern with stability of the façade; in fact, these indications are not necessarily each related to steel deterioration. However, if the supports are deteriorating, this is a condition which, if left unaddressed, could cause significant issues with the façade in the long term. A similar issue is currently being studied on the marble clad north and south walls of the 8 story portion of the building. The conditions found at the stone facades are not nearly as severe at this time as those found on the marble portions.

We recommend an investigation and study be performed for the stone panel supports. This would include reviewing the drawings to determine the types of details used for these connections. Also included would be a thorough up-close examination of select areas of the stone façade. Finally, it also might include removing the stone in small, isolated areas to examine the condition of the steel supports.



Figure 5-1 Close up of cracked and patched stone panels – Elevation 1



Figure 5-2 Deteriorated mortar joint at base of stone panels – Elevation 20



Figure 5-3 Rust staining on ground – Elevation 20

Condition 2

The stone panels at the parapet height have shifted a small amount in various areas around the building (Photo 5-4). Evidence of this was visible from the ground and from the roof level. None of the panels appear to be loose based on our visual evaluation; however, the cause of the movement should be further investigated. The parapets on the high roof and the east side low roof have been enclosed in metal siding and flashing (Photo 5-5). The parapet on the west side low roof has not been enclosed; however, vertical control joints have been added to the roof side face of the parapet (Photo 5-6).

The movement of the stone at the parapet is consistent with horizontal expansion of the parapet. If the parapets were constructed with brick without control joints, this may explain the expansion and movement of the stone. However, additional research into the construction of the parapets and the reasons behind installing control joints and metal enclosure is recommended.



Figure 5-4 Shifted stone panels at parapet – Elevation 13



Figure 5-5 Enclosed parapet wall – Elevation 13



Figure 5-6 Exposed parapet wall with control joints – Elevation 15

Condition 3

The sealant joints in the stone panels are in poor condition. The sealant is no longer flexible and in some areas is losing adhesion to the stone. On Elevation 19, a few joints were observed that appeared as though there may be mortar in the joint behind the sealant (Photo 5-7). If this is the case, the joint would be ineffective as a movement joint. Stone spalls were noted on Elevation 15 (Photo 5-8). An ineffective movement joint could cause this type of damage. We recommend that the sealant be removed in a few of these joints to determine their construction. The spalled stone pieces should be removed.

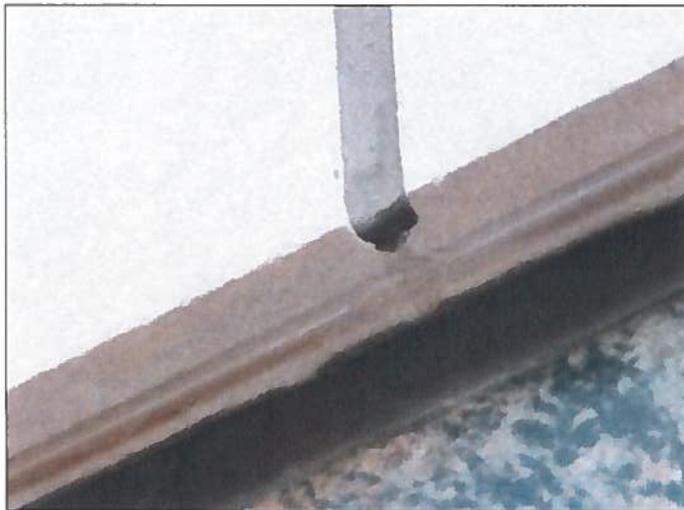


Figure 5-7 Stone joint with possible mortar behind sealant – Elevation 19

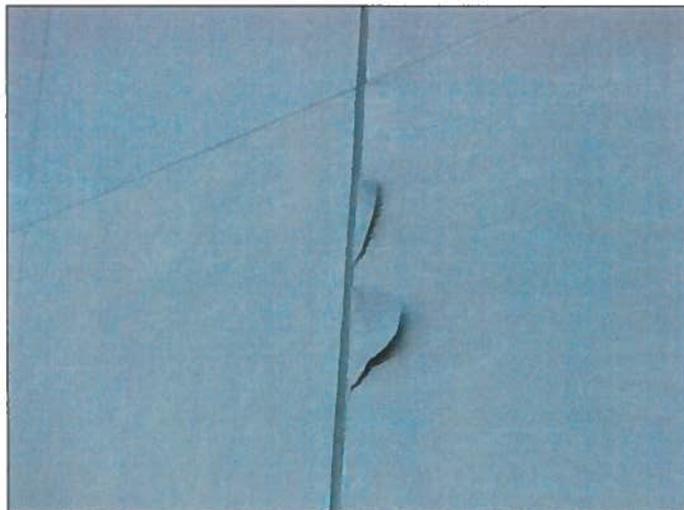


Figure 5-8 Spalled stone at sealant joint – Elevation 15

Condition 4

Deteriorated mortar joints were observed in the area where the garage Elevation 21 intersects with the north wall of the Museum, Elevation 20 (Photo 5-9). The deterioration appears to be significant and ongoing based on the patches in the stone in this area. It is also possible that this condition is related to Condition 1 previously discussed. We recommend further investigation of this area to determine the source of the deterioration and whether the stone panel supports are deteriorated.



Figure 5-9 Deteriorated mortar joint at garage wall intersection – Elevation 20

Condition 5

A granite panel at the base of the wall at the east end of Elevation 20 has cracked horizontally (Photo 5-10). The panel is bowing away from the wall slightly. We recommend that this panel either be replaced or stabilized in place with anchors.



Figure 5-10 Cracked granite panel – Elevation 20

Condition 6

A loose recessed light was noted in the soffit (Photo 5-11). If this light is loose enough, it could be a falling hazard. It should be secured or removed.



Figure 5-11 Loose recessed light in soffit – Elevation 24

