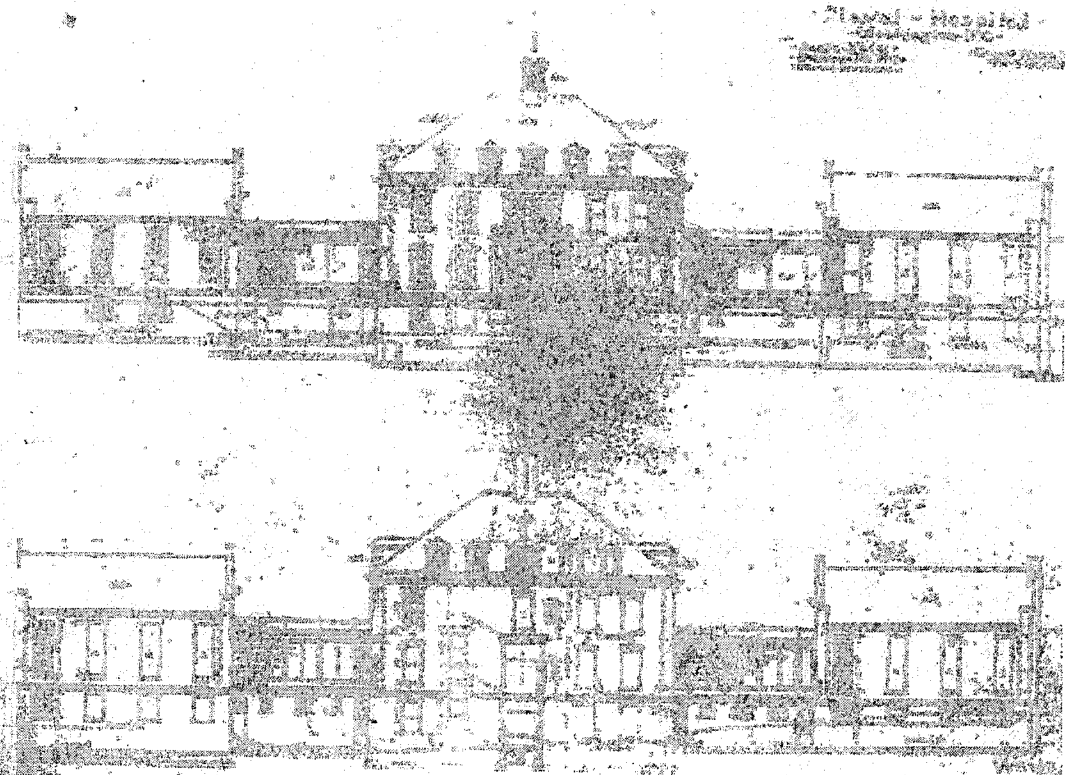
Potomac Annex: Buildings 1 & 3-7

SWANKE HAYDEN CONNELL ARCHITECTS



Historic Structures Report, Corrected Final Submission

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Chapter 6

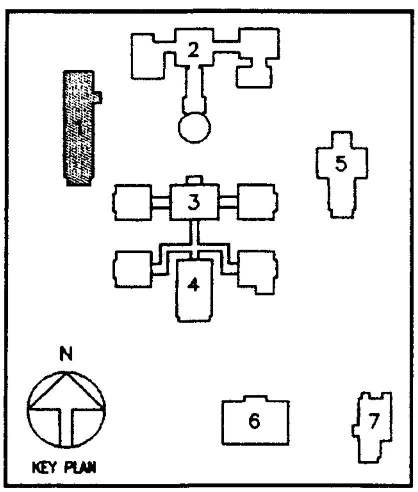
INTRODUCTION

The purpose of a materials conservation analysis is to identify significant materials and techniques of construction and decoration, to describe the conditions of those materials, and, in the event of deficiencies in materials, to determine repair options and to recommend actions for restoration, conservation or preservation treatment.

This Materials Conservation Analysis involved visual inspection of the building's exterior beginning in July 1994 and extending through October 1995. Inspection of the exterior was made from the ground level, through the windows at various floors on all elevations, and at the roof level. The exterior conditions, which encompass both missing and deteriorated building materials, are organized by material. For each material, there is a description of its deterioration, a list of treatment, options, and, a recommendation for treatment. This analysis is performed in order to determine the extent of materials deterioration and to contribute to a prioritized summary of repairs, included in *Chapter 9, Design Guidelines/ Rehabilitation Actions.*

An in depth analysis of the mortars can be found in Chapter 7, *Mortar Analysis*, while conditions related to soiling of materials are addressed in *Chapter 8, Materials Cleaning Analysis.* Specifications relating to the work described here can be found in *Chapter 10, Guideline Specifications.* The Restoration and Rehabilitation zones in which these materials exist are designated in *Chapter 9, Design Guidelines/ Rehabilitation Action.*

BUILDING 1: EXTERIOR EXISTING CONDITIONS



Introduction

Conditions on Building 1 at the Potomac Annex are generally good. On Building 1 the yellow brickwork exhibits light and superficial soiling and requires little or no intervention. The granite on this building shows more moderate soiling. The use of window air conditioners has resulted in staining of some granite elements such as window sills and the water table or band course.

The pointing is generally in excellent condition with notable exception: 1) where granite building elements such as keystones, sills and band courses meet brickwork, the mortar joints are open; 2) the end joints of canted brick lintels are consistently open; 3) the butt joints on the granite band courses at ground level are open or have been badly repointed or caulked. From these open joints on the band course have emanated cracks and open joints which extend in almost all cases to the first floor granite window sills and in some cases up to second floor windows. Damage to brickwork other than stress cracks is minor.

The wood elements require only typical periodic maintenance consisting of scraping and painting except for the dormer windows which have been recently repainted.

Concrete has generally not fared well on Building 1. Sidewalks and associated walls exhibit deterioration which is at times severe; efflorescences, bulging, and network cracking are noted particularly in areaways. Steps and slabs which have been repaired and painted are not visually well integrated into the rest of the building.

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning.

Brick

General Conditions and Soiling

Yellow, unglazed brick is the primary construction material for Building 1. Overall the brick is in good condition, exhibiting only light, superficial soiling.

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 1 in association with the vertical or head joints of the granite water table. The stresses associated with the open joints transfer up and through the brick above, following the mortar joint pattern. Frequently they continue up to the first floor granite window sills (Figure 1-1). In some cases these cracks extend up the wall to the second floor windows (Figure 1-2). These conditions are pervasive on all elevations of Building 1. Stress cracks and open joints are also associated with the two areaways on the front of Building 1 (Figures 1-3, 1-4, 1-5).

Other Open Joints

The heads of the windows in Building 1 consist of wedged shaped brick voussoirs with granite keystones. The joints between the keystones and brick are consistently open as are the joints between the brick voussoir at each end of the window head trim and the surrounding brickwork of the wall (Figure 1-6).

Movement

A small brick retaining wall at the south end of Building 1 is somewhat displaced and exhibits efflorescence of salt (Figure 1-7). Brick piers for the small stoop at the north end also show movement (Figure 1-8).

Glossary located at end of document.

Spalls and Damaged Brick

The northeast corner of Building 1 has damaged brick (Figure 1-9). There is a minor spall on the first floor window, second to the right from the main entrance (Figure 1-10).

Concrete

Concrete can be found at the window wells, capstones, and the two porches on Building 1. The window wells exhibit movement away from the building. The resulting damage from this movement has been repaired with cement and caulk which are now both failing (Figures 1-11 and 1-12). There is some damage to the concrete in the window wells (Figure 1-13). Cement capstones have been dislodged by contact with automobiles and have cracked from the rusting of embedded metal railings (Figure 1-14). Some of the joints in these capstones have been caulked and overlaid with bitumen (Figure 1-15). The slabs of the portico which were presumably cracked or disfigured have been coated with a cementitious material which is a poor match for surrounding concrete (Figure 1-16). The supporting arches for the south areaway consists of badly deteriorated concrete (Figure 1-17). The exposed concrete foundation on the south and rear of the building shows some deterioration due to rebar corrosion (Figure 1-18).

Wood

Windows, dormers, cornices, the portico and the sun porch consist of painted wood. While the wood itself is generally in good condition (windows in the dormers show more deterioration), most of these elements are in need of scraping, painting, and caulking. This is particularly true of the small dormers.

Copper

Copper leaders and roof flashing are in good condition. However, leaders and gutters require cleaning. Evidence of blockage and associated damage to the painted woodwork nearby is noted (Figure 1-19).

Granite and Cast Stone

Granite and cast stone form the water table which surrounds the building at the base of the first floor. These elements - like the granite keystones - are generally in good condition but are lightly to heavily soiled. However, the joints between juxtaposed stones are open or have been filled with caulk (Figure 1-20). The bed joints and the top horizontal joints for the granite water table are generally open. Run-off from window air conditioners has stained the granite (Figure 1-21).

Iron Railings

Iron railings are found in the areaways and on the two main entrances to Building 1. These railings are generally in good condition, requiring periodic scraping and painting. Water entry at their bases has rusted some of the railings causing damage to the concrete (Figures 1-5 and 1-14).

BUILDING 1: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin, but also an expansion/contraction joint to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

No Treatment: Water will begin or continue to deteriorate the wall with increasing intensity.

Cut and Point: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

Cut and Point: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 1 the stress cracking in the brick is related to the open head joints in the granite water table or corrosion of iron anchors. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer to the weakest elements, first the mortar and finally the brick will crack. This condition allows more water to enter which results in further, often more serious, deterioration of other building elements. This condition may also be caused by rusting iron anchors in window lintels and sills. Several bricks have also been damaged by impact.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked or Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This option re-establishes the mechanical integrity of the wall and also provides an aesthetically superior solution.

Bulging Retaining Wall

The pressure of juxtaposed earth combined with hydrostatic water pressure and salt crystallization are forces strong enough to cause retaining walls to bulge and shift.

Bulging Retaining Wall - Treatment Options

No Treatment: Shifting or bulging of the wall will continue and may ultimately lead to unsafe conditions.

Excavate, Waterproof, Cut and Point: Earth is excavated from next to the wall, the waterproofing skin renewed. The joints on the opposite side of the wall are cut and repointed. This will keep the wall in its current configuration.

Rebuild Wall: The existing wall is demolished. Earth is excavated and the wall is rebuilt with proper waterproofing. Brick must be selected to match existing brick on the building and pointing should match surrounding mortar in color, texture and profile.

Bulging Retaining Wall - Treatment Recommendation

Excavate, Waterproof, Cut and Point: The bulging of the wall is not significant enough to warrant demolition and reconstruction.

Coating on Concrete Slabs at Portico and South Entrance Stoop

A cementitious coating has been applied to both concrete slabs at the principal entrances to Building 1. These coatings have undoubtedly been applied to provide a waterproof skin to deteriorating concrete and to give a uniform appearance to presumably cracked concrete. Unfortunately, the color and texture of the coating do not harmonize well with existing materials. In addition, the coating may be masking underlying problems in the concrete.

Coating on Concrete Slabs - Treatment Options

No Treatment: While the rate of deterioration of the concrete may be slowed by the coating, the current solution is clearly unsightly.

Remove Coating, Repair Concrete, Repaint: This option allows for an assessment of the condition of the concrete and permits any required repairs. (Repairs may have been executed at the time of the application of the current coating). A paint which is closer in color to the tan-grey of concrete would be applied. The gritty texture of the current coating should be avoided.

Demolish Slab and Pour New Concrete: Inherent problems of waterproofing and the suspect existing conditions of the concrete could be addressed and dealt with in this option.

Coating on Concrete Porches - Treatment Recommendation

Demolish Slab and Pour New Concrete: This option provides a more lasting solution to the current concrete problems on this building. (See other concrete problems addressed below.)

Separating and Damaged Concrete Window Wells

Window wells are constructed to provide light into the basements of the buildings. These wells are often subject to severe stress and deterioration due to their location at or below grade and their original construction method. The window wells require more frequent periodic maintenance due to these conditions.

Separating and Damaged Concrete Window Wells - Treatment Options

No Treatment: While the conditions of these wells do not pose a significant hazard to the building, the conditions will worsen over time.

Repair with new Concrete Patching Techniques: All existing concrete and caulk repairs should be removed and new concrete infills or patches should be made in a matching concrete.

Demolish and Rebuild: This option would provide the opportunity to eliminate existing problems and to tie the wells into the building.

Separating and Damaged Concrete Window Wells - Treatment Recommendation

Demolish and Rebuild: The new wells can be pitched to better drain water. The use of granite (as in Buildings 5, 6 and 7) is an excellent solution.

Cracked and Deteriorating Concrete Capstones

The concrete capstones have both an aesthetic and mechanical function. Capstones are added to cap or cover the exposed joints in a brick or concrete block wall or to cap or finish the top of a concrete wall. Pre-cast concrete capstones can be shaped to shed water (by canting and the use of a drip edge), thereby protecting the mortar joints of a brick wall. In order to preserve the walls they protect, the capstones require proper maintenance by repointing all deteriorated joints and replacing all cracked stones to match existing. Where poorly maintained and corroding posts of metal railings have caused cracking of the concrete capstone, they should be patched to prevent further damage.

Cracked and Deteriorating Concrete Capstones - Treatment Options

No Treatment: Deterioration will continue and become more severe. Current damage to the capstones is unsightly.

Repointing of Joints and Repair Using Concrete Patching Techniques: While this option slows deterioration, concrete patches are difficult to execute and may not match the existing concrete. The bitumen surrounding certain cross joints can be mechanically removed and the joints repointed with mortar.

Demolish and Rebuild (See related work for areaway walls): This allows for the setting of a sleeve within the new capstone to receive the metal posts of the railings and re-setting of the capstones.

Cracked and Deteriorating Concrete Capstones - Treatment Recommendation

Demolish and Rebuild: This is the correct repair.

Areaway Concrete Walls and Arches

Areaways are designed to provide access to basement entrances to the building. Because the concrete walls associated with these areaways are at or below grade they are often in poor condition as is the case on this east elevation of Building 1.

Areaway Concrete Walls and Arches - Treatment Options

No Treatment: The concrete will continue to deteriorate at increasing rates with possible de-stabilization of the overlying porch.

Repair Using Concrete Patching Techniques: Deteriorated areas of concrete should be removed, the rebar corrosion should be removed and primed and concrete patches installed. Additionally, waterproofing of concrete walls should also be carried out as described above. This solution will be unsightly unless a paint is applied to all areas of the concrete to blend the patching material with the existing remaining concrete. The coating will require maintenance every 5 - 10 years.

Demolish and Rebuild: This option is the most expensive but the arches are already seriously deteriorated. The capstones, the south entrance's concrete slab and the rusted iron railings could all be addressed at the same time.

Areaway Concrete Walls and Arches - Treatment Recommendation

Demolish and Rebuild: New concrete can be better isolated from the surrounding soil which appears to be one of the sources of the deterioration of the concrete. The overlying concrete slab could also be rebuilt at this time.

Cracks in Exposed Concrete Foundation Wall

The foundation wall supports the entire structure. Deterioration of this concrete is minor, but it should be dealt with at an early stage. To neglect it's maintenance will only cause major problems of water entrance resulting in further deterioration at a later date.

Cracks in Exposed Concrete Foundation - Treatment Options

No Treatment: Deterioration will continue to worsen.

Cut and Repair using Concrete Patching Techniques: Damage is minor, and aesthetics are not a significant issue here. Rebars should be cleaned and painted and a cement patch installed. It is not necessary to paint the concrete wall.

Cracks in Exposed Concrete Foundation - Treatment Recommendation

Cut and Repair using Concrete Patching Techniques: This is the only viable option.

Peeling and Failing Paint on Wood

(Note: some dormer windows may need to be replaced.)

Paint not only protects wood from excessive moisture and ultra-violet light damage, but also decorates particular elements, establishing the tonal pattern on building elevation. Periodically, paint should be renewed to re-establish both of these purposes from time to time.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate, and more paint will fail, compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Blocked Copper Gutters and Leaders

Gutters and leaders conduct water off and away from the buildings. When they are not properly maintained, water will collect. During cold weather it will freeze, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Clear Gutters and Leaders: This is no other viable choice.

Rust Stains on Granite Band Course

Aesthetically, the granite band course provides a light colored building element which gives visual "lift" to the building. Stains on this element compromise the aesthetic effect.

Rust Stains on Granite Band Course - Treatment Options

No Treatment: While the stains pose no physical threat to the granite, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains. (See also *Chapter 8. Materials Cleaning Analysis*)

Rust Stains on Granite Band Course - Treatment Recommendation

Remove Stains with Iron Chelating Poultice: This is the least damaging method to remove the rust staining.

Rusting Iron Railings

(Note: See related deficiency, *Cracked and Deteriorating Concrete Capstones*, above.)

Railings are provided primarily as a safety measure. If these railings fail at their bases, safety is not assured.

Rusting Iron Railings - Treatment Options

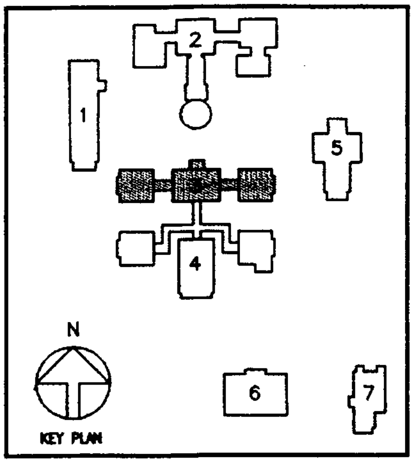
No Treatment: Corrosion will continue at ever-increasing rates.

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: This approach deals with the current level of corrosion and any future corrosion. This process should be part of a periodic maintenance program on 2-3 year cycles.

Rusting Iron Railings - Treatment Recommendation

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: Demolition of the areaway concrete will obviate this approach at that location; otherwise it is the standard treatment.

BUILDING 3: EXTERIOR EXISTING CONDITIONS



Introduction

Conditions on Buildings 3 at the Potomac Annex are generally fair-to-good. Buff colored brick is moderately and selectively soiled. This soiling appears to be embedded in a cracked and crazed surface glaze which is not entirely intact. White glazed brick is lightly soiled and is damaged in some areas.

Pointing on Building 3 is in good condition with notable exception: 1) Where limestone building elements such as lintels, sills and band courses meet brickwork, the mortar joints are open;). Vertical butt joints on the limestone water table are open; 3) From these open joints on the water table step cracks have emanated to window sills; 4) Bluestone window wells have open joints.

Some limestone elements are damaged and stained; however, the wood elements require only typical periodic maintenance consisting of scraping and painting.

Concrete has generally not fared well on Building 3. Concrete sidewalks and associated walls and steps exhibit deterioration which is at times severe; efflorescences, bulging, and network cracking are noted particularly in areaways(which are also constructed partly of brick).

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning. Some leaders have been purposely blocked. Paint on metal roofs is in poor condition and requires a more intense and more frequent maintenance program.

Brick

General Conditions and Soiling

The buff brick is soiled moderately and selectively giving it a mottled appearance (Figure 3-1). This brick exhibits a crazed and cracked outer skin which entraps much of the soiling (Figure 3-2). Minor graffiti and bitumen deposits are found on this brick (Figure 3-3). The removal of window grates at the basement level damaged some of the brick (Figure 3-4).

The white glazed brick, like the buff brick, is selectively damaged but to a much lesser extent (Figure 3-5). The areas of loss comprise about twenty percent of the total surface area of this brick.

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 3 in association with the vertical or head joints of the limestone water table (Figure 3-6). Stress cracks and open joints have been caulked at the basement level (Figure 3-7). Caulk repairs are also seen at grade for open joints between brick and concrete sidewalks (Figure 3-8).

Limestone

Limestone is used for capstones on the raked cornices, parapet walls, keystones and some window lintels, sills and belt courses (or water tables) on Building 3. All of these limestone elements shows signs of loss but do not suffer from active granular disintegration or stress cracking. The light build up of gypsum and flyash appears to be confined to the window lintels and keystones and sills (Figure 3-9). The head joints in the water table and the joints of most of the limestone elements are open or have been repointed with visually or physically incompatible materials (Figure 3-10).

Metal brackets supporting the power lines have rusted and stained the limestone water table (Figure 3-11). In addition, the window air conditioning units have stained this water table as well as some of the limestone window sills (Figure 3-12). During the most recent campaign of repainting of the woodwork, paint has been splattered on the limestone elements. Limestone elements near parking areas or areas of vehicular exhibit percussive damage (Figure 3-13).

Bluestone

Window wells for Building 3 are constructed of sandstone (Bluestone is classified as a sandstone). Many of the stones are displaced and the interstitial joints are open.

Wood

All wood elements on the exterior require scraping, painting and caulking.

Concrete and Brick Areaway and Retaining Wall, Capstones and Steps

The concrete has not fared well on Building 3. The curved brick retaining wall on the north elevation of Building 3 is bulging significantly and exhibits extensive efflorescence (Figure 3-14). Capstones are crumbling (Figure 3-15) and previous repairs are failing (Figure 3-16). (It should be noted that during the examination of the facades, bluestone was found on the north stairway, indicating that it, not concrete, was probably the original material for the steps.) The underside of the concrete slab that forms the floor of the entrance portico to Building 3 is very badly damaged (associated with corroding rebar) with losses are as large as several inches in depth (Figure 3-17). These losses are associated with dampness, efflorescence and extensive corrosion of the rebar.

Copper

Copper leaders are generally in good condition, but some blockages are noted with associated damage to brickwork.

Iron Railings

Iron railings on porticos and stairways are rusting due to lack of maintenance. The rust has stained some of the concrete and limestone elements.

Tin Roofs

Tin roofs which have been painted show extensive loss and lack of adhesion of paint (Figure 3-18).

BUILDING 3: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin but also expansion/contraction joints to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

<u>No Treatment</u>: Water will begin or continue to deteriorate the wall with increasing intensity.

<u>Cut and Point</u>: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

<u>Cut and Point</u>: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 3 the stress cracking in the brick is related to the open head joints in the limestone water table. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer to the weakest elements, first the mortar and finally the brick will crack. This allows more water to enter resulting in further, often more serious, deterioration of other building elements. This condition may also be caused by rusting iron anchors in window lintels and sills.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked, Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This options returns the mechanical integrity of the wall and also provides an aesthetically superior solution.

Damaged Limestone

These limestone elements provide aesthetic contrast to the brick.

Damaged Limestone - Treatment Options

No Treatment - allows for further deterioration of limestone; damage is visually disruptive

Repair with Patching Mortar - a good match in color and texture can be achieved

Dutchman Repair - A good match can be achieved, but at a higher cost.

Damaged Limestone - Treatment Recommendation

Repair with Patching Mortar - Damage is not extensive enough to warrant dutchmen. Where limestone has been damaged by impact, install safeguards such as guard rails or stanchions.

Bulging Retaining Wall

The pressure of juxtaposed earth combined with hydrostatic water pressure and salt crystallization are forces strong enough to cause retaining walls to bulge and shift.

Bulging Retaining Wall - Treatment Options

No Treatment: Shifting or bulging of the wall will continue and may ultimately lead to unsafe conditions.

Excavate, Waterproof, Cut and Point: Earth is excavated from next to the wall, the waterproofing skin renewed. The opposite side of the wall is cut and repointed. This will keep the wall in its current configuration.

Rebuild Wall: The existing wall is demolished. Earth is excavated and the wall is rebuilt with proper waterproofing. Brick must be selected to match existing brick on the building and pointing should match surrounding mortar in color, texture and profile.

Bulging Retaining Wall - Treatment Recommendation

Excavate, Waterproof, Cut and Point: The bulging of the wall is not significant enough to warrant demolition and reconstruction.

Cracked and Deteriorating Concrete Capstones

The concrete capstones have both an aesthetic and mechanical function. Capstones cap or cover the exposed joints in a brick or concrete block wall or to cap or finish the top of a concrete wall. Pre-cast concrete capstones can be shaped to shed water (by canting and the use of a drip edge), thereby protecting the mortar joints of a brick wall. In order to preserve the wall which they protect, the capstones require proper maintenance by repointing all deteriorated joints and replacing all cracked stones to match existing. Where poorly maintained posts of metal railings have caused cracking of the concrete capstone, they should be patched to prevent further damage.

Cracked and Deteriorating Concrete Capstones - Treatment Options

No Treatment: Deterioration will continue and become more severe. Current damage to the capstones is unsightly.

Repointing of Joints and Repair Using Concrete Patching Techniques: While this option slows deterioration, concrete patches are difficult to execute and may not match the existing concrete. The bitumen surrounding certain cross joints can be mechanically removed and the joints repointed with mortar.

Demolish and Rebuild (See related work for areaway walls.): This allows for the setting of a sleeve within the new capstone to receive the metal posts of the railings and re-setting of the capstones.

Cracked and Deteriorating Concrete Capstones - Treatment Recommendation

Demolish and Rebuild: This is the correct repair.

Areaway Concrete Walls and Steps

Areaways are designed to provide access to basement entrances to the building. Because the concrete walls associated with these areaways are at or below grade they are often in poor condition.

Areaway Concrete Walls and Steps - Treatment Options

No Treatment: The concrete will continue to deteriorate at increasing rates with possible de-stabilization of the overlying porch.

Repair Using Concrete Patching Techniques: Deteriorated areas of concrete should be removed, the rebar corrosion removed and primed and concrete patches installed. In addition waterproofing of concrete walls should also be carried out as described above. This solution will be unsightly unless a paint is applied to all areas of the concrete to blend the patching material with the existing remaining concrete. The coating will require maintenance every 5 - 10 years.

Demolish and Rebuild: This option is the most expensive but the arches are already seriously deteriorated. The capstones, the south entrance's concreteslab and the damage from the rusted iron railings could all be addressed at the same time.

Areaway Concrete Walls and Steps - Treatment Recommendation

Demolish and Rebuild: New concrete can be better isolated from the surrounding soil which appears to be one of the sources of the deterioration of the concrete. The overlying concrete slab could also be rebuilt at this time.

Peeling and Failing Paint on Wood

Paint not only protects wood from excessive moisture and ultra-violet light damage, but it also decorates particular elements, establishing the tonal pattern on the building elevation. Periodically, the paint should be renewed to re-establish both of these purposes.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate. More paint will fail therefore compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Blocked Copper Gutters and Leaders

Gutters and leaders are provided to conduct water off of and away from the building. When not properly maintained, water will collect and expand, especially during cold weather, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This activity should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Clear Gutters and Leaders: There is no other viable choice.

Rust Stains on Limestone

Aesthetically, the limestone provides a light colored building element which gives visual "lift" to the building. Stains on this element compromises this aesthetic effect.

Rust Stains on Limestone - Treatment Options

No Treatment: While the stains pose no physical threat to the limestone, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains

Rust Stains on Limestone - Treatment Recommendation

Remove Stains with Iron Chelating or Iron Reducing Poultice: This is the least damaging method to remove the rust staining.

Rusting Iron Railings

Railings are provided primarily as a safety measure. If these railings fail at their bases, safety is not assured.

Rusting Iron Railings - Treatment Options

No Treatment: Corrosion will continue at ever-increasing rates.

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: This approach deals with the current level of corrosion and any future corrosion. This process should be part of a periodic maintenance program on 2-3 year cycles.

Rusting Iron Railings - Treatment Recommendation

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: Demolition of the areaway concrete will obviate this approach at that location. Otherwise it is the standard treatment.

Failing Paint on Tin Roofs

Paint is applied to metal surfaces to provide protection and give color balance.

Failing Paint on Tin Roofs - Treatment Options

No Treatment: Corrosion and paint loss will eventually diminish a roof's integrity.

Scrape, Prime, and Paint: This approach deals with the current level of corrosion and any future corrosion as well as re-established the color balance on the elevation. This process should be part of a periodic maintenance program on 5-year cycles.

Failing Paint on Tin Roofs - Treatment Recommendation

Scrape, Prime, and Paint: This approach deals with the current level of corrosion and any future corrosion; it also re-establishes the color balance on the elevation. This process should be part of a periodic maintenance program on 5-year cycles.

Holes and Metal Inserts in Brickwork (from Installation of Window Grates)

The holes and metal inserts appear to have been supports for signage. If allowed to remain within the brickwork, they will continue to deteriorate and expand. The corrosion product will cause the brick to crack and spall. The holes offer entry ports for water causing subsequent freeze/thaw damage.

Holes and Metal Inserts in Brickwork - Treatment Options

No Treatment: The holes will continue to allow water to enter the wall, and the existing metal inserts will continue to rust. Both actions have the potential to cause unsightly damage to the brick.

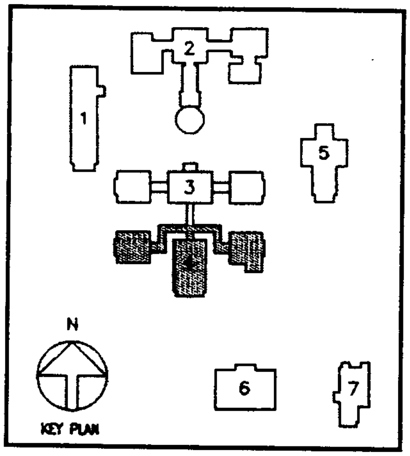
Remove Inserts and Fill All holes: A sympathetic mortar mix with fine sand, cement, lime and pigment can be used to fill these holes.

Remove and Replace Brick: Brick can be cut out and replaced with matching brick and mortar.

Holes and Metal Inserts in Brickwork - Treatment Recommendations

Remove Inserts and Fill All holes: The holes are small enough such that a mortar replacement will be both aesthetically successful and long lasting.

BUILDING 4: EXTERIOR EXISTING CONDITIONS



Introduction

Conditions on Building 4 at the Potomac Annex are generally fair-to-good. Buff colored brick is moderately and selectively soiled. This soiling appears to be embedded in a cracked and crazed surface glaze which itself is not entirely intact. White glazed brick is lightly soiled and is damaged in some areas.

Pointing on Building 4 is in good condition with notable exception: 1) Where limestone building elements such as lintels, sills and band courses meet brickwork, the mortar joints are open; 2) Vertical butt joints on the limestone water table are open; 3) From these open joints on the water table step cracks have emanated to window sills; 4) Blue stone window wells have open joints.

Some limestone elements are damaged and stained, but the wood elements require only typical periodic maintenance consisting of scraping and painting.

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning. Paint on metal roofs is in poor condition and requires a more intense and more frequent maintenance program.

Brick

General Conditions and Soiling

The buff brick is soiled moderately and selectively giving it a mottled appearance (Figure 4-1). This brick exhibits a crazed and cracked outer skin which entraps much of the soiling. Bitumen deposits are found on this brick (Figures 4-2 and 4-3).

The white glazed brick, like the buff brick, is selectively damaged but to a much lesser extent (Figure 4-4). The areas of loss comprise about twenty percent of the total surface area of this brick.

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 4 in association with the vertical or head joints of the limestone water table in the same way as on Building 3 (Figure 4-5).

Damaged Brick

Brick has been dislodged and broken by impact at entryways (Figure 4-6).

Glossary located at end of document.

Limestone

Limestone is used for capstones on the raked cornices, parapet walls, keystones and some window lintels, sills and belt courses (or water tables) on Building 4. All of these limestone elements shows signs of loss, but do not suffer from active granular disintegration or stress cracking. The light build up of gypsum and flyash appears to be confined to the window lintels and keystones and sills (Figure 4-7). The head joints in the water table and the joints of most of the limestone elements are open or have been repointed with visually or physically incompatible materials. Limestone elements are often soiled with biological growth (Figure 4-8).

Damage has occurred to limestone elements both by impact from vehicles and by corrosion of iron anchors (Figures 4-9, 4-10, 4-11, 4-12). (Vehicular impact has also displaced granite capstones and corrosion has also cracked some nearby bricks.) Some previous repairs to limestone are unsightly (Figure 4-13).

Wood

All wood elements on the exterior require scraping, painting and caulking.

Copper

Copper leaders are generally in good condition, but there are some blockages associated with damaged brickwork (Figures 4-14 and 4-15).

Iron Railings

Iron railings on porticos and stairways are rusting due to lack of maintenance. The rust has stained some of the concrete and limestone elements.

Tin Roofs

Tin roofs which have been painted show extensive loss and lack of adhesion of paint.

BUILDING 4: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin, but also expansion/contraction joints to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

No Treatment: Water will begin or continue to deteriorate the wall with increasing intensity.

Cut and Point: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

Cut and Point: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 4 the stress cracking in the brick is related to the open head joints in the limestone water table. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer to the weakest elements, then the mortar and finally the brick will crack. This allows more water to enter resulting in further, often more serious, deterioration of other building elements. This condition may also be caused by rusting iron anchors in window lintels and sills. Some of the bricks have been damaged from impact.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked, Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This options returns the mechanical integrity of the wall and also provides an aesthetically superior solution.

Damaged Limestone on Window Sills

These limestone elements provide aesthetic contrast to the brick

Damaged Limestone - Treatment Options

No Treatment - This option allows for further deterioration of limestone; damage is visually disruptive.

Repair with Patching Mortar - A good match in color and texture can be achieved.

Dutchman Repair - A good match can be achieved, but at a higher cost.

Damaged Limestone - Treatment Recommendation

Repair with Patching Mortar - Damage is not extensive enough to warrant dutchmen.

Damaged Limestone on Portico

These limestone elements provide aesthetic contrast to the brick

Damaged Limestone - Treatment Options

No Treatment - This option allows for further deterioration of limestone; damage is visually disruptive.

Repair with Patching Mortar - A good match in color and texture can be achieved.

Dutchman Repair - A good match can be achieved but at a higher cost.

Damaged Limestone - Treatment Recommendation

Dutchman Repair - damage is extensive and confined to specific elements of defined geometric shapes which are well repaired by dutchmen. Corroded iron anchors should be replaced with stainless steel.

Displaced Granite Capstones

Capstones have both an aesthetic and mechanical function. Capstones are added to cap or cover the exposed joints in a brick or concrete block wall or to cap or finish the top of a concrete or brick wall. Capstones can be shaped to shed water (by canting and the use of a drip edge), thereby protecting the mortar joints of a brick wall.

Displaced Granite Capstones - Treatment Options

No Treatment: Deterioration will continue and become more severe. Current damage to the capstones is unsightly.

Reset and Re-Anchor: This will protect the brick below and visually integrate the steps.

Displaced Granite Capstones - Treatment Recommendation

Reset and Re-Anchor: This is the only viable repair option; use only non-ferric anchors.

Peeling and Failing Paint on Wood

Paint not only protects wood from excessive moisture and ultra-violet light damage, but also decorates particular elements, establishing the tonal pattern on the building elevation. Periodically, paint should be renewed to re-establish both of these purposes.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate. More paint will fail therefore compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Blocked Copper Gutters and Leaders

Gutters and leaders are provided to conduct water off of the building. When they are not properly maintained, water will collect. It will freeze during cold weather, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Clear Gutters and Leaders: This is no other viable choice.

Rust Stains on Limestone

Aesthetically, the limestone provides a light colored building element which gives visual "lift" to the building. Stains on this element compromises this aesthetic effect.

Rust Stains on Limestone - Treatment Options

No Treatment: While the stains pose no physical threat to the limestone, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains

Rust Stains on Limestone - Treatment Recommendation

Remove Stains with Iron Chelating or Iron Reducing Poultice: This is the least damaging method which will remove the rust staining.

Rusting Iron Railings

Railings are provided primarily as a safety measure. If these railings fail at their bases, safety is not assured.

Rusting Iron Railings - Treatment Options

No Treatment: Corrosion will continue at ever-increasing rates.

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: This approach deals with the current level of corrosion and prevents any future corrosion. This process should be part of a periodic maintenance program on 2-3 year cycles.

Rusting Iron Railings - Treatment Recommendation

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: Demolition of the areaway concrete will obviate this approach at that location. Otherwise it is the standard treatment.

Failing Paint on Tin Roofs

Paint is applied to metal surfaces to provide protection and give color balance.

Failing Paint on Tin Roofs - Treatment Options

No Treatment: Corrosion and paint loss will occur.

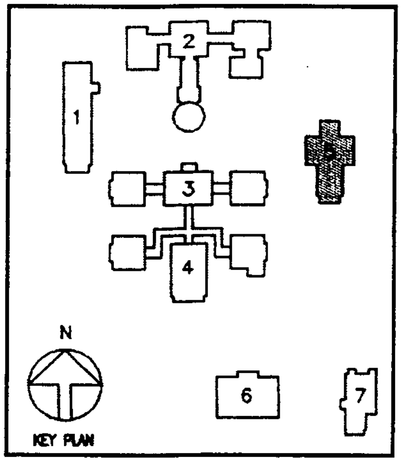
Scrape, Prime, and Paint: This approach deals with the current level of corrosion and any future corrosion as well as re-establishes the color balance on the elevation. This process should be part of a periodic maintenance program on 5-year cycles.

Failing Paint on Tin Roofs - Treatment Recommendation

Scrape, Prime, and Paint: This approach deals with the current level of corrosion and any future corrosion; it will also re-establish the color balance on the elevation. This process should be part of a periodic maintenance program on 5-year cycles.

Glossary located at end of document.

BUILDING 5: EXISTING EXTERIOR CONDITIONS



Introduction

Conditions on Building 5 at the Potomac Annex are generally good. On Building 5 the yellow brickwork exhibits light and superficial soiling requiring little or no intervention. The granite on this building shows more moderate soiling. The use of window air conditioners has resulted in staining of some granite elements such as window sills and the water table or band course.

The pointing on this building is generally in excellent condition, with notable exception. On Building 5 where granite building elements such as keystones, sills and band courses meet brickwork, the mortar joints are open. In addition the end joints of canted brick lintels are consistently open. Further, the butt joints on the granite band courses at ground level are open or have been badly repointed or caulked. From these open joints on the band course, cracks have emanated and open joints extend to the first floor granite window sills and, in some cases, to second floor windows. Damage to brickwork other than stress cracks is minor.

With the exception of the columns on Building 5, wooden elements require only typical periodic maintenance consisting of scraping and painting.

Concrete has generally not fared well in this building. Sidewalks and associated walls exhibit deterioration which is at times severe.

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning.

Brick

General Conditions and Soiling

Yellow, unglazed brick is the primary construction material for Building 5. Overall the brick is in good condition while exhibiting light, superficial soiling.

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 5 in association with the vertical and head joints of the granite water table. The stresses associated with the open joints transfer up and through the bricks above, following the mortar joint pattern. Frequently, they continue up to the first floor granite window sills (Figure 5-1). Articulated brick corners have consistently open joints where the corners meet the plane of the brick walls (Figure 5-2). These conditions are pervasive on all elevations of Building 5. Stress cracks and open joints are also associated with the loading area on the north elevation of Building 5 (Figure 5-3).

Other Open Joints

The head of the windows in Building 5 consist of wedged shaped brick voussoirs with granite keystones. The joints between the keystones and brick are consistently open as are the joints between the brick voussoir at each end of the window head trim and the surrounding brickwork of the wall.

Damaged Brick

The northwest corner of Building 5 has damaged brick. (Figure 5-4).

Concrete

Concrete is used at the portico (north) and two side porches (east and west elevations) on Building 5. The steps of the west porches are damaged (Figure 5-5) and rusted railings have damaged the concrete capstones (Figure 5-6).

Wood

Windows, dormers, cornices, and porches consist of painted wood. While the wood itself is in generally in good condition (windows in the dormers show more deterioration), most of these elements are in need of scraping, painting, and caulking. The main exception are the columns for the front porch, some of which show serious deterioration (Figure 5-7).

Copper

Copper leaders and roof flashing are in good condition. However, the leaders and gutters require cleaning.

Cast Iron

One wooden column on the front porch has been replaced with cast iron. The paint is peeling causing the iron to rust and stain the granite supports. (Figure 5-8).

Granite

Granite forms the water table which surrounds the building at the base of the first floor. These elements - like the granite keystones - are generally in good condition but are lightly to heavily soiled (Figure 5-9). The joints between juxtaposed stones are open or have been filled with caulk or poorly repointed (Figure 5-10). The bed joints and top joints for the granite water table are generally open. Run-off from window air conditioners has stained the granite. Granite window wells have open joints (Figure 5-11). Bitumen has been accidentally spattered on some granite window wells (Figure 5-12).

Iron Railings

Iron railings are generally in good condition, requiring only periodic scraping and painting. However, water entry at their bases has rusted some of the railings, causing damage to the concrete (Figure 5-6).

BUILDING 5: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin, but also expansion/contraction joints to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

<u>No Treatment</u>: Water will continue to deteriorate the wall with increasing intensity.

<u>Cut and Point</u>: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

<u>Cut and Point</u>: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 5 the stress cracking in the brick is related to the open head joints in the granite water table. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer to the weakest elements, then the mortar and finally the brick will crack. This allows more water to enter resulting in further, often more serious, deterioration of other building elements. This condition may also be caused by rusting iron anchors in window lintels and sills.

Glossary located at end of document.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked, Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This options returns the mechanical integrity of the wall and also provides an aesthetically superior solution.

Cracked and Deteriorating Concrete Capstones on West Porch

The concrete capstones have both an aesthetic and mechanical function. Capstones are added to cap or cover the exposed joints in a brick or concrete block wall or to cap or finish the top of a concrete wall. Pre-cast concrete capstones can be shaped to shed water (by canting and the use of a drip edge), thereby protecting the wall. In order to preserve the wall which they protect, the capstones require proper maintenance by repointing all deteriorated joints and replacing all cracked stones to match existing. Where poorly maintained posts of metal railings have caused cracking of the concrete capstone, they should be patched to prevent further damage.

Cracked and Deteriorating Concrete Capstones - Treatment Options

No Treatment: Deterioration will continue and become more severe. Current damage to the capstones is unsightly.

Repointing of Joints and Repair Using Concrete Patching Techniques: While this option slows deterioration, concrete patches are difficult to execute and may not match the existing concrete. The bitumen surrounding certain cross joints can be mechanically removed and the joints repointed with mortar.

Glossary located at end of document.

Demolish and Rebuild: This allows for the setting of a sleeve within the new capstone to receive the metal posts of the railings and re-setting of the capstones.

Cracked and Deteriorating Concrete Capstones - Treatment Recommendations

Demolish and Rebuild: This is the preferred repair. It eliminates a great deal of maintenance.

Deteriorating Concrete Steps on North, East and West Porches

Steps are needed to provide safe and easy access to buildings with different levels, deteriorating steps are a safety hazard.

Deteriorating Concrete Steps - Treatment Options

No Treatment: The concrete will continue to deteriorate at increasing rates and continue to pose a safety hazard.

Repair in Concrete: Deteriorated areas would be removed, rebar corrosion removed and then painted and patched with a sympathetic concrete material. This solution will be temporary and unsightly.

Demolish and Rebuild: This option is the most expensive, but the steps are badly damaged, and capstones and railing should be dealt with at the same time.

Deteriorating Concrete Steps - Treatment Recommendation

Demolish and Rebuild: This is the best option both visually and for safety; the rebuilt steps should be constructed with granite to match existing.

Peeling and Failing Paint on Wood

(Note: some dormer windows may need to be replaced.)

Paint not only protects wood from excessive moisture and ultra-violet light damage, but also decorates particular elements, establishing the tonal pattern on the building elevation. Periodically, the paint should be renewed to re-establish both of these purposes.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate. More paint will fail, therefore, compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Damaged Wood on North Porch Columns

The columns provide support for the portico roof. The paint on the columns is severely checked and peeling, indicating moisture within the columns.

Damaged Wood on North Porch Columns - Treatment Options

No Treatment: Wood will continue to rot and deteriorate.

Remove Rotted Wood; Replace with New Wood Elements: New pine or poplar wood bases will re-establish the structural integrity of the columns. Wood dutchmen can be used to replace small areas of rot. Other voids can be filled with epoxy wood filler. A method to increase the air circulation within the hollow column should be devised.

Damaged Wood on North Porch Columns - Treatment Recommendation

Remove Rotted Wood; Replace with New Wood Elements: This is the only viable option.

Blocked Copper Gutters and Leaders

Gutters and leaders are provided to conduct water off of the building. When they are not properly maintained, water will collect and expand, especially during cold weather, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Glossary located at end of document.

Clear Gutters and Leaders: There is no other acceptable option.

Rust Stains on Granite Band Course

Aesthetically, the granite band course not only provides a light colored building element which gives visual "lift" to the building, but it also helps shed water off of the wall. Stains on this element compromise the aesthetic effect.

Rust Stains on Granite Band Course - Treatment Options

No Treatment: While the stains pose no physical threat to the granite, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains. (See also Chapter 8. *Materials Cleaning Analysis*)

Rust Stains on Granite Band Course - Treatment Recommendation

Remove Stains with Iron Chelating Poultice: This is the least damaging method to remove the rust staining.

Rusting Iron Railings

(Note: See related deficiency, *Cracked and Deteriorating Concrete Capstones*, above.)

Railings are provided primarily as a safety measure. If these railings fail at their bases, safety is not assured.

Rusting Iron Railings - Treatment Options

No Treatment: Corrosion will continue at ever-increasing rates.

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: This approach deals with the current level of corrosion and prevents future corrosion. This process should be part of a periodic maintenance program on 2-3 year cycles.

Rusting Iron Railings - Treatment Recommendation

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: Demolition of the areaway concrete will obviate this approach at that location. Otherwise it is the standard treatment.

Rusting Iron Replacement Column Plinth on North Portico

Maintenance of this plinth is essential to the structural integrity of the entrance portico.

Rusting Iron Replacement Column Plinth on North Portico - Treatment Options

No Treatment: Corrosion will continue and eventually threaten the structure of the portico.

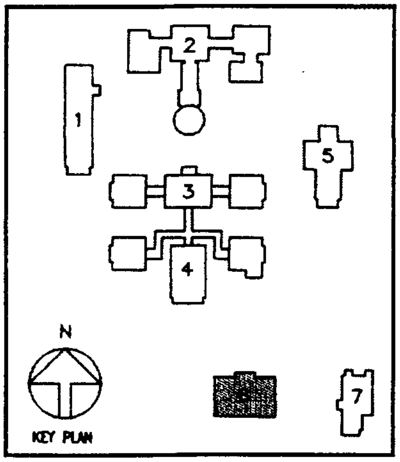
Scrape, Prime and Paint: Scraping will remove the existing corrosion. Priming with a carefully selected metal primer will prevent further rusting. Fresh paint will unite the column paint with the existing paint scheme and protect the primer. This repair will not prevent rust from continuing to form on the interior surface.

Replacement: Replace the existing metal plinth with a wooden plinth to match adjacent wooden plinths in material and profile. Coordinate this work with the work proscribed in Damaged wood on North Porch Columns section above.

Rusting Iron Replacement Column on North Portico - Treatment Recommendation

Replacement: Replace the existing metal plinth with a wooden plinth to match adjacent wooden plinths in material and profile. Coordinate this work with the work proscribed in the Damaged wood on North Porch Columns section above.

BUILDING 6: EXISTING EXTERIOR CONDITIONS



Introduction

Conditions on Building 6 at the Potomac Annex are generally good. On Building 6 the yellow brickwork exhibits light and superficial soiling requiring little or no intervention. The granite on this building shows more moderate soiling. The use of window air conditioners has resulted in staining of some granite elements such as window sills and the water table or band course.

The pointing on this building is generally in excellent condition, with notable exception. On Building 6 where granite building elements such as keystones, sills and band courses meet brickwork, the mortar joints are open. In addition the end joints of canted brick lintels are consistently open. Further, the butt joints on the granite band courses at ground level are either open, badly repointed, or caulked. From these open joints on the band course cracks have emanated and open joints extend to the first floor granite window sills and, in some cases, up to second floor windows. Damage to brickwork other than stress cracks is minor.

On Building 6, wooden elements require only typical periodic maintenance consisting of scraping and painting. Concrete has generally not fared well in this building. Sidewalks and associated walls exhibit deterioration which is at times severe.

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning.

Brick

General Conditions and Soiling

Yellow, unglazed brick is the primary construction material for Building 6. Overall the brick is in good condition while exhibiting light, superficial soiling.

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 6 in association with the vertical or head joints of the granite water table. The stresses associated with the open joints transfer up and through the brick above, following the mortar joint pattern. Frequently they continue up to the first floor granite window sills (Figure 6-1). In some cases these cracks extend below the water table to the granite basement window lintels (Figures 6-2 and 6-3). Articulated brick corners have consistently open joints where the corners meet the plane of the brick walls. These conditions are pervasive on all elevations. Brick work below grade on the west side of the front entrance shows efflorescence and open joints (Figure 6-4).

Other Open Joints

The head of the windows in Building 6 consist of wedged shaped brick voussoirs with granite keystones. The joints between the keystones and brick are consistently open as are the joints between the brick voussoir at each end of the window head trim and the surrounding brickwork of the wall.

Damaged Brick

Embedded metal anchors (purpose unknown) remain in place or have been removed, leaving holes in the masonry (Figure 6-5). The holes are unsightly while the metal anchors are sites of future damage by freezing water.

Concrete

Concrete steps and sidewalks leading to the basement on the west side of the entrance portico show signs of deterioration by expanding (rusting) iron railings (Figure 6-6) and otherwise general failure (Figures 6-7 and 6-8).

Wood

Windows, dormers, cornices, the portico and porches consist of painted wood. While the wood itself is generally in good condition, most of these elements are in need of scraping, painting and caulking.

Copper

Copper leaders and roof flashing are in good condition; however, leaders and gutters require cleaning.

Granite

Granite forms the water table which surrounds the building at the base of the first floor. These elements - like the granite keystones and basement window lintels and sills - are generally in good condition but are lightly to heavily soiled. The joints between juxtaposed stones are open or have been filled with caulk or too strong of a pointing mortar. The bed joints and the top horizontal joints for the granite water table are generally open. Run-off from window air conditioners has stained some of the granite.

Iron Railings

Iron railings are generally in good condition. They require periodic scraping and painting. Water entry at their bases has rusted some of the railings, causing damage to the concrete. (Figure 6-6).

BUILDING 6: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin, but also expansion/contraction joints to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

No Treatment: Water will begin or continue to deteriorate the wall with increasing intensity.

Cut and Point: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

Cut and Point: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 6 the stress cracking in the brick is related to the open head joints in the granite water table. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer from weakest elements to the mortar and then the brick will crack. This allows more water to enter resulting in further, often more serious, deterioration of other building elements. This condition may also be caused by rusting iron anchors in window lintels and sills.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Glossary located at end of document.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked, Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This options returns the mechanical integrity of the wall and also provides an aesthetically superior solution.

Holes and Metal Inserts in Brickwork

The holes and metal inserts appear to have been supports for signage. If allowed to remain within the brickwork, they will continue to deteriorate and expand, causing the brick to crack and spall. The holes offer entry ports for water causing subsequent freeze/thaw damage.

Holes and Metal Inserts in Brickwork - Treatment Options

No Treatment: The holes will continue to allow water to enter the wall, and the existing metal inserts will continue to rust. Both actions have the potential to cause unsightly damage to the brick.

Remove Inserts and Fill All holes: A sympathetic mortar mix with fine sand, cement, lime and pigment can be used to fill these holes.

Remove and Replace Brick: Brick can be cut out and replaced with matching brick and mortar.

Holes and Metal Inserts in Brickwork - Treatment Recommendations

Remove Inserts and Fill All holes: The holes are small enough such that a mortar replacement will not be unsightly, and it will be permanent.

Cracked and Deteriorating Concrete Steps and Sidewalks

(Note: See also *Rusting Iron Railings* below.)

Steps and sidewalks are needed to provide safe and easy access to buildings with different levels. Deteriorating steps are a safety hazard.

Cracked and Deteriorating Concrete Steps and Sidewalks - Treatment Options

No Treatment: The concrete deterioration will continue and become more severe. Current damage is unsafe and unsightly.

Repair with Concrete Patching Techniques: Deteriorated areas would be removed, rebar corrosion removed and then painted and patching with a sympathetic concrete material executed. While this solution will slow down the deterioration, it is difficult to execute well and could be unsightly.

Demolish and Rebuild: This option allows for complete repair of the rusting railings as well as re-establishing safe access.

Cracked and Deteriorating Concrete Steps and Sidewalks - Treatment Recommendation

Demolish and Rebuild: This is the best option for both visual and safety reasons.

Peeling and Failing Paint on Wood

Paint not only protects wood from excessive moisture and ultra-violet light damage, but also decorates particular elements, establishing the tonal pattern on the building elevation. Paint should be renewed to re-establish both of these purposes from time to time.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate, and more paint will fail, therefore compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Blocked Copper Gutters and Leaders

Gutters and leaders are provided to conduct water off of the building. When not properly maintained, water will collect and freeze during cold weather, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Clear Gutters and Leaders: This is no other choice.

Rust Stains on Granite Band Course

Aesthetically, the granite band course provides a light colored building element which gives visual "lift" to the building. Stains on this element compromise the aesthetic effect.

Rust Stains on Granite Band Course - Treatment Options

No Treatment: While the stains pose no physical threat to the granite, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains. (See also Chapter 8 *Materials Cleaning Analysis*)

Rust Stains on Granite Band Course - Treatment Recommendation

Remove Stains with Iron Chelating Poultice: This is the least damaging method to remove the rust staining.

Rusting Iron Railings

(Note: See related deficiency, *Cracked and Deteriorating Concrete Steps and Sidewalks*, above.)

Railings are provided primarily as a safety measure. If these railings fail at their bases, safety is not assured.

Rusting Iron Railings - Treatment Options

No Treatment: Corrosion will continue at ever-increasing rates.

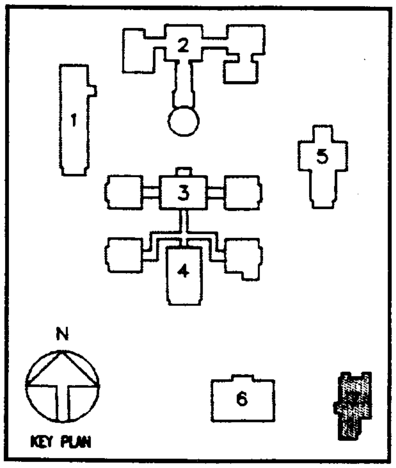
Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: This approach deals with the current level of corrosion and any future corrosion. This process should be part of a periodic maintenance program on 2-3 year cycles.

Rusting Iron Railings - Treatment Recommendation

(Note: The recommended treatment below is valid only as long as concrete steps and walks continue to be patched. If the existing concrete is replaced, then the correct construction detail for installing metal posts in concrete should be used.)

Excavate, Scrape, Prime, Paint, Fill with Concrete, Caulk: It is the standard repair for this deficiency.

BUILDING 7: EXTERIOR EXISTING CONDITIONS



Introduction

Conditions on Building 7 at the Potomac Annex are generally good. On Building 7 the yellow brickwork exhibits light and superficial soiling requiring little or no intervention. The granite on this building shows more moderate soiling. The use of window air conditioners has resulted in staining of some granite elements such as window sills and the water table or band course.

The pointing on this building is generally in excellent condition, with notable exception. On Building 7 where granite building elements such as keystones, sills and band courses meet brickwork, the mortar joints are open. In addition the end joints of canted brick lintels are consistently open. Further, the butt joints on the granite band courses at ground level are open or have been badly repointed or caulked. From these open joints on the band course, cracks have emanated and open joints extend to the first floor granite window sills and, in some cases, up to second floor windows. Damage to brickwork other than stress cracks is minor.
On Building 7, wooden elements require only typical periodic maintenance consisting of scraping and painting. Concrete has generally not fared well in this building. Sidewalks and associated walls exhibit deterioration which is at times severe.

Metal railings are in good condition with some rust evident where they are anchored into the concrete. Copper gutters and leaders - some recently replaced - are in good condition but require periodic cleaning.

Brick

General Conditions and Soiling

Yellow, unglazed brick is the primary construction material for Building 7. Overall the brick is in good condition while exhibiting light, superficial soiling. Bitumen has been spattered on the brickwork when waterproofing repairs were executed (Figure 7-1).

Stress Cracks and Open Joints

Stress cracks and open joints are found on Building 7 in association with the vertical or head joints of the granite water table. The stresses associated with the open joints transfer up and through the brick above, following the mortar joint pattern. Frequently they continue up to the first floor granite window sills. Articulated brick corners have consistently open joints where the corners meet the plane of the brick walls. These conditions are pervasive on all elevations. Semi-round brick arches also have open mortar joints (Figure 7-2). Brickwork near a concrete retaining wall contains open joints due to shifting of the concrete wall (Figure 7-3).

Other Open Joints

The head of the windows in Building 7 consist of wedged shaped brick voussoirs with granite keystones. The joints between the keystones and brick are consistently open as are the joints between the brick voussoir at each end of the window head trim and the surrounding brickwork of the wall (Figure 7-4).

Concrete

Concrete is used for the walkways and nearby walls as well as a retaining wall on Building 7. The tops of the walls associated with walkways have been repaired in the past, and these repairs are failing (Figure 7-5). Some concrete stucco is also failing where it has been directly applied to brickwork (Figure 7-6). A concrete retaining wall on the west elevation near the main entrance portico shows efflorescence and some bulging (Figure 7-7). Concrete bases for the piers under the entrance portico are damaged (Figure 7-8). Other sidewalk walls have damaged capstones Figure 7-9).

Wood

Windows, dormers, cornices, the portico and the sun porch consist of painted wood. While the wood itself is generally in good condition, most of these elements (especially small dormers) are in need of scraping, painting, and caulking.

Copper

Copper leaders and roof flashing are in good condition. However, leaders and gutters require cleaning.

Granite

Granite forms the water table which surrounds the building at the base of the first floor. These elements - like the granite keystones - are generally in good condition but are soiled in a range from light to heavy. However, the joints between juxtaposed stones are open or have been filled with caulk. The bed joints and the top horizontal joints for the granite water table are generally open. Run-off from window air conditioners has stained some of the granite. Granite steps exhibit failing pointing and caulking (Figure 7-10).

Iron Railings

Iron railings are generally in good condition, requiring periodic scraping and painting.

BUILDING 7: EXTERIOR TREATMENT OPTIONS AND RECOMMENDATIONS

Open Mortar Joints in Brick and Stone Elements

Brick and stone construction elements are pointed with mortar to provide not only a watertight skin, but also expansion/contraction joints to buildings. Pointing requires periodic maintenance. Where the mortar is cracked or missing, water can enter the wall causing deterioration of metal construction elements or interior decorative materials such as plaster or wood.

Open Joints - Treatment Options

No Treatment: Water will begin or continue to deteriorate the wall with increasing intensity.

Cut and Point: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Open Joints - Treatment Recommendation

Cut and Point: There is no viable alternative to this approach.

Stress Cracks in Brickwork

Building stresses can be transferred from one element to another. At Building 7 the stress cracking in the brick is related to the open head joints in the granite water table. Moisture entering the wall through open joints has caused expansion/contraction stresses within the wall. Due to the nature of masonry construction, these stresses easily transfer from the weakest elements, to the mortar and finally the brick will crack. This allows more water to enter which results in further, often more serious, deterioration of other building elements.

Stress Cracks, Cracked or Spalled brick - Treatment Options

(Note: Treatments discussed here are for cracked brick. Open mortar joints associated with the stress cracks should be cut out and repointed as above.)

No Treatment: Water will continue to cause further deterioration of building elements.

Epoxy Repair: Structural epoxies can mend broken bricks, but this technique is often difficult to execute and unsightly when completed.

Remove and Replace Brickwork: Bricks are cut out and replacements that match existing in texture, color and size are reset in mortar to match surrounding pointing in color, texture, and profile. Retain as much of the original materials as posisble; replacement material should match, as closely as possible, the original material. If rusting metal sills or lintels are found, remove them and install stainless steel replacements. Where bricks have been damaged by impact, install protective devices such as guard rails and stanchions.

Stress Cracks, Cracked, Spalled Brickwork - Treatment Recommendation

Remove and Replace Brickwork: This options returns the mechanical integrity of the wall and also provides an aesthetically superior solution.

Cracked and Deteriorating Concrete Walkways and Wall Capstones

Walkways and wall capstones are needed to provide safe and easy access to buildings as well as aesthetic purposes.

Cracked and Deteriorating Concrete Walkways and Wall Capstones - Treatment Options

No Treatment: The concrete deterioration will continue and become more severe. Currently, the damaged walkways are unsafe and unsightly.

Repair with Concrete Patching Techniques: Deteriorated areas would be removed, rebar corrosion removed and then painted and patching with a sympathetic concrete material executed. While this solution will slow down the deterioration, it is difficult to execute well and could be unsightly.

Demolish and Rebuild: This option allows for complete repair as well as re-establishing safe access.

Cracked and Deteriorating Concrete Walkways and Wall Capstones - Treatment Recommendation

Demolish and Rebuild: This is the best option both visually and for safety.

Bulging Concrete Retaining Wall

The pressure of juxtaposed earth combined with hydrostatic water pressure and salt crystallization are strong enough forces to shift and cause retaining walls to bulge.

Bulging Concrete Retaining Wall - Treatment Options

No Treatment: Shifting or bulging of the wall will continue and may ultimately lead to unsafe conditions.

Excavate, Waterproof, Cut and Point: Earth is excavated from next to the wall, the waterproofing skin renewed. This will keep the wall in its current configuration.

Rebuild Wall: The existing wall is demolished. Earth is excavated and the wall is rebuilt with proper waterproofing.

Bulging Concrete Retaining Wall - Treatment Recommendation

Rebuild Wall: Continued movement of this wall could jeopardize the support for the entrance.

Failed Concrete Stucco

Stucco has been applied for decorative purposes. When it was installed, the proper surface preparation was omitted.

Failed Concrete Stucco - Treatment Options

No Treatment: The stucco presents no real hazard but will continue to fall off in a random manner.

Remove Stucco on Decorative Brick Only: Remove the existing stucco with hand tools from the yellow semi-glazed brick.

Failed Concrete Stucco - Treatment Recommendations

Remove Stucco on Decorative Brick Only: This requires little intervention with little risk of damage to the brick.

Deteriorating Concrete Bases for Brick Piers

The concrete bases provide support for entrance piers. If they become compromised structurally, the piers will fail, causing extensive damage to the entrance portico above.

Deteriorating Concrete Bases for Brick Piers - Treatment Options

No Treatment: Further deterioration of the concrete will ultimately jeopardize the piers.

Repair with Concrete Patching Techniques and Waterproof: Excavation of the earth near the bases can be followed by patching with new concrete. After the concrete cures, it should be waterproofed before the earth is pushed back into place. This will slow or stop the current deterioration.

Deteriorating Concrete Bases for Brick Piers - Treatment Options

Repair with Concrete Patching Techniques and Waterproof: Complete demolition is not necessary since little of these bases is visible. This repair will adequately extend the lifetime of the bases.

Peeling and Failing Paint on Wood

Paint not only protects wood from excessive moisture and ultra-violet light damage, but also decorates particular elements, establishing the tonal pattern on the building elevation. Paint should be renewed to re-establish both of these purposes from time to time.

Peeling and Failing Paint - Treatment Options

No Treatment: Wood elements will continue to deteriorate. More paint will fail therefore compromising the aesthetics of the building.

Scrape, Prime, Paint and Caulk: This should be part of the normal maintenance program every 5 to 7 years.

Peeling and Failing Paint - Treatment Recommendation

Scrape, Prime, Paint and Caulk: There is no other viable choice.

Blocked Copper Gutters and Leaders

Gutters and leaders are provided to conduct water off of the building. When they are not properly maintained, water will collect and expand, especially during cold weather, causing more extensive damage to the storm drainage system as well as other parts of the building.

Blocked Copper Gutters and Leaders - Treatment Options

No Treatment: Continued deterioration of paint and wood in areas where water builds up above the blockage.

Clear Gutters and Leaders: This should be part of a yearly maintenance program.

Blocked Copper Gutters and Leaders - Treatment Recommendation

Clear Gutters and Leaders: There is no other acceptable option.

Rust Stains on Granite Band Course

Aesthetically, the granite band course provides a light colored building element which gives visual "lift" to the building. Stains on this element compromise the aesthetic effect.

Rust Stains on Granite Band Course - Treatment Options

No Treatment: While the stains pose no physical threat to the granite, the aesthetic problems are obvious.

Remove Stains with Iron Chelating Poultice: Treatment with clay poultices of ammonium thioglycolate will remove these stains. (See also Chapter 8 *Materials Cleaning Analysis*.)

Rust Stains on Granite Band Course - Treatment Recommendation

Remove Stains with Iron Chelating Poultice: This is the least damaging method to remove the rust stains.

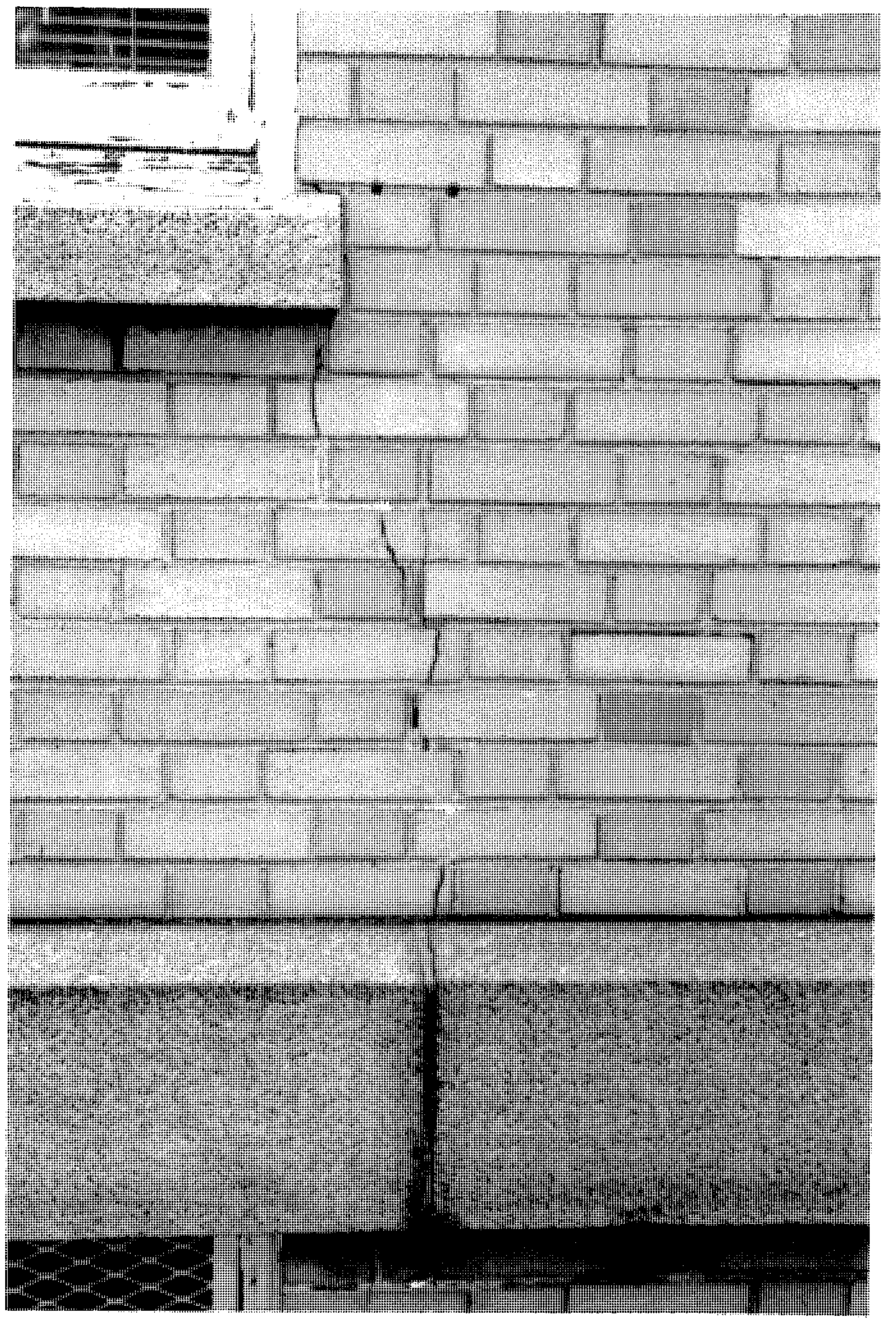


Figure 1-1

Location: North Elevation of Building 1 at West End
Problem: Stress crack (and open joints) from granite water table joint to first floor window
Cause of Problem: Freezing water in open joints of water table and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 1-2

Location: East Elevation of Building 1 at North End
Problem: Stress crack (and open mortar joints) between first and second floor windows
Cause of Problem: Freezing water in open joints and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 1-3

Location: East Elevation of Building 1 in South Areaway
Problem: Open mortar joints
Cause of Problem: Freezing water in open joints of granite water table.
Suggested Remedy: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

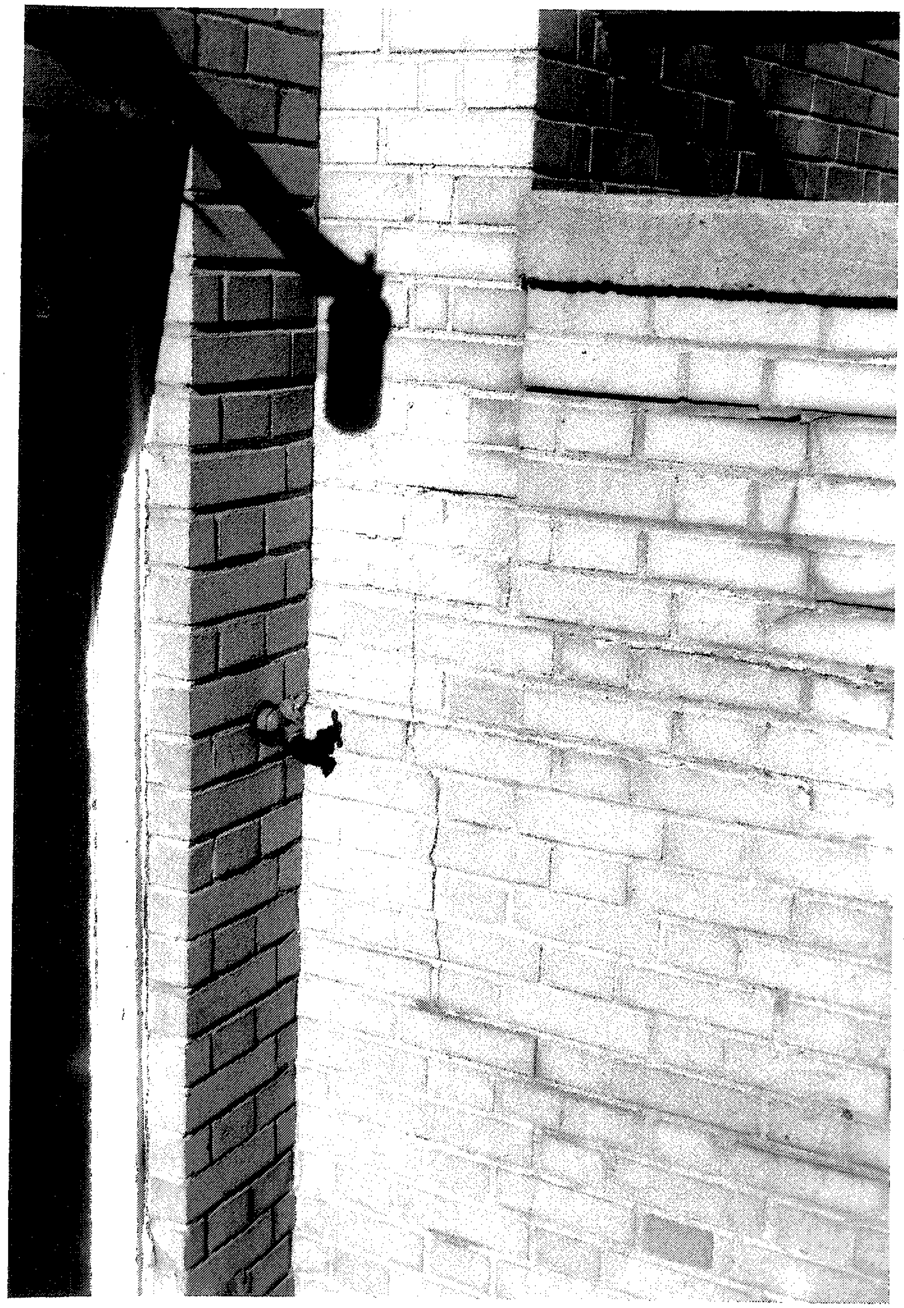


Figure 1-4

Location: East Elevation of Building 1 in Central Areaway
Problem: Open mortar joints and stress cracks in brickwork
Cause of Problem: Freezing water in open joints.
Suggested Remedy: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile. Crack brick should be removed and then replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 1-5

Location: East Elevation of Building 1 in South Areaway
Problem: Open and badly repointed joints associated with iron railings
Cause of Problem: Freezing water in open joints, rusting iron railings
Suggested Remedy: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

Figure 1-6

Location: East Elevation of Building 1 at North End
Problem: Open joints between granite keystones and brick voussoirs
Cause of Problem: Freezing water in open joints
Suggested Remedy: Existing mortar should be raked from the joints to a minimum depth of 3/4 inches. Repoint joints with fresh mortar that matches existing pointing mortar in color, texture and profile.

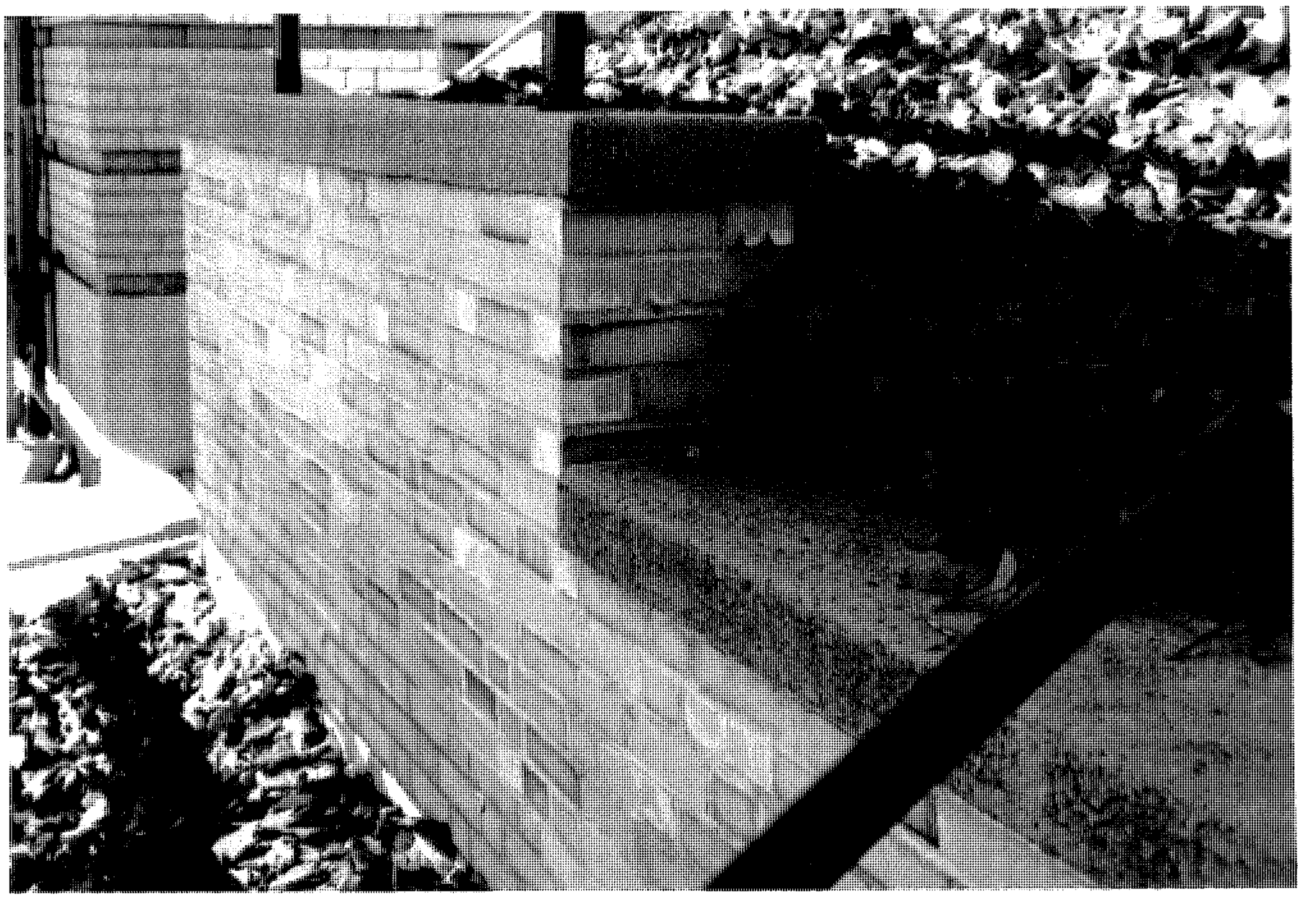


Figure 1-7

Location: South Elevation of Building 1 near South Areaway
Problem: Bulging and efflorescing brick retaining wall
Cause of Problem: Movement and freezing of water in the wall
Suggested Remedy: Earth should be excavated from next to the wall, the waterproofing skin renewed. The opposite side of the wall is cut and repointed.

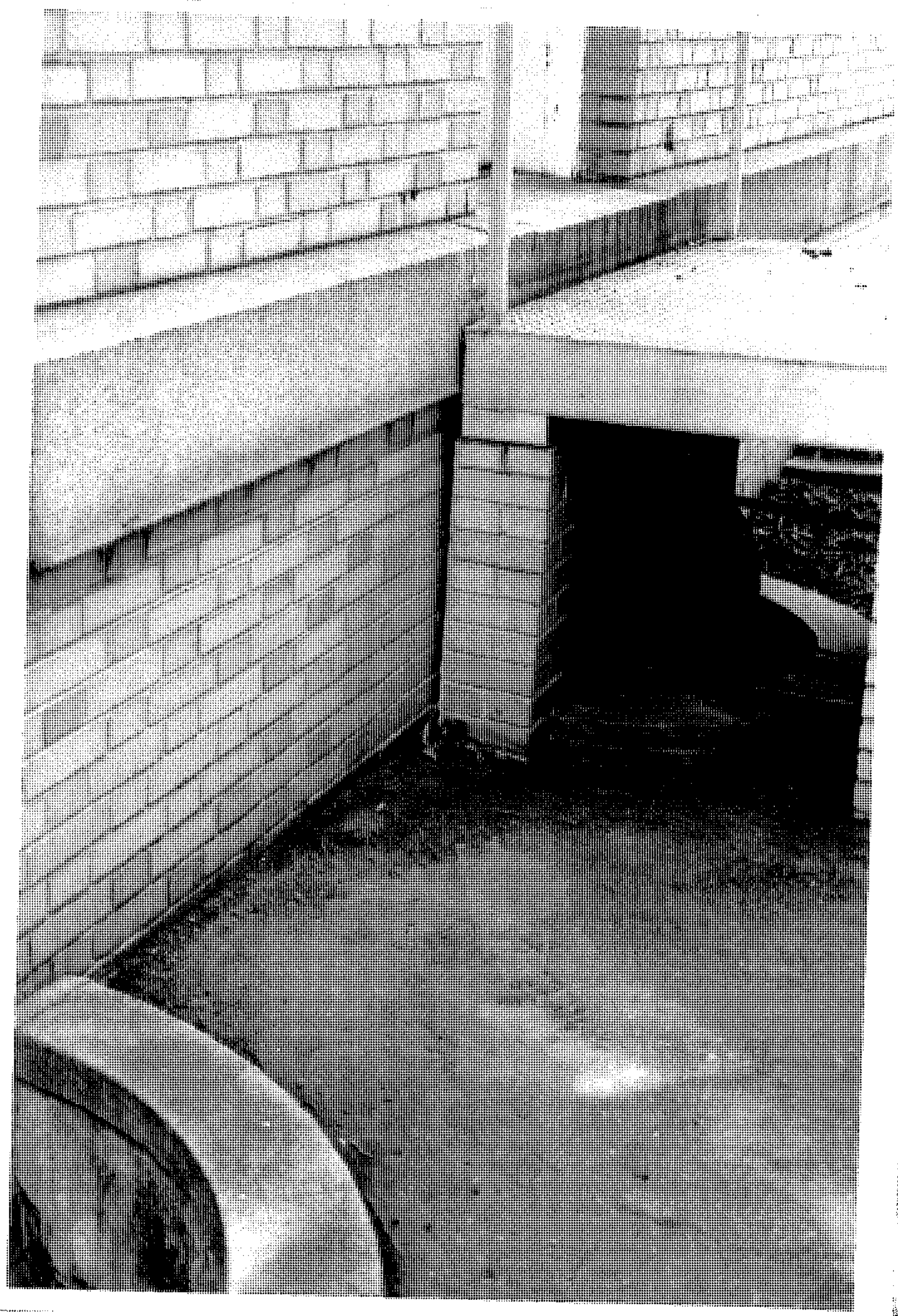


Figure 1-8

Location: North Elevation of Building 1 at Central Steps
Problem: Shifting of brick piers for steps
Cause of Problem: Rear piers not anchored to walls
Suggested Remedy: Rebuild piers anchoring rear ones to the wall

Figure 1-9

Location: Northeast Corner of Building 1
Problem: Damaged brick
Cause of Problem: Impact from vehicles
Suggested Remedy: Brick should be removed and replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 1-10

Location: East Elevation of Building 1 in Central Area
Problem: Spalled brick
Cause of Problem: Freezing water in open joints and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 1-11

Location: East Elevation of Building 1 at North End
Problem: Movement of concrete window wells
Cause of Problem: Freezing water in joints between brick wall and window well
Suggested Remedy: Demolish and rebuild

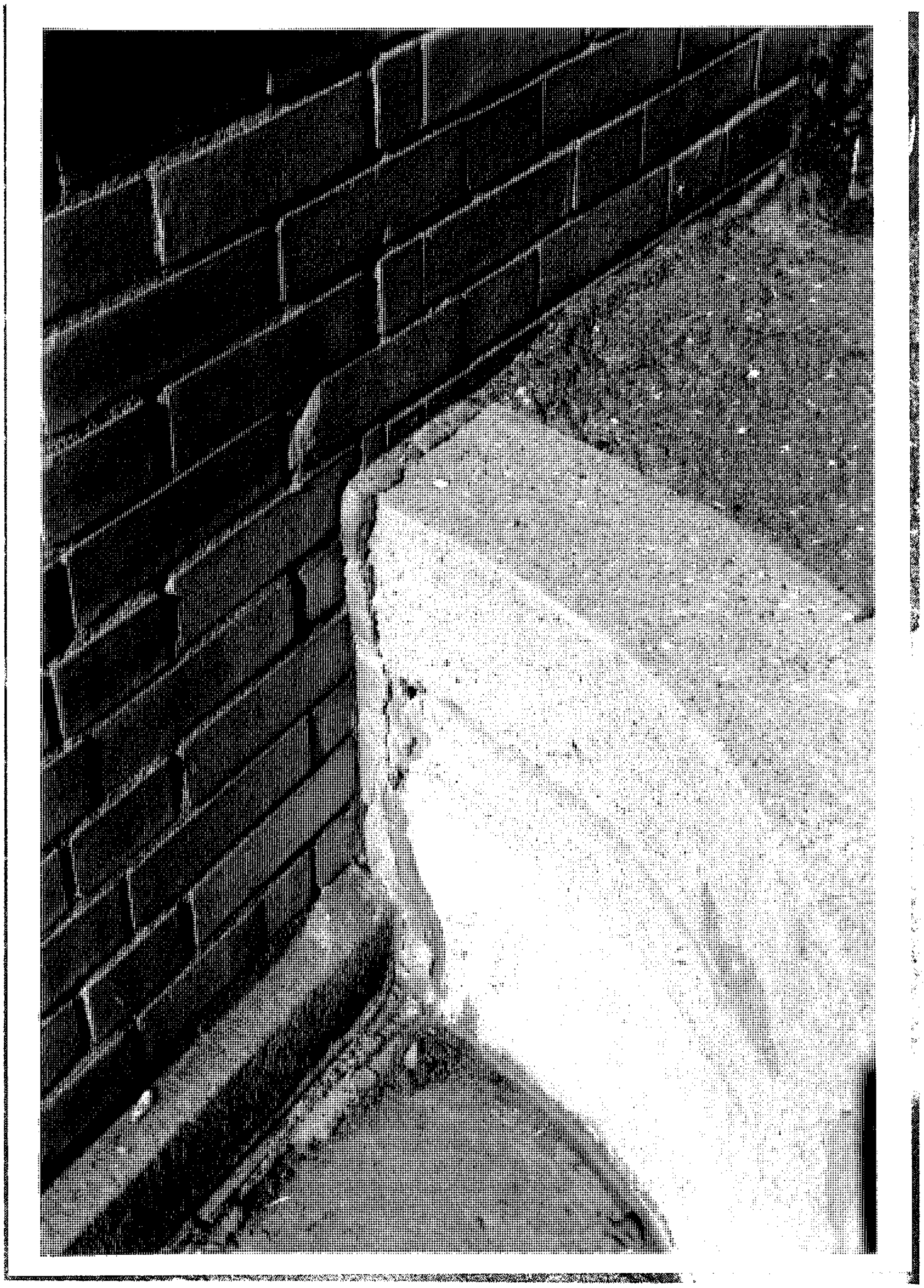


Figure 1-12

Location: East Elevation of Building 1 in Central Area
Problem: Failure of joint between brick walls and concrete window wells
Cause of Problem: Freezing water in joints between brick wall and window well
Suggested Remedy: Demolish and rebuild

Figure 1-13

Location: East Elevation of Building 1 at North End
Problem: Damaged tops of concrete window wells
Cause of Problem: Freezing water and movement of window wells
Suggested Remedy: Demolish and rebuild

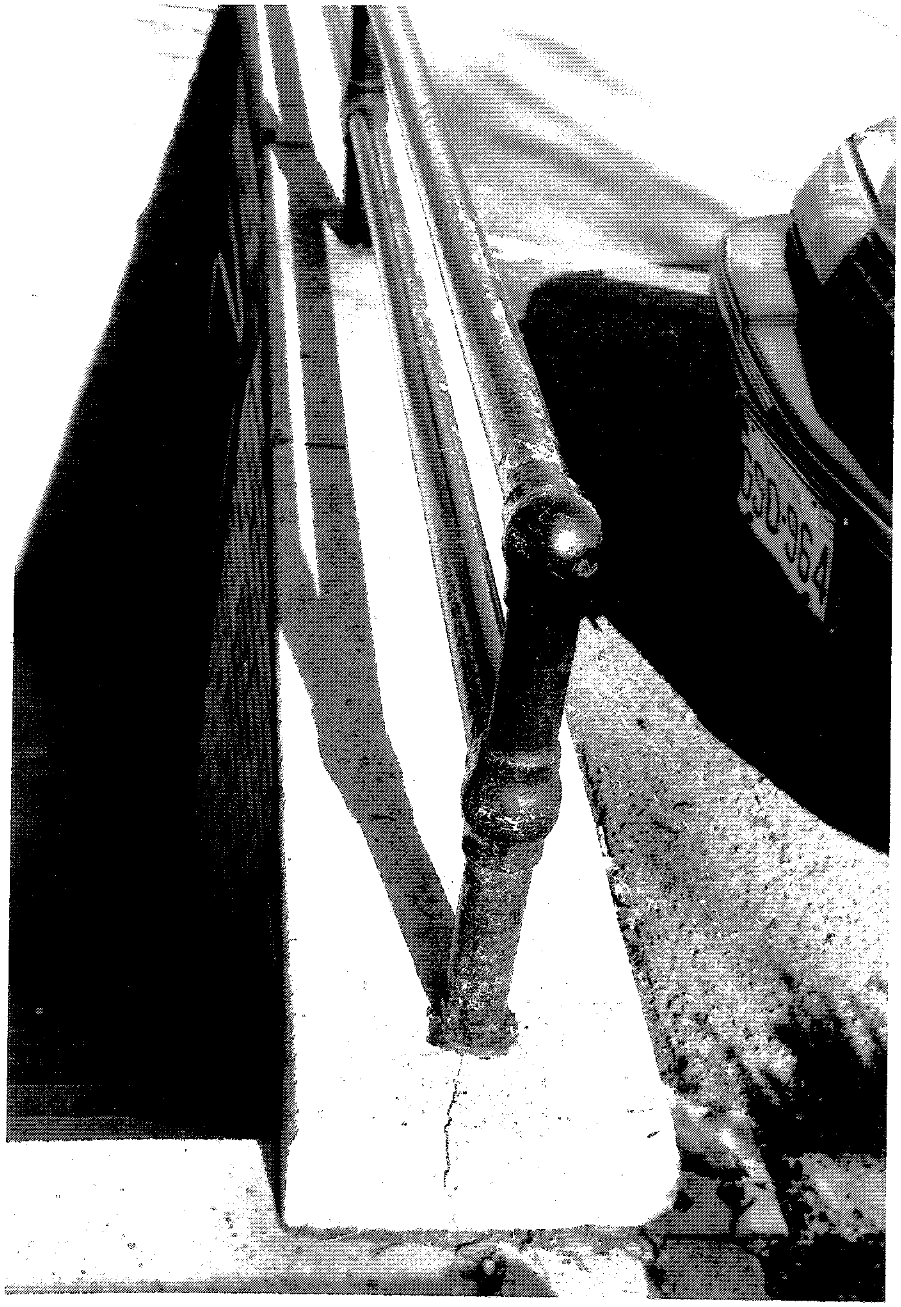


Figure 1-14

Location: East Elevation of Building 1 in Central Areaway
Problem: Damaged concrete capstones
Cause of Problem: Rusting iron railings
Suggested Remedy: Demolish and rebuild in concrete

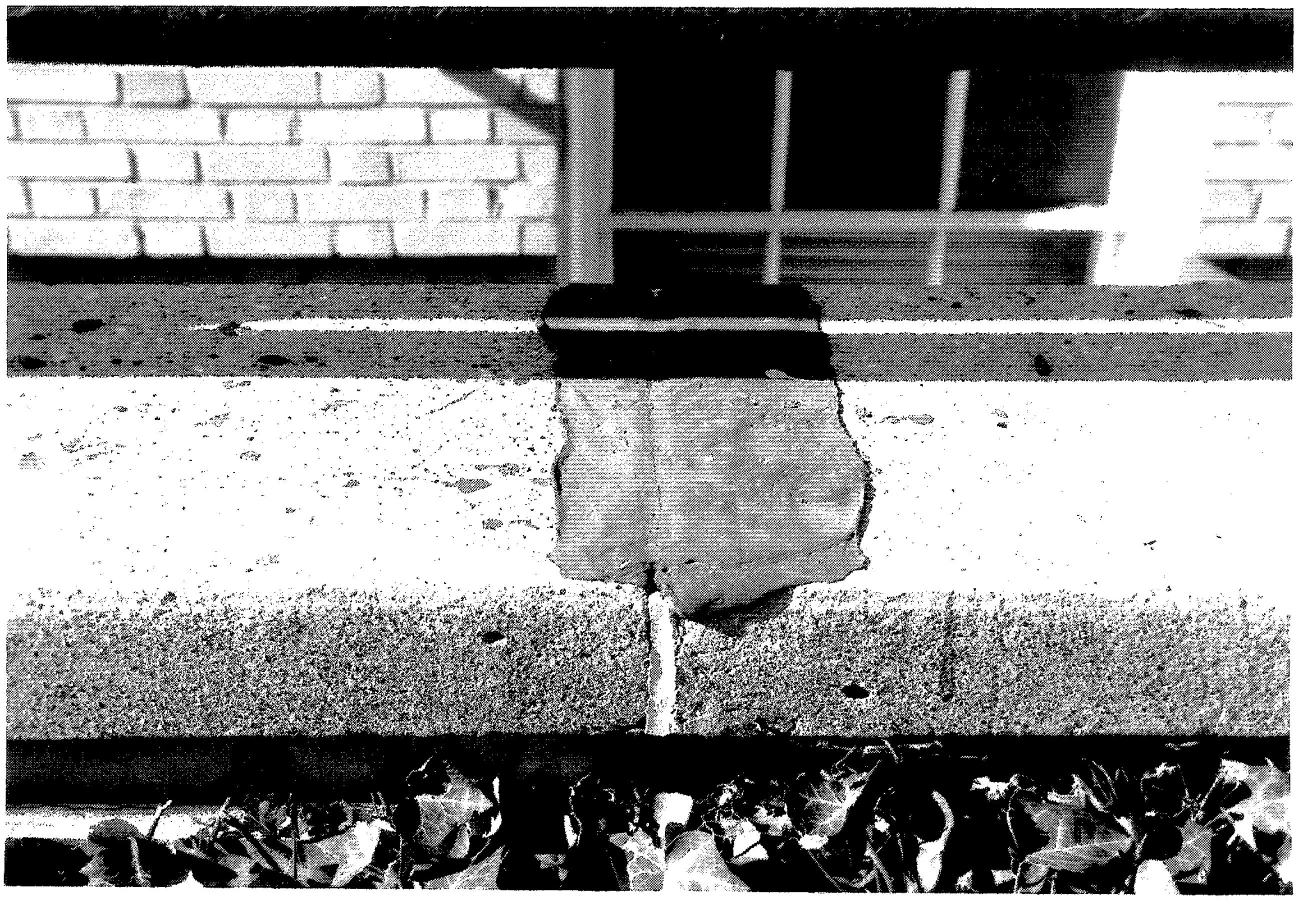


Figure 1-15

Location: East Elevation of Building 1 in South Areaway
Problem: Bitumen repairs to concrete capstone joints
Cause of Problem: Improper maintenance procedures
Suggested Remedy: Remove bitumen; cut and repoint joint (if capstones are replaced this remedy is unnecessary)

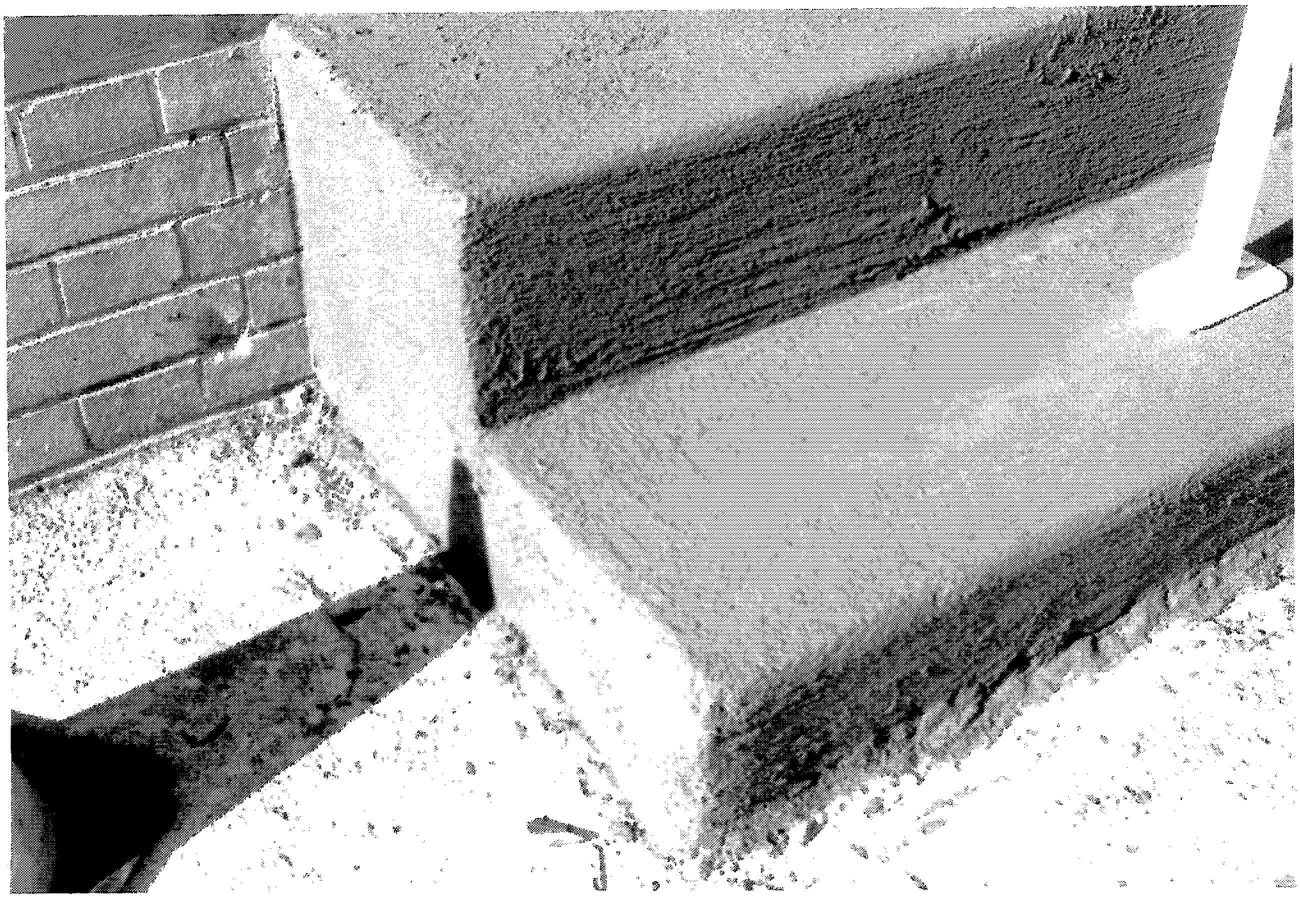


Figure 1-16

Location: East Elevation of Building 1 at South Entryway
Problem: Cementitious coating on concrete steps
Cause of Problem: Improper maintenance procedures
Suggested Remedy: Demolish and repour concrete slab

Figure 1-17

Location: South Elevation of Building 1 at South Areaway
Problem: Cracked concrete arches
Cause of Problem: Water penetration due to damage concrete slab
Suggested Remedy: Demolish and repour concrete slab and arches

Figure 1-18

Location: South Elevation of Building 1 near Southwest Corner
Problem: Cracked concrete window "lintel"
Cause of Problem: Water penetration and rusting rebar
Suggested Remedy: Rebar should be cleaned and painted and a cement patch installed

Figure 1-19

Location: East Elevation of Building 1 at North End
Problem: Damage woodwork and paint
Cause of Problem: Water penetration due to blocked gutter and leader
Suggested Remedy: Clear and maintain gutters and leaders.

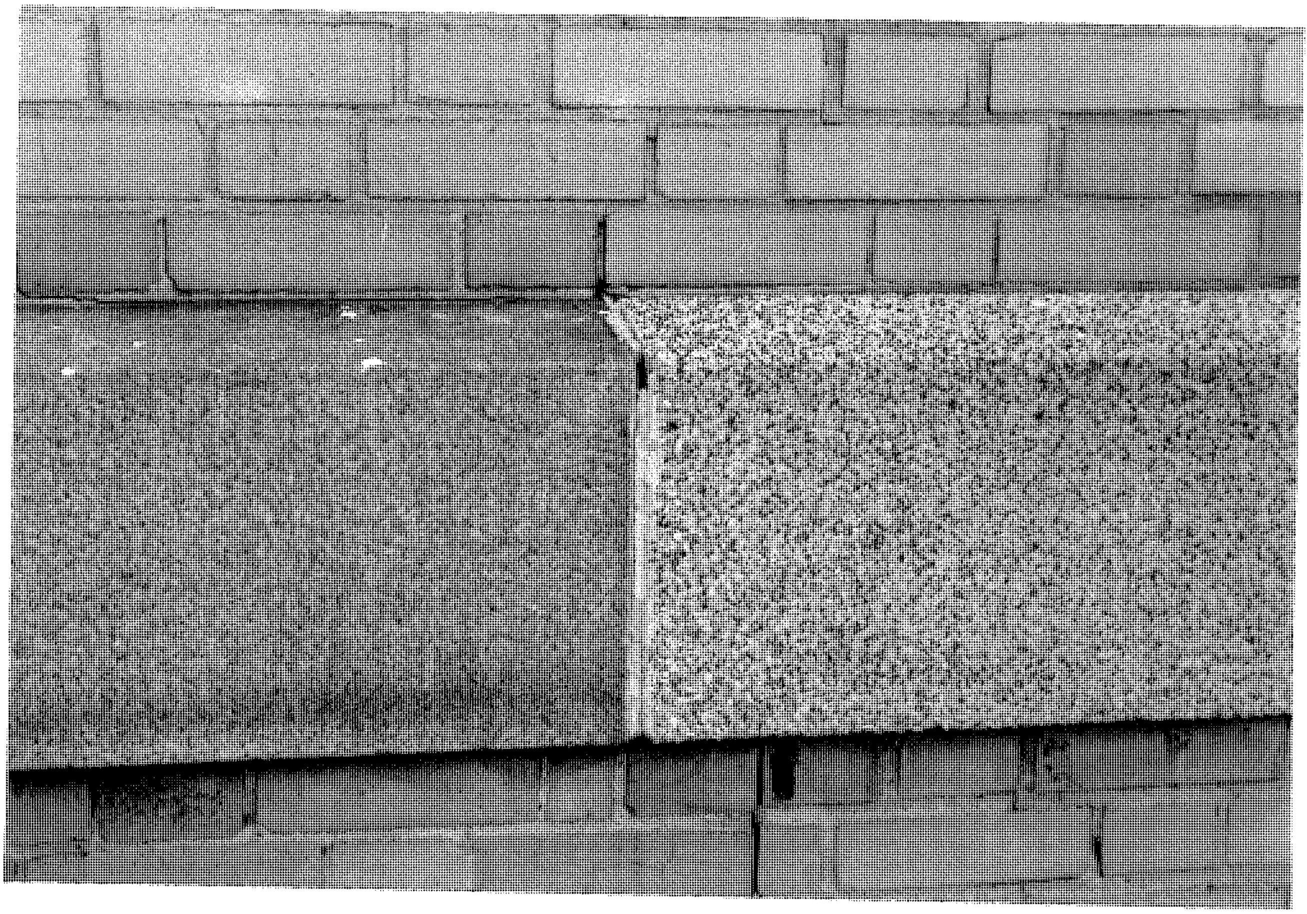


Figure 1-20

Location: North Elevation of Building 1 at near East End
Problem: Open mortar joints
Cause of Problem: Susceptibility of vertical joints to water run-off
Suggested Remedy: Cut and point (see Chapter VIII. Mortar Analysis for mortar suggestions)

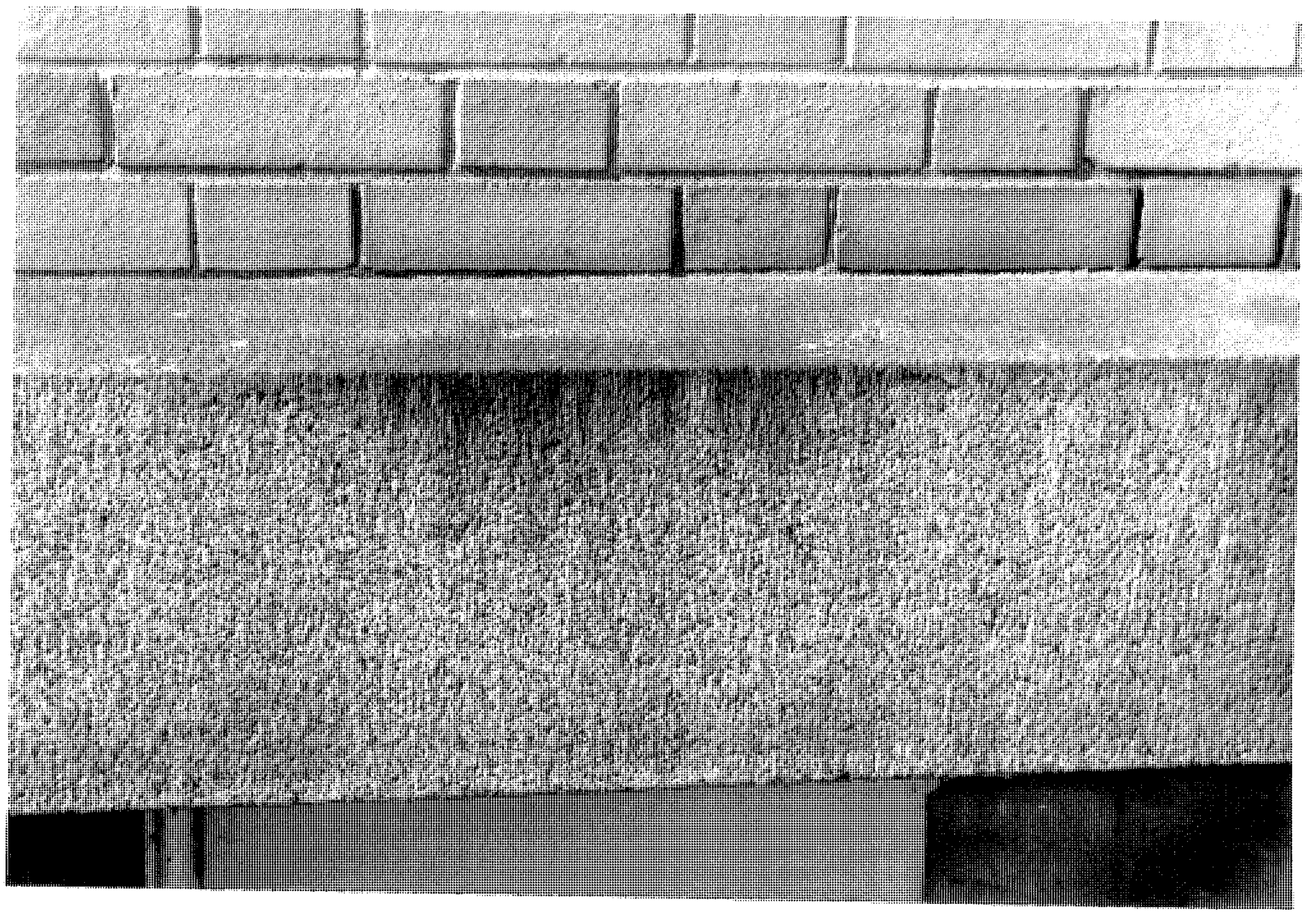


Figure 1-21

Location: East Elevation of Building 1 at near North Entrance
Problem: Rust stains on granite water table
Cause of Problem: Run-off-from window air conditioners
Suggested Remedy: Poultice with iron-chelating agent

Figure 3-1

Location: West Elevation of Building 3 on West Pavilion
Problem: Mottled soiling of buff brick and light soiling of white brick
Cause of Problem: Atmospheric pollution
Suggested Remedy: The buff brick will not clean by conventional or unconventional methods (see also Chapter VIII. *Materials Cleaning Analysis*)

Figure 3-2

Location: North Elevation of Building 3 near West Pavilion
Problem: Damage brick
Cause of Problem: Unknown but may be poorly fabricated brick
Suggested Remedy: There is no remedy other than replacement of all buff brick

Figure 3-3

Location: North Elevation of Building 3 near West Pavilion
Problem: Bitumen deposits on brick
Cause of Problem: Poorly executed maintenance procedures
Suggested Remedy: Remove with solvent poultice (details are discussed in Chapter VIII. *Materials Cleaning Analysis*)

Figure 3-4

Location: South Elevation of Building 3 on East Pavilion
Problem: Damaged brick
Cause of Problem: Installation of window grates
Suggested Remedy: Remove inserts and fill all holes

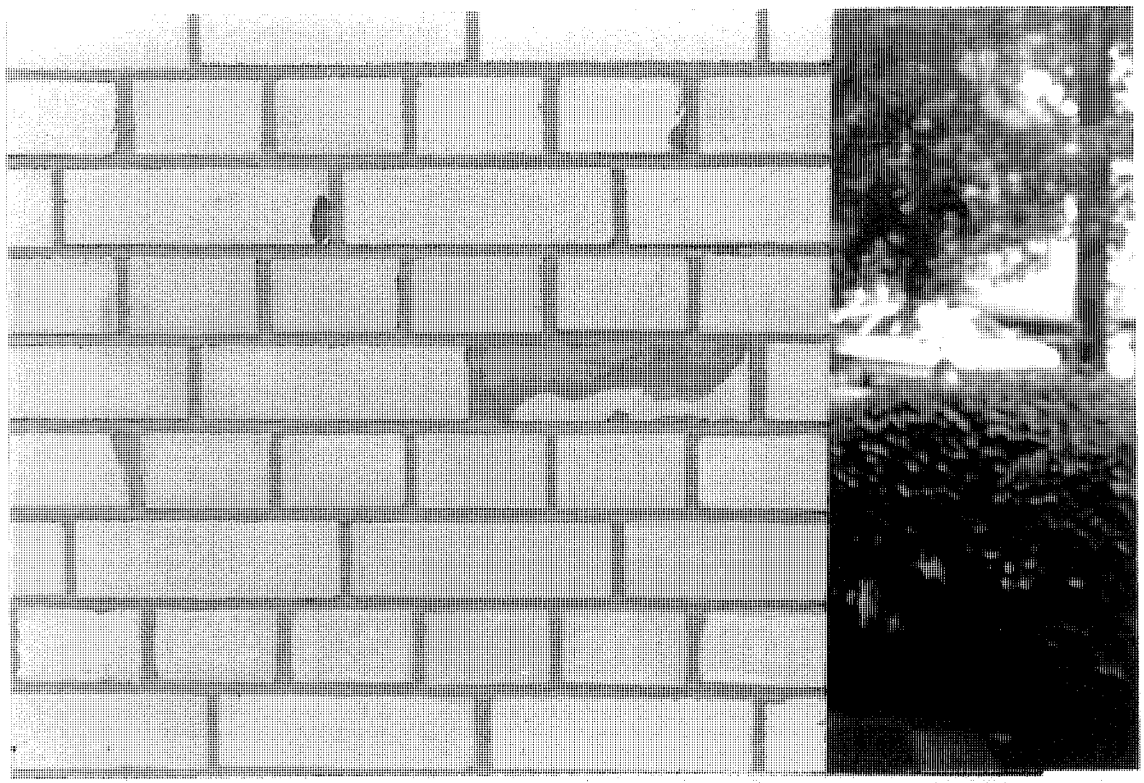


Figure 3-5

Location: East Elevation of Building 3 on West Pavilion
Problem: Damaged brick
Cause of Problem: Unknown but may be freezing water or impact damage
Suggested Remedy: Replace with matching brick and mortar

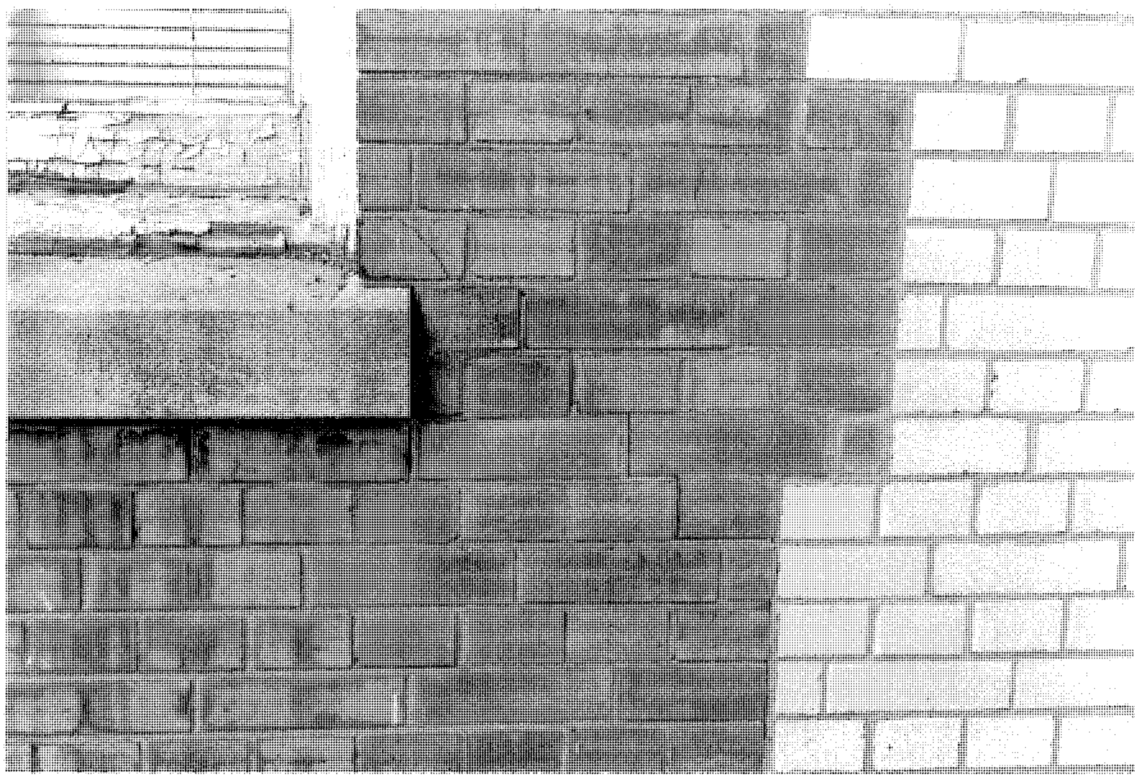


Figure 3-6

Location: East Elevation of Building 3 on East Pavilion
Problem: Open joints and stress cracks
Cause of Problem: Freezing water in open joints and/or rusting of iron anchors
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

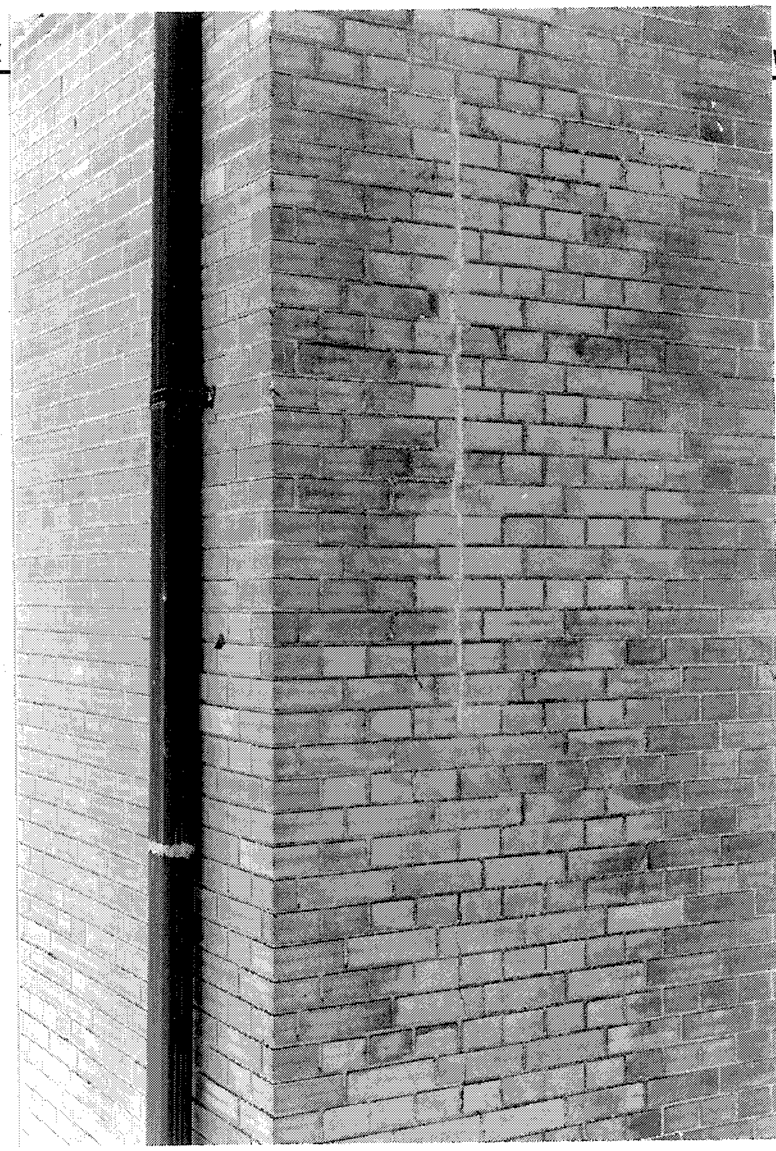


Figure 3-7

Location: South Elevation of Building 3 at West Corner
Problem: Stress crack in brick (caulked)
Cause of Problem: Unknown but possibly differential heat stress
Suggested Remedy: Remove brickwork and replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile

Figure 3-8

Location: East Elevation West Pavilion on North Side of Building 3
Problem: Caulked open joints
Cause of Problem: Improper maintenance
Suggested Remedy: Remove caulk and repoint with mortar

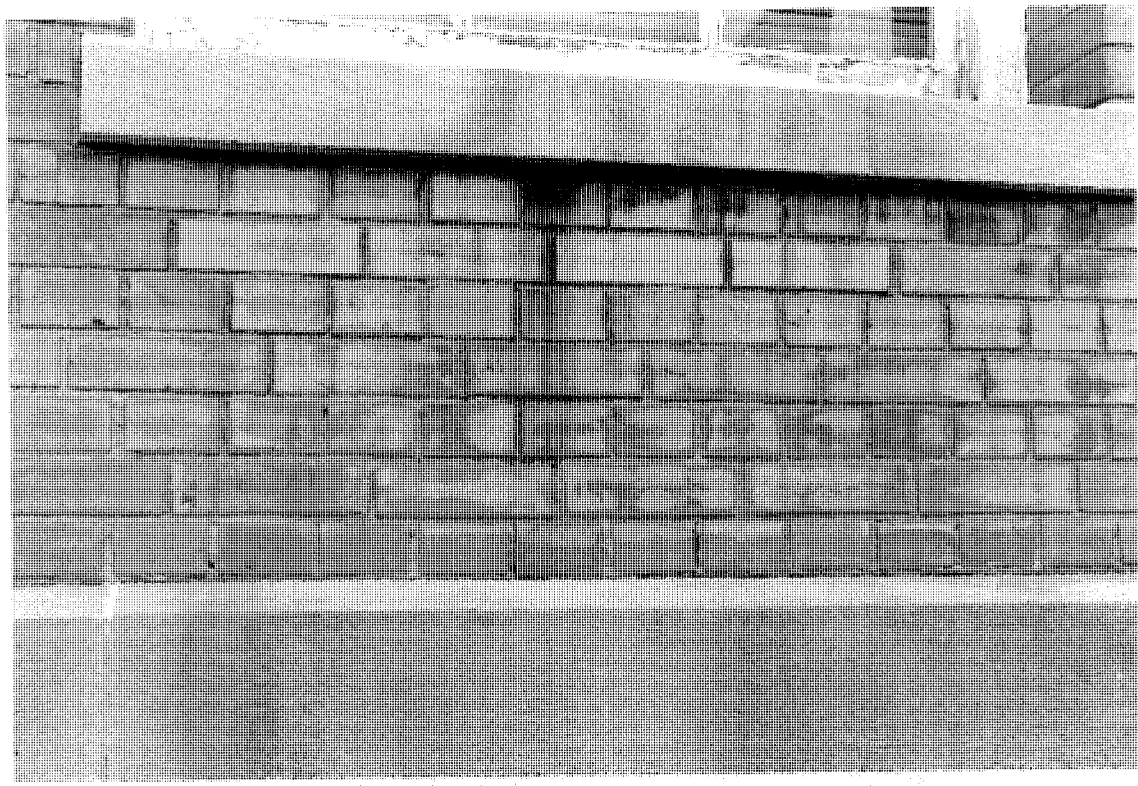


Figure 3-9

Location: South Elevation of Building on East Pavilion
Problem: Gypsum and flyash under limestone sills
Cause of Problem: Atmospheric pollution
Suggested Remedy: Water misting cleaning (for details see Chapter VIII. *Materials Cleaning Analysis*)

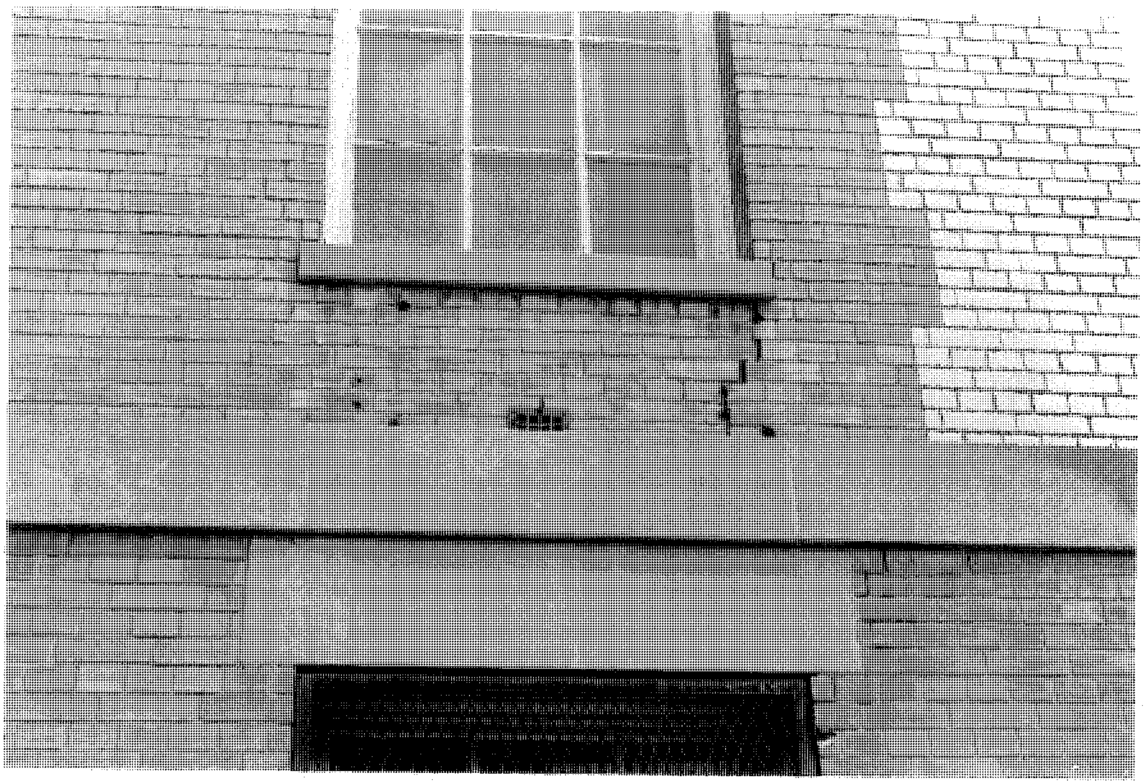


Figure 3-10

Location: South Elevation of Building 3 on West Pavilion
Problem: Open mortar joints
Cause of Problem: Freezing water in open joints and/or rusting iron anchors in window sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 3-11

Location: North Elevation of Building 3 on West Pavilion
Problem: Stains on limestone
Cause of Problem: Rusting iron attachments
Suggested Remedy: Remove stain with iron poultice (scrape and paint iron elements)

Figure 3-12

Location: West Elevation of Breezeway between Buildings 3 & 4
Problem: Damaged limestone
Cause of Problem: Impact from vehicles
Suggested Remedy: Repair with patching mortar

Figure 3-13

Location: East Elevation of Building 3 on South Corner of East Pavilion
Problem: Damaged limestone
Cause of Problem: Impact from vehicles
Suggested Remedy: Repair with patching mortar

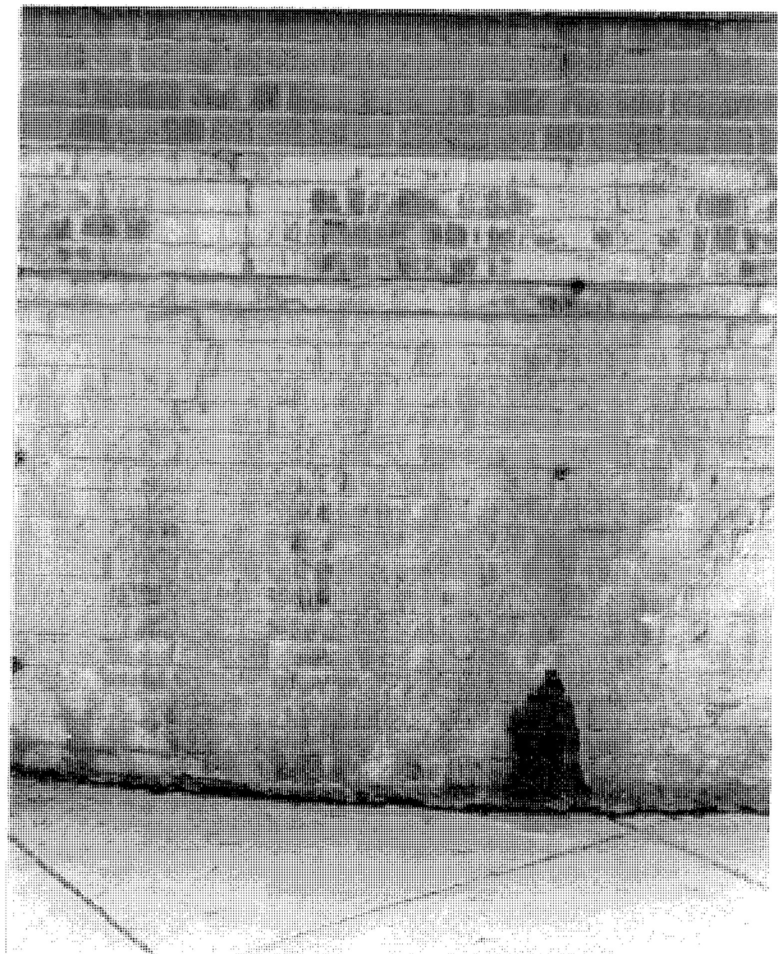


Figure 3-14

Location: North Elevation of Building 3 in Central Areaway
Problem: Bulging, cracked, efflorescing retaining wall
Cause of Problem: Water infiltration
Suggested Remedy: Excavate, waterproof, cut and point

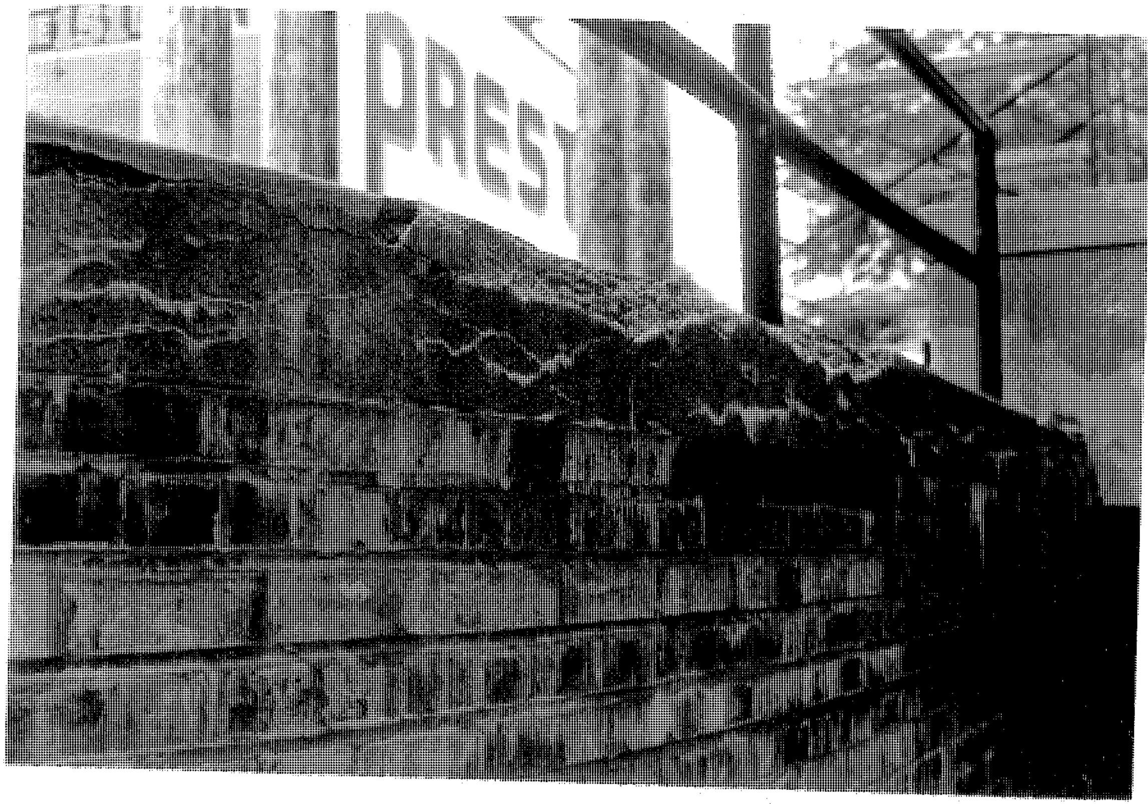


Figure 3-15

Location: North Elevation of Building 3 in Central Areaway
Problem: Damaged concrete capstones
Cause of Problem: Water infiltration and corroding iron railings
Suggested Remedy: Remove and replace with new concrete

Figure 3-16

Location: North Elevation of Building 3 in Central Areaway
Problem: Damaged concrete capstones with repairs
Cause of Problem: Improper and unsightly maintenance procedures
Suggested Remedy: Remove and replace with new concrete

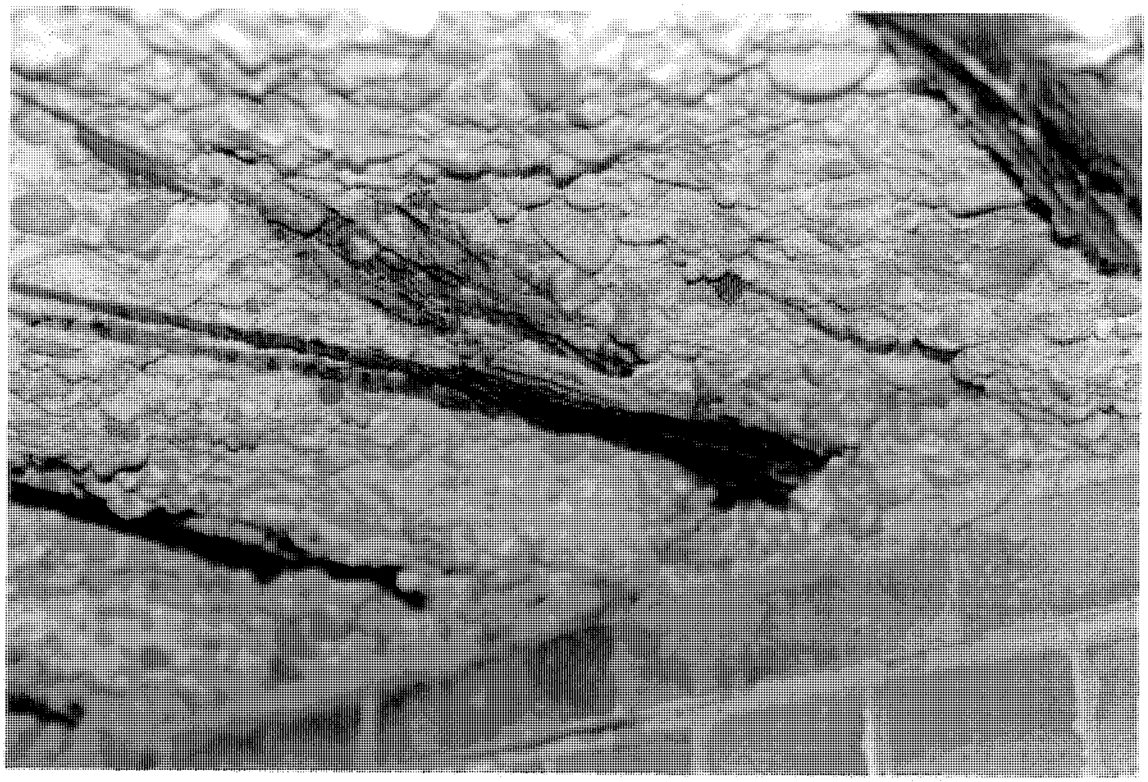


Figure 3-17

Location: North Elevation of Building 3 in Central Areaway
Problem: Damaged concrete and corroding rebar
Cause of Problem: Water infiltration
Suggested Remedy: Demolish and rebuild

Figure 3-18

Location: East Elevation of Building 3 on East Pavilion
Problem: Failing paint
Cause of Problem: Inadequate maintenance
Suggested Remedy: Scrape, prime and paint

Figure 4-1

Location: East Elevation of East Pavilion on Building 4
Problem: Mottled soiling of buff brick and light soiling of white brick
Cause of Problem: Atmospheric pollution
Suggested Remedy: The buff brick will not clean by conventional or unconventional methods (see also Chapter VIII.

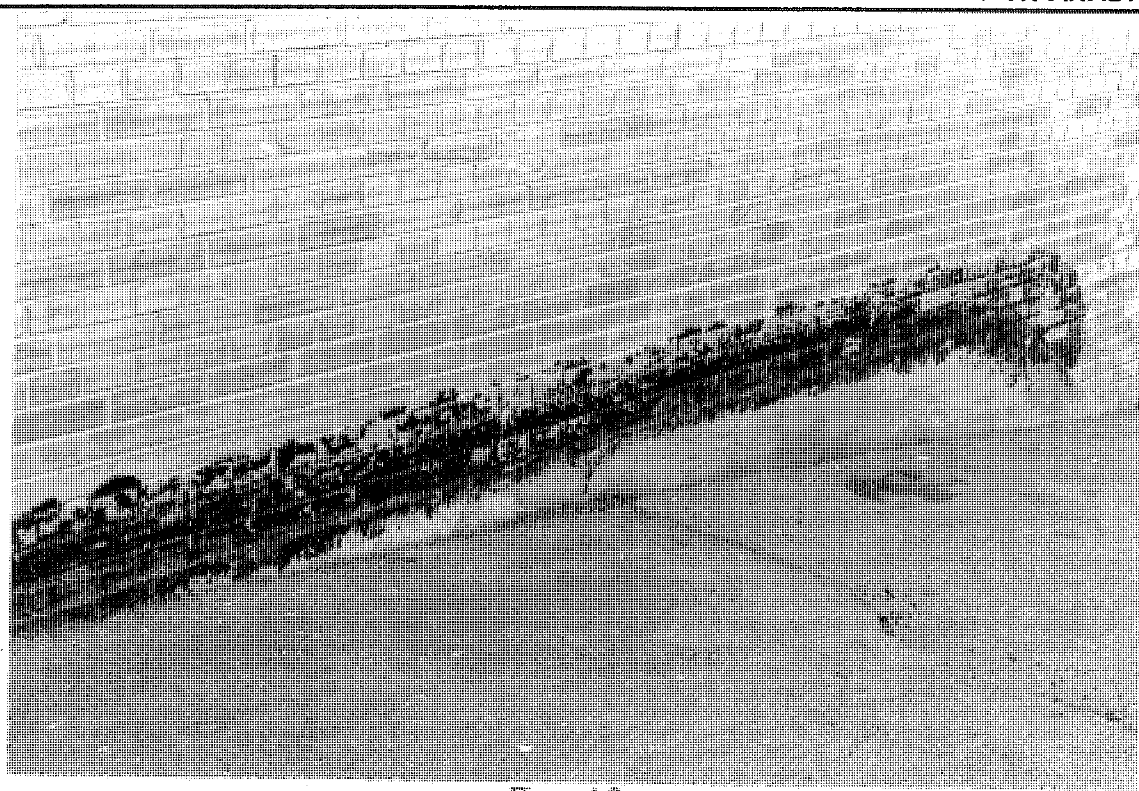


Figure 4-2

Location: North Elevation of Building 4 on West Pavilion
Problem: Bitumen deposits on brick
Cause of Problem: Poorly executed maintenance procedures
Suggested Remedy: Remove with solvent poultice (details are discussed in Chapter VIII. *Materials Cleaning Analysis*)

Figure 4-3

Location: South Elevation of Building 4 on East Pavilion
Problem: Bitumen deposits on brick and limestone
Cause of Problem: Poorly executed maintenance procedures
Suggested Remedy: Remove with solvent poultice (details are discussed in Chapter VIII. *Materials Cleaning Analysis*)

Figure 4-4

Location: North Elevation of Building 4 on West Pavilion
Problem: Damaged brick
Cause of Problem: Unknown but possibly freezing water or impact damage
Suggested Remedy: Replace with matching brick and mortar

Figure 4-5

Location: East Elevation of East Pavilion on Building 4
Problem: Open joints and stress cracks
Cause of Problem: Freezing water in open joints and/or rusting of iron anchors
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

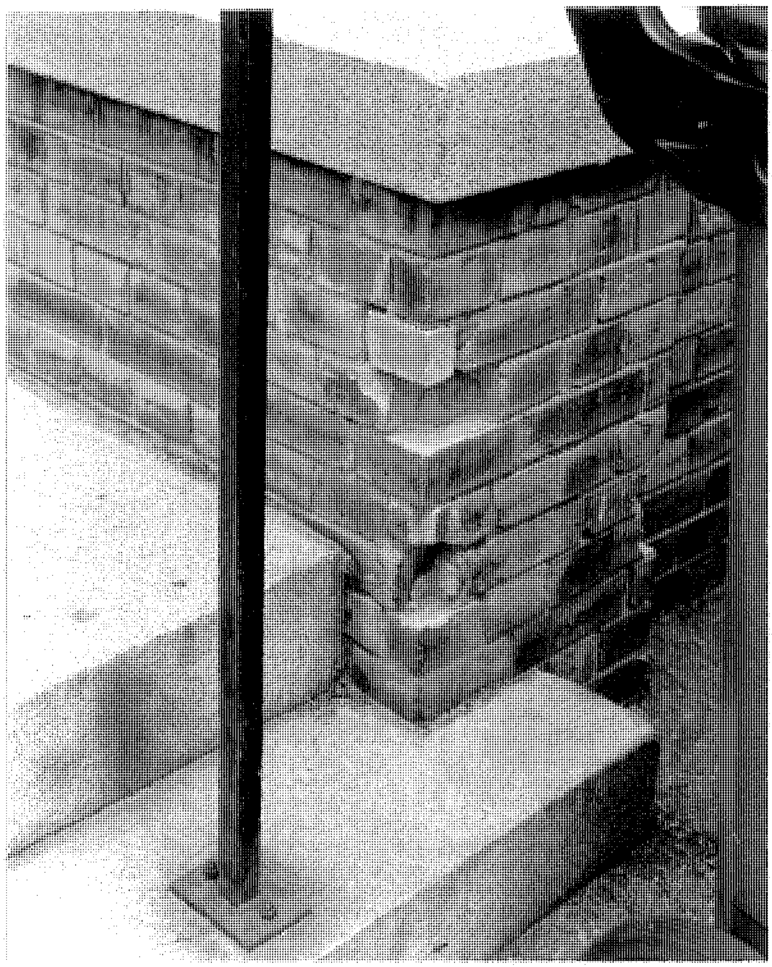


Figure 4-6

Location: East Elevation of Building 3 on East Pavilion
Problem: Open joints and damaged and missing brick
Cause of Problem: Vehicular impact
Suggested Remedy: Remove damaged; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile

Figure 4-7

Location: North Elevation of Building 4 on West Pavilion
Problem: Gypsum and flyash under limestone sills
Cause of Problem: Atmospheric pollution
Suggested Remedy: Water misting cleaning (for details see Chapter VIII. *Materials Cleaning Analysis*)

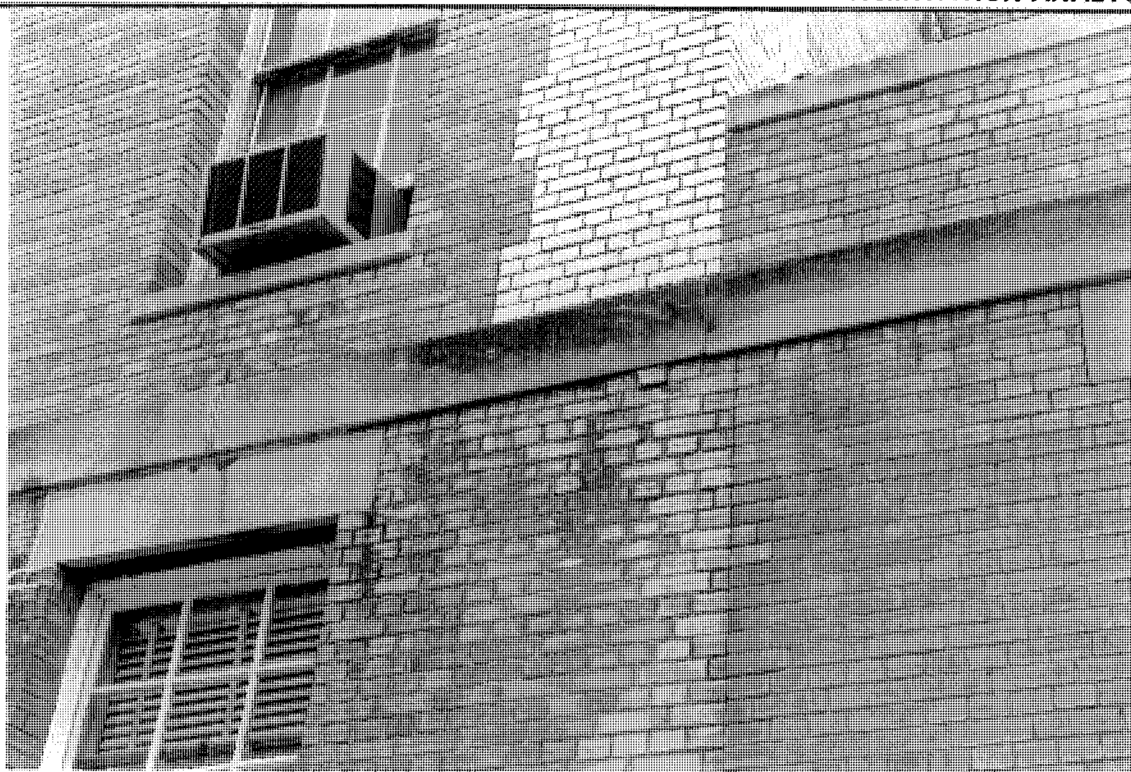


Figure 4-8

Location: West Elevation of Building 4
Problem: Biological soiling
Cause of Problem: Slow drying and overhanging trees
Suggested Remedy: Clean with power wash and detergent (for details see Chapter VIII. *Materials Cleaning Analysis*)

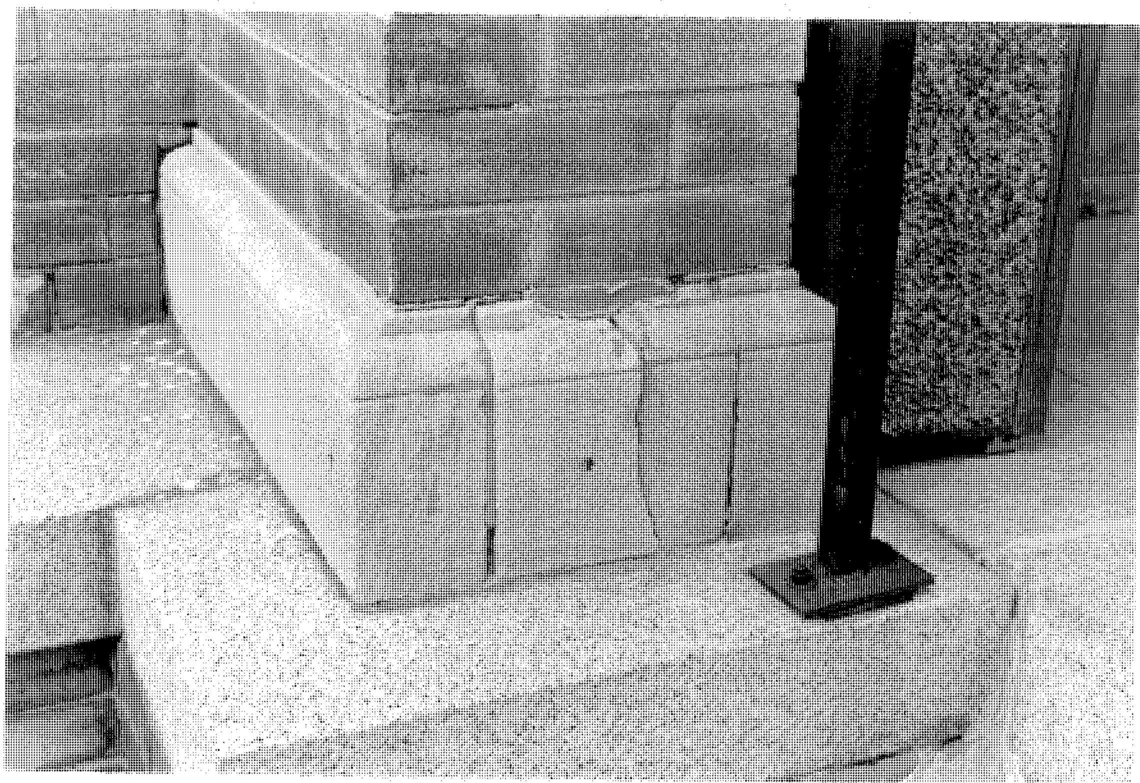


Figure 4-9

Location: West Elevation of Building 4 on South Portico
Problem: Damaged limestone
Cause of Problem: Impact damage or corrosion of iron anchors
Suggested Remedy: Remove damaged limestone and assess anchors; replace with stainless steel if corroded and replace limestone with dutchman

Figure 4-10

Location: South Elevation of Building 4 on South Portico
Problem: Damaged limestone
Cause of Problem: Corrosion of iron anchors
Suggested Remedy: Replace anchors with stainless steel and replace limestone with dutchman

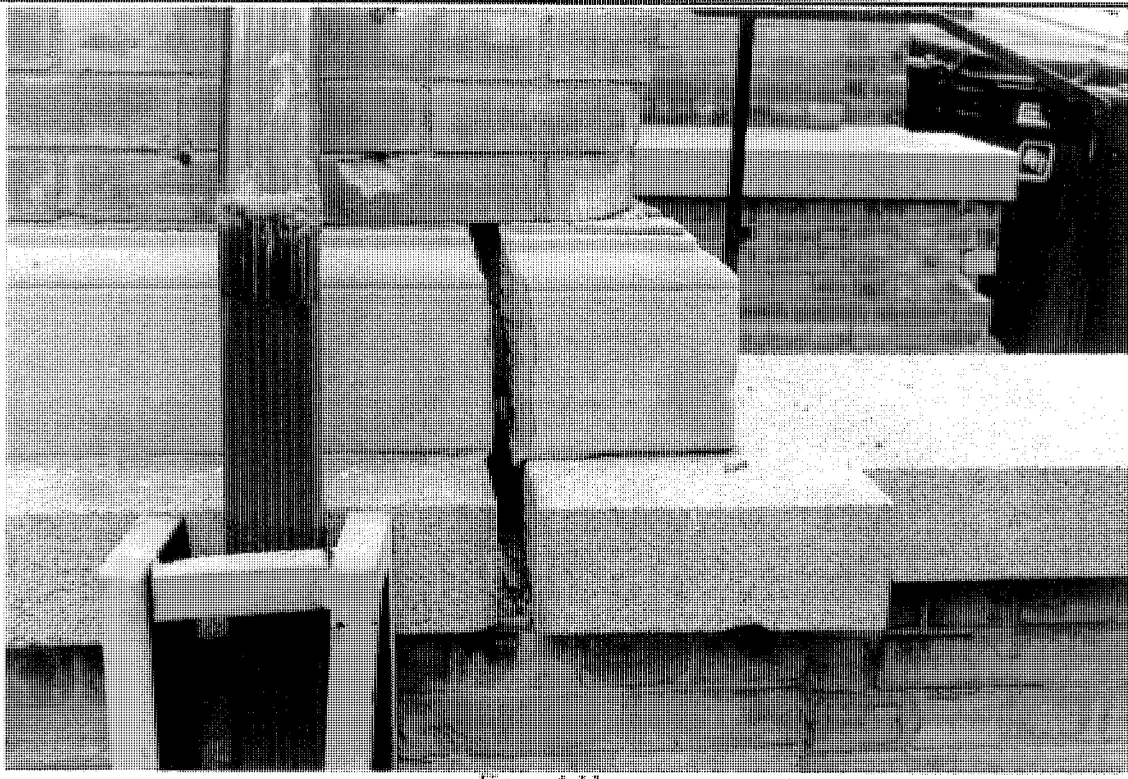


Figure 4-11

Location: South Elevation of Building 4 on South Portico
Problem: Damaged limestone
Cause of Problem: Vehicular impact
Suggested Remedy: Replace limestone with dutchman

Figure 4-12

Location: South Elevation of Building 4 on South Portico
Problem: Displaced granite
Cause of Problem: Vehicular impact
Suggested Remedy: Reset and re-anchor granite

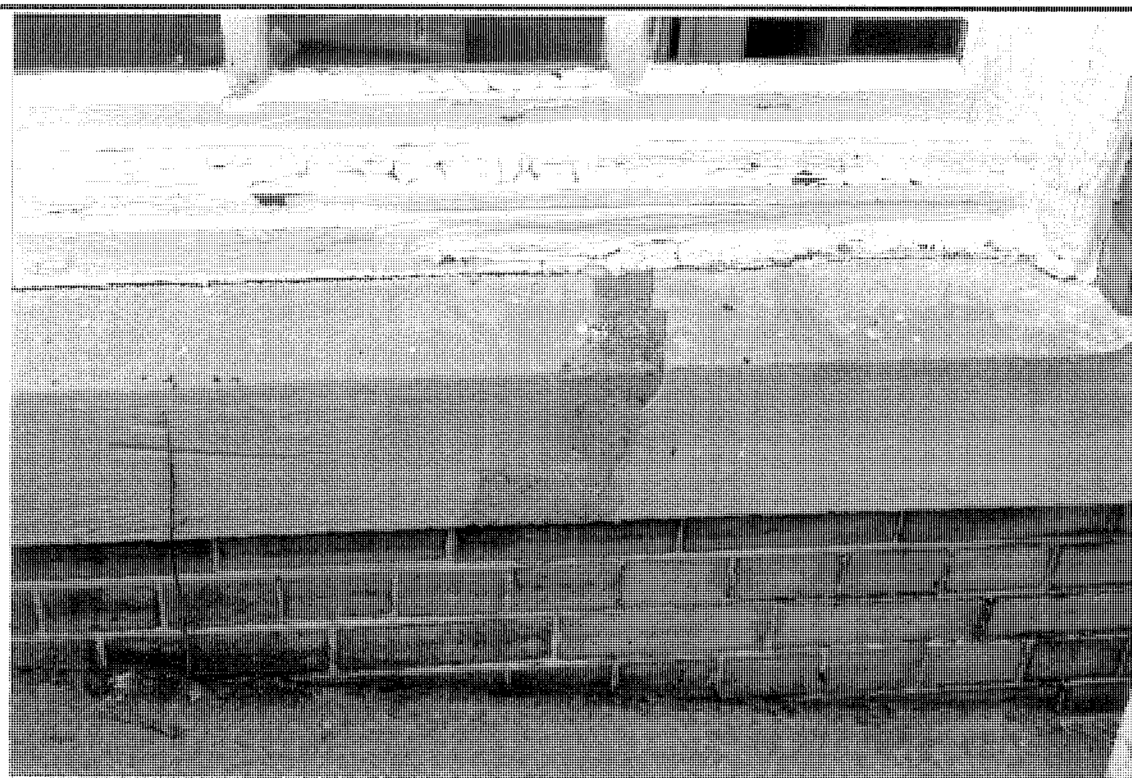


Figure 4-13

Location: West Elevation of Breezeway between Buildings 3 and 4
Problem: Damaged and repaired limestone
Cause of Problem: Improper choice of materials
Suggested Remedy: Remove and replace with better matching patching mortar

Figure 4-14

Location: South Elevation of Building 4 on Garage of East Pavilion
Problem: Open joints and displaced brick
Cause of Problem: Water infiltration from poorly functioning gutter and leader
Suggested Remedy: Clear gutters and leaders; reset brick with proper mortar

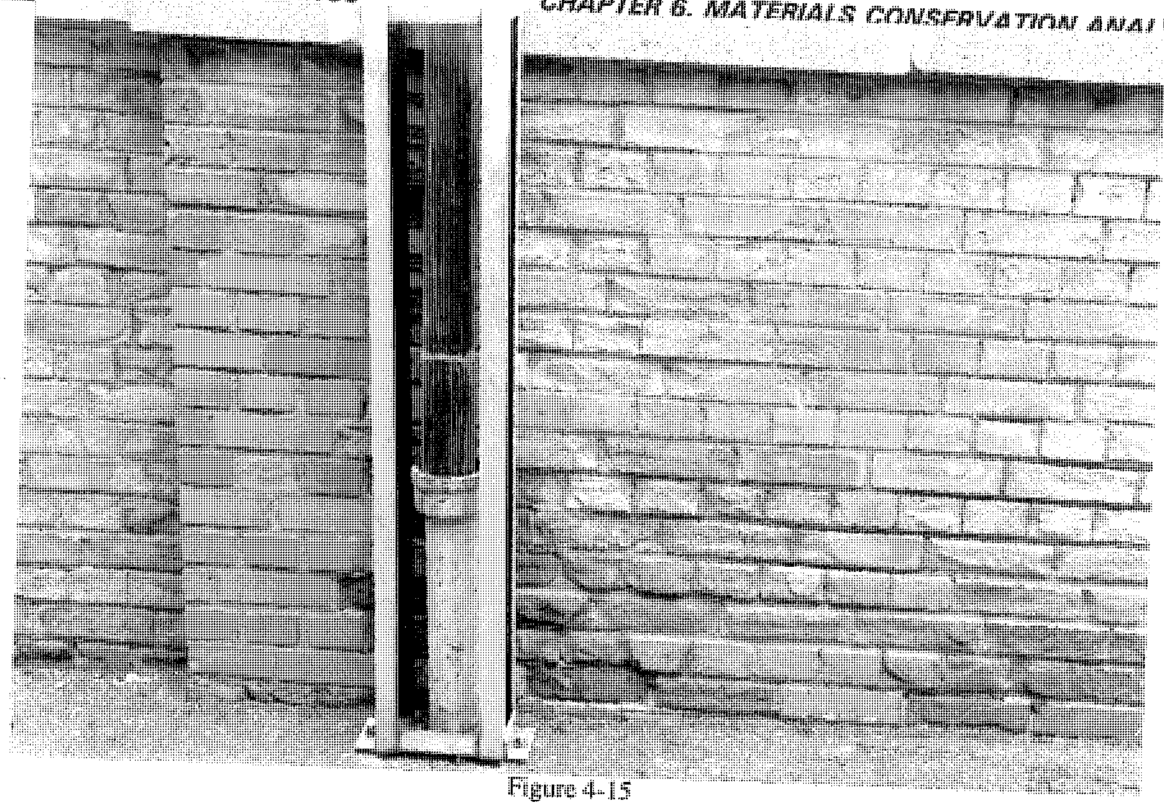


Figure 4-15

Location: South Elevation of Building 4 on South Portico
Problem: Damaged brick
Cause of Problem: Water infiltration from poorly functioning leader
Suggested Remedy: Clear leader

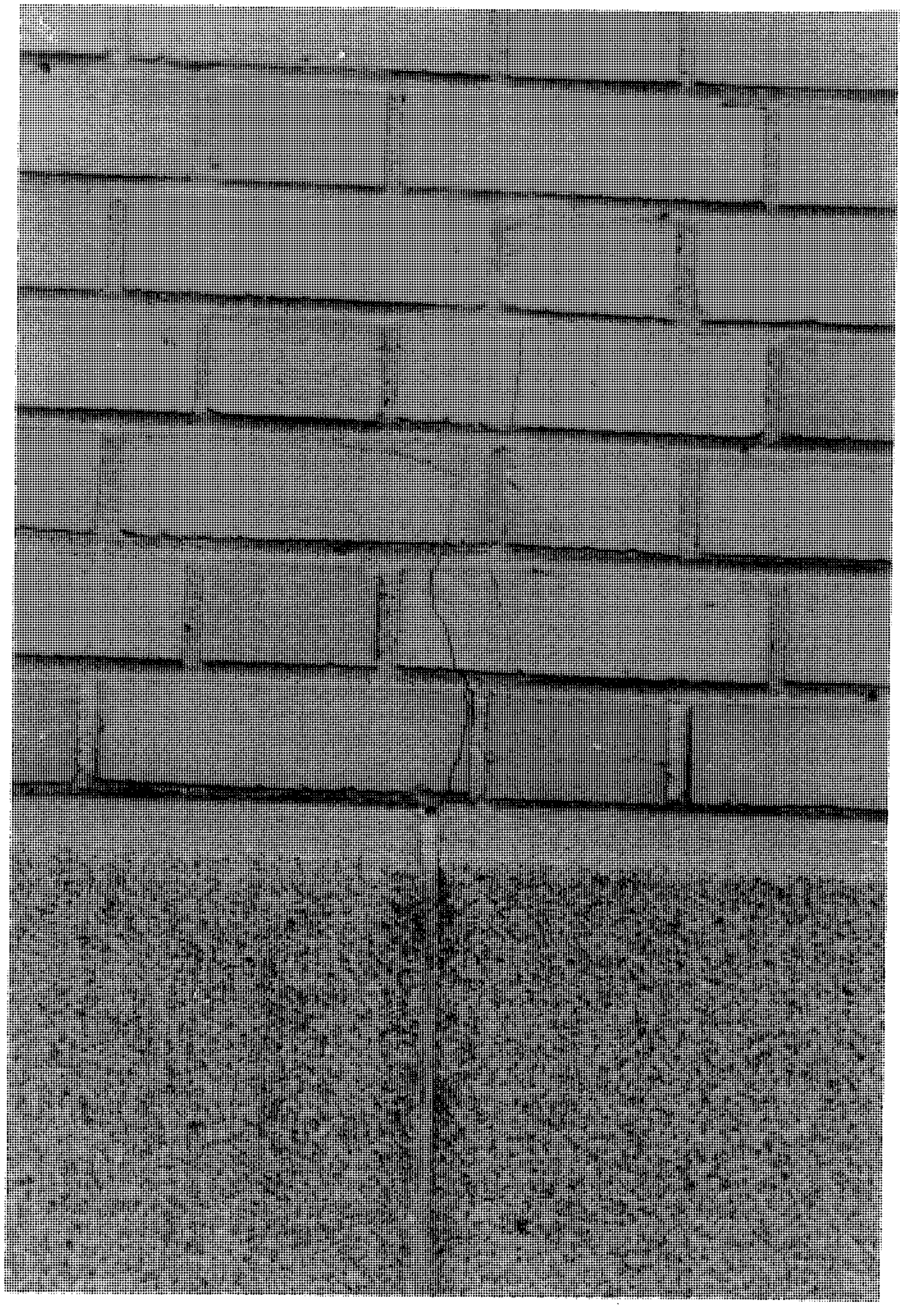


Figure 5-1

Location: North Elevation of Building 5 near West End
Problem: Stress cracks in brick and open mortar joints
Cause of Problem: Freezing water in open joints of water table and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

Figure 5-2

Location: East Elevation of Building 5 near South End
Problem: Open mortar joints at articulate brick
Cause of Problem: Freezing water in joints
Suggested Remedy: cut and point joints

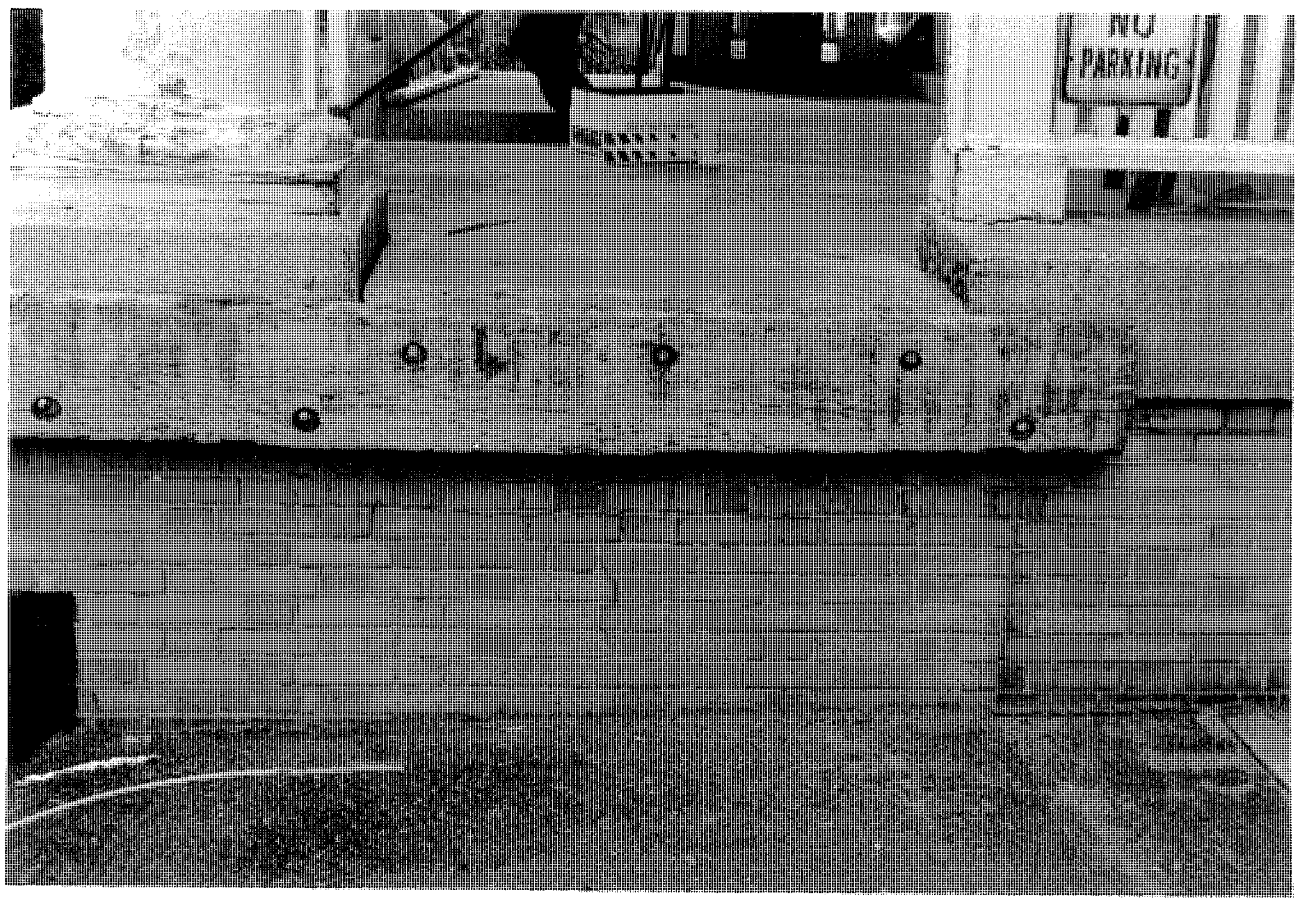


Figure 5-3

Location: North Elevation of Building 5 at West End of Porch
Problem: Open mortar joints and stress cracks in brick
Cause of Problem: Freezing water in joints; impact damage
Suggested Remedy: Brick should be removed and then replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile

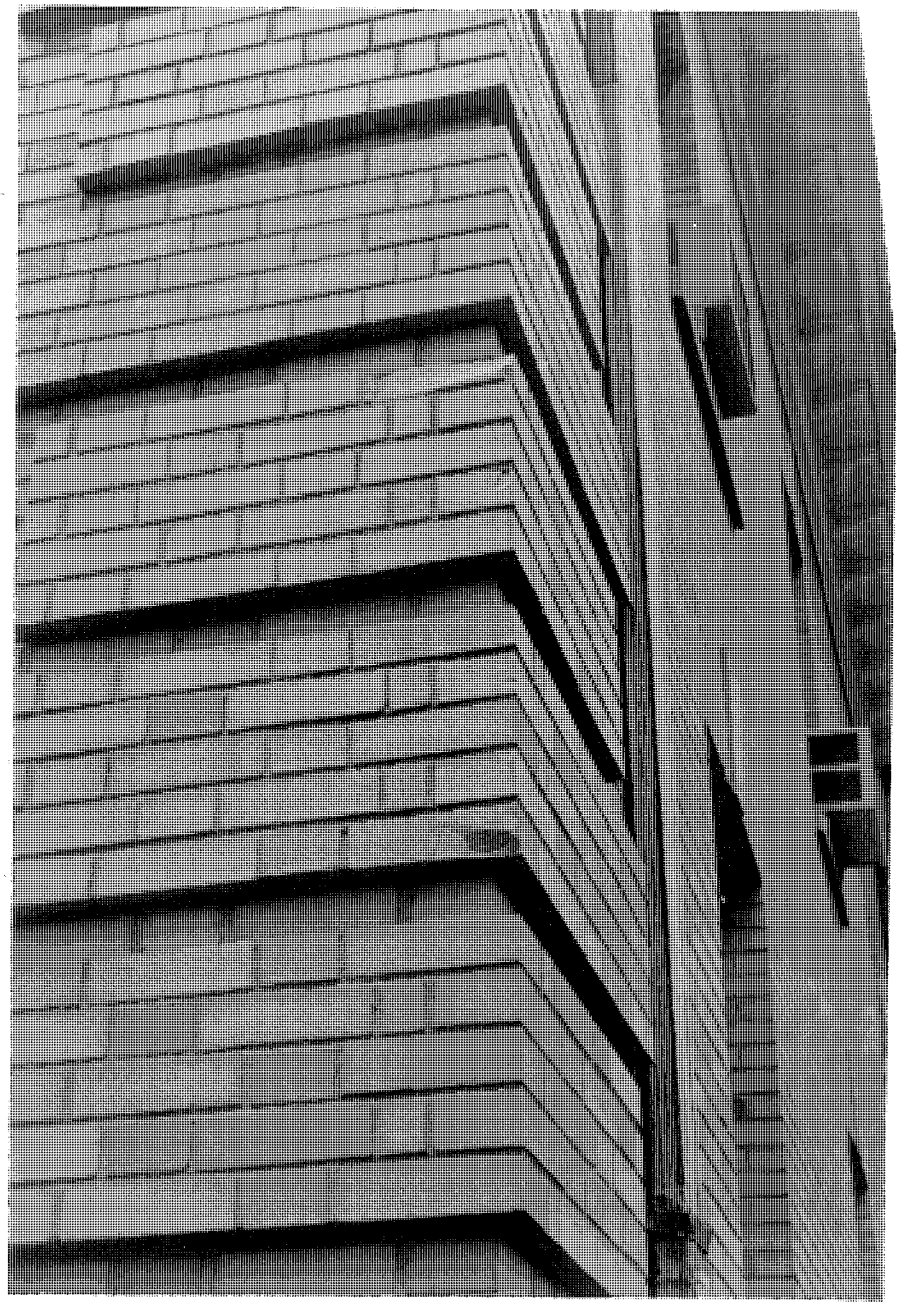


Figure 5-4

Location: Northwest Corner of Building 5
Problem: Damage brick
Cause of Problem: Unknown but perhaps impact damage
Suggested Remedy: Brick should be removed and then replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile

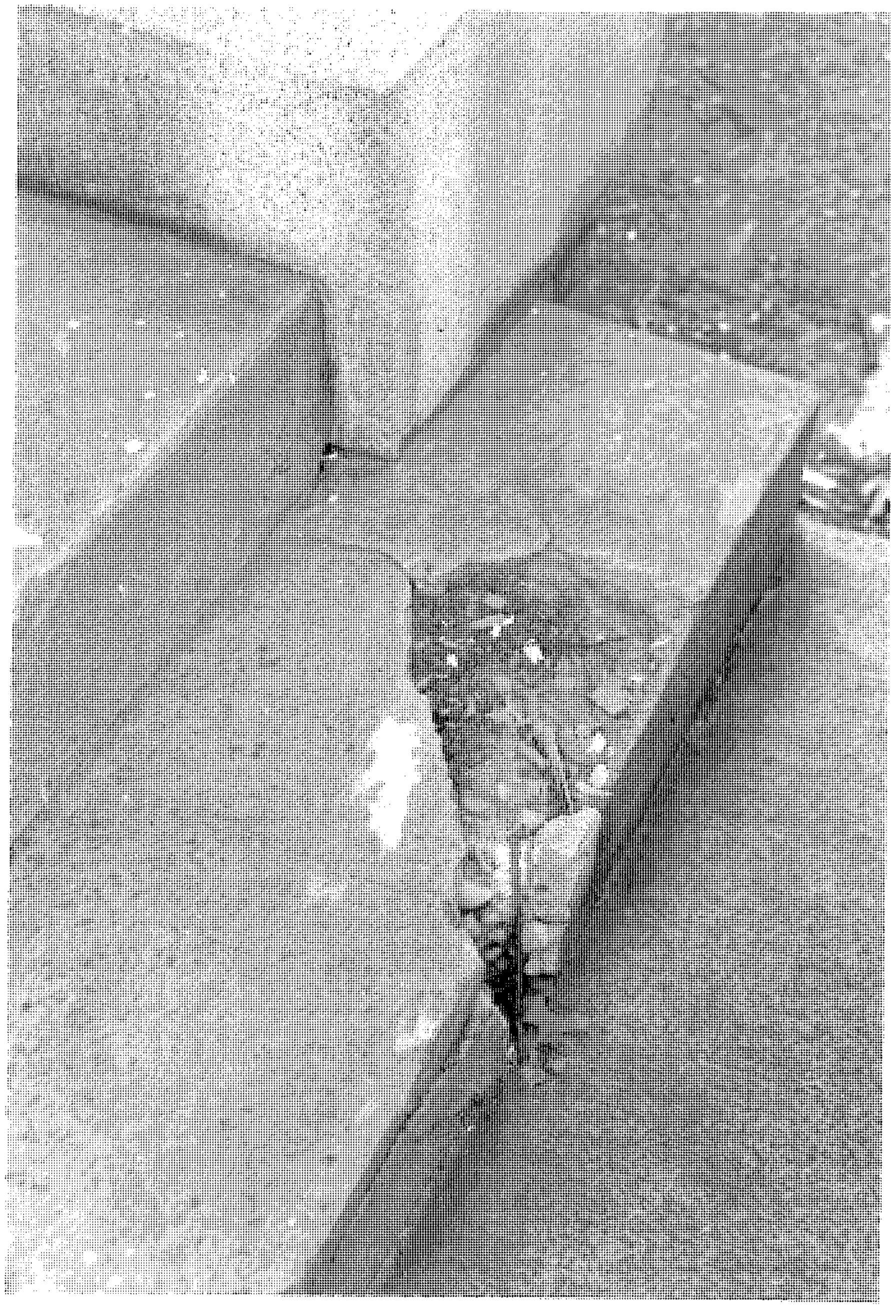


Figure 5-5

Location: West Elevation of Building 5 at Central Entryway
Problem: Damaged concrete
Cause of Problem: Water penetration and freezing
Suggested Remedy: Demolish and rebuild

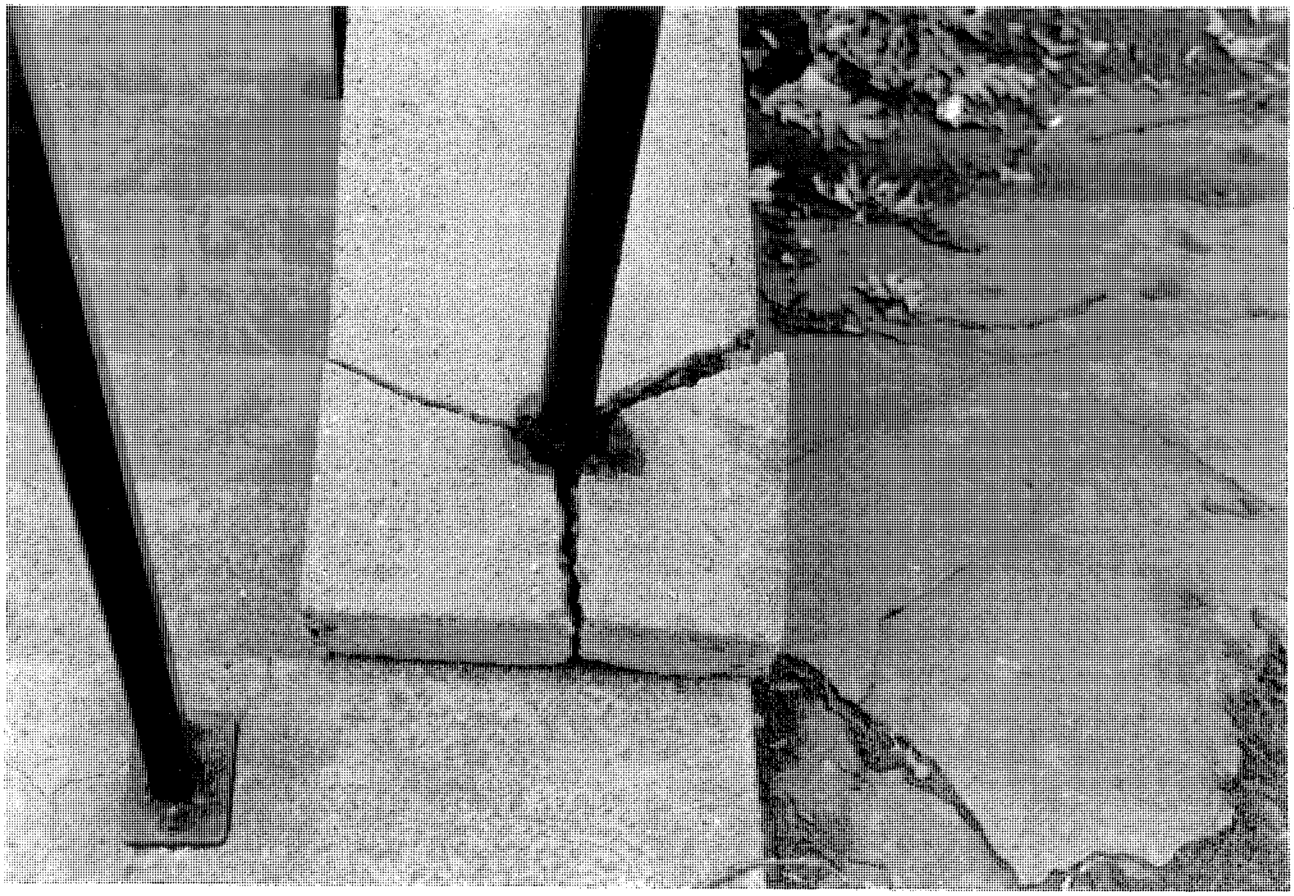


Figure 5-6

Location: West Elevation of Building 5 at Steps to Areaway
Problem: Damaged concrete
Cause of Problem: Water penetration and freezing; rusting of iron railings
Suggested Remedy: Demolish and rebuild

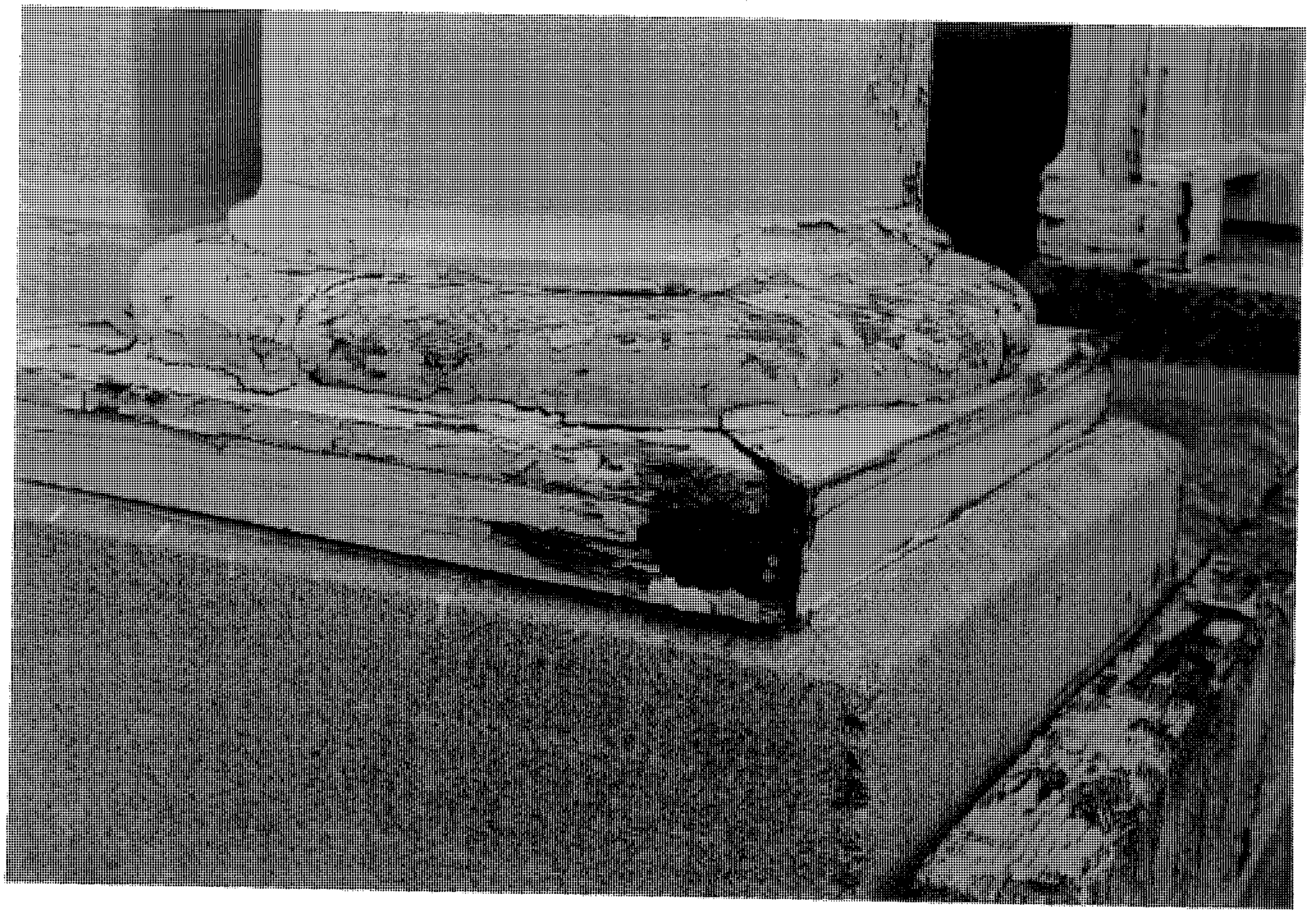


Figure 5-7

Location: North Elevation of Building 5 at Westernmost Column of Portico
Problem: Damaged wooden base
Cause of Problem: Water penetration and poor maintenance
Suggested Remedy: Remove rotted wood and replace with new elements

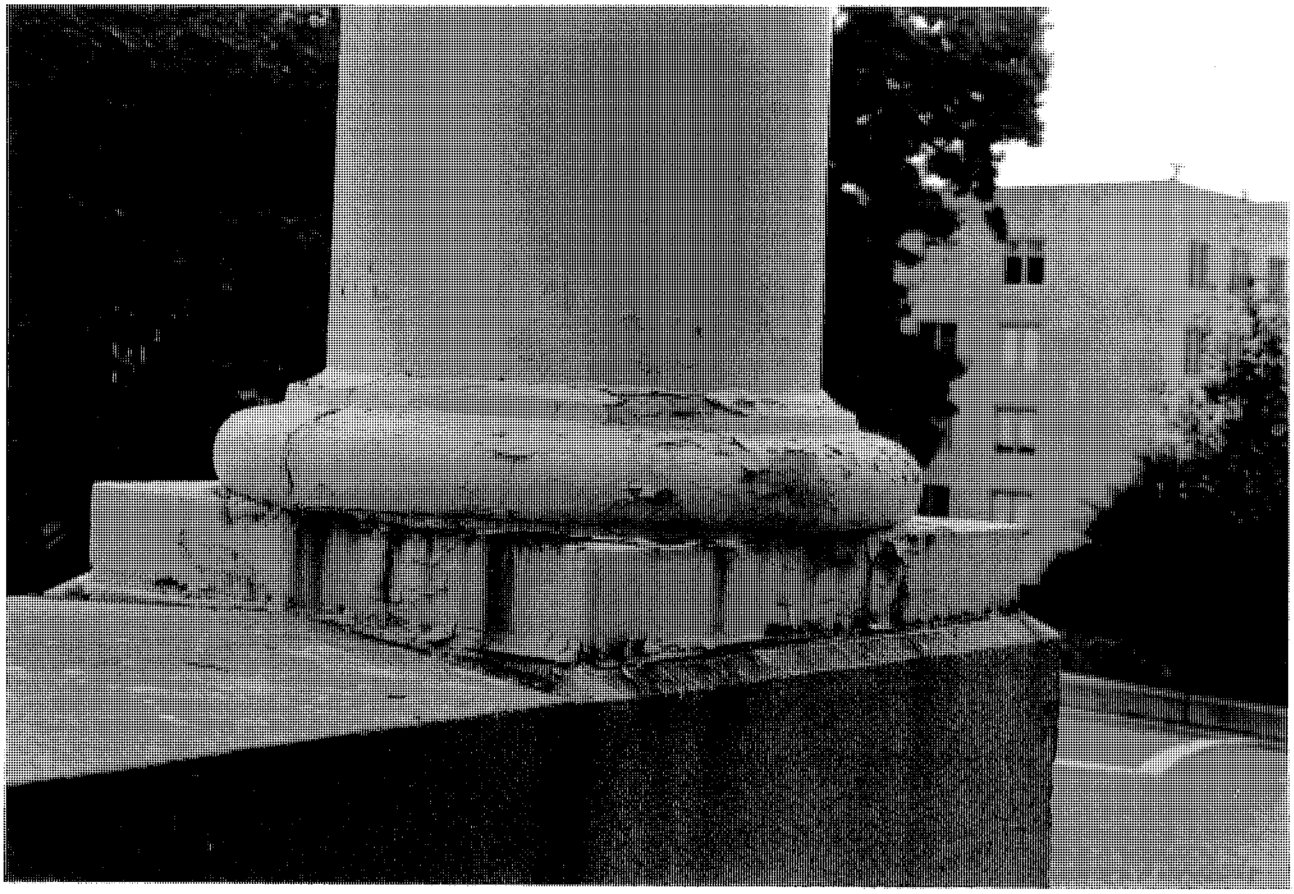


Figure 5-8

Location: North Elevation of Building 5 at Easternmost Column of Portico
Problem: Rusting of column leading to staining of granite
Cause of Problem: Water penetration of paint film and poor maintenance of paint
Suggested Remedy: Scrape and repaint column; poultice iron stain with chelating agent

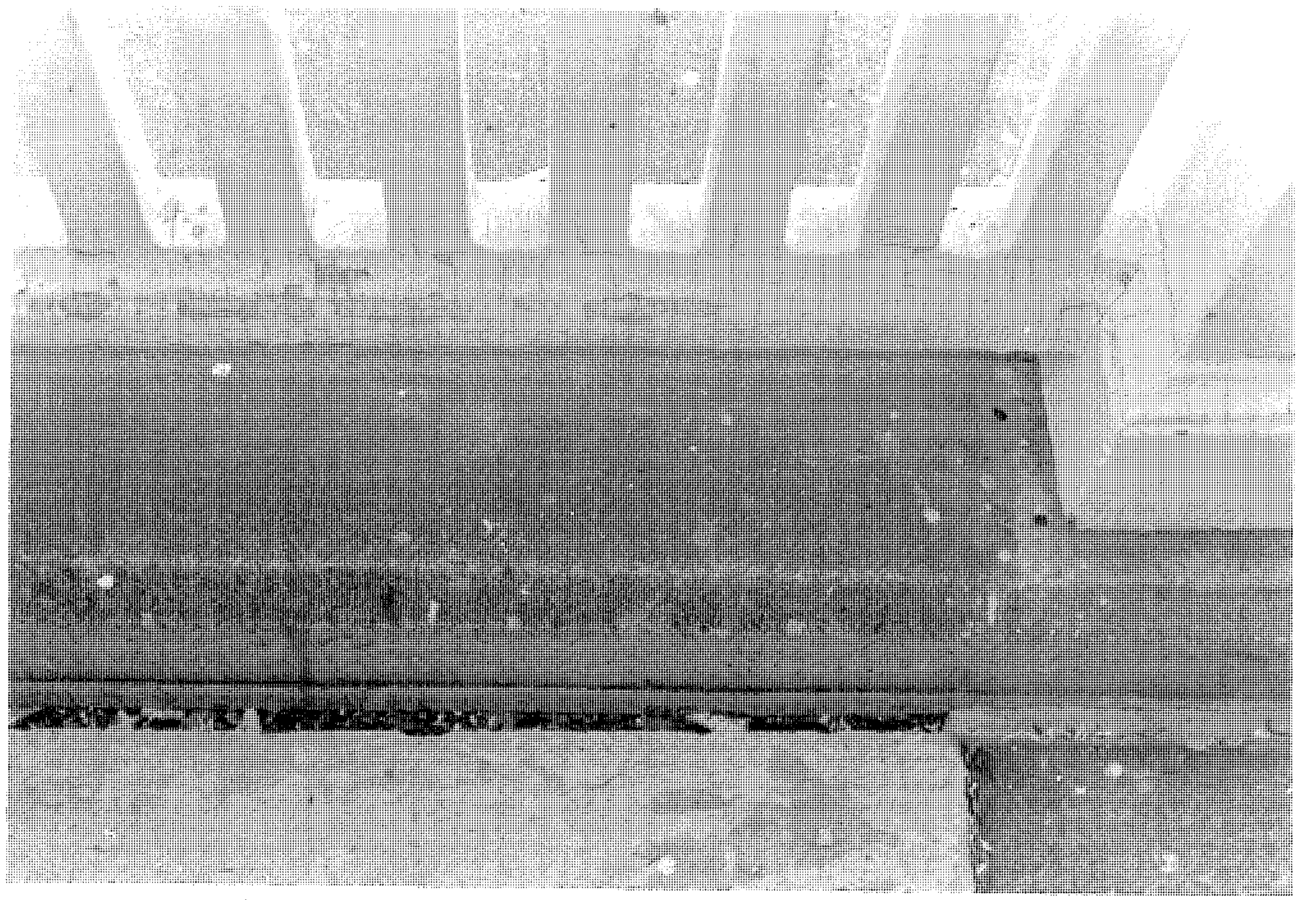


Figure 5-9

Location: North Elevation of Building 5 at Portico Balustrade
Problem: Soiling of granite
Cause of Problem: Atmospheric pollution
Suggested Remedy: Chemical cleaning (see Chapter VIII. Materials Cleaning Analysis for details)

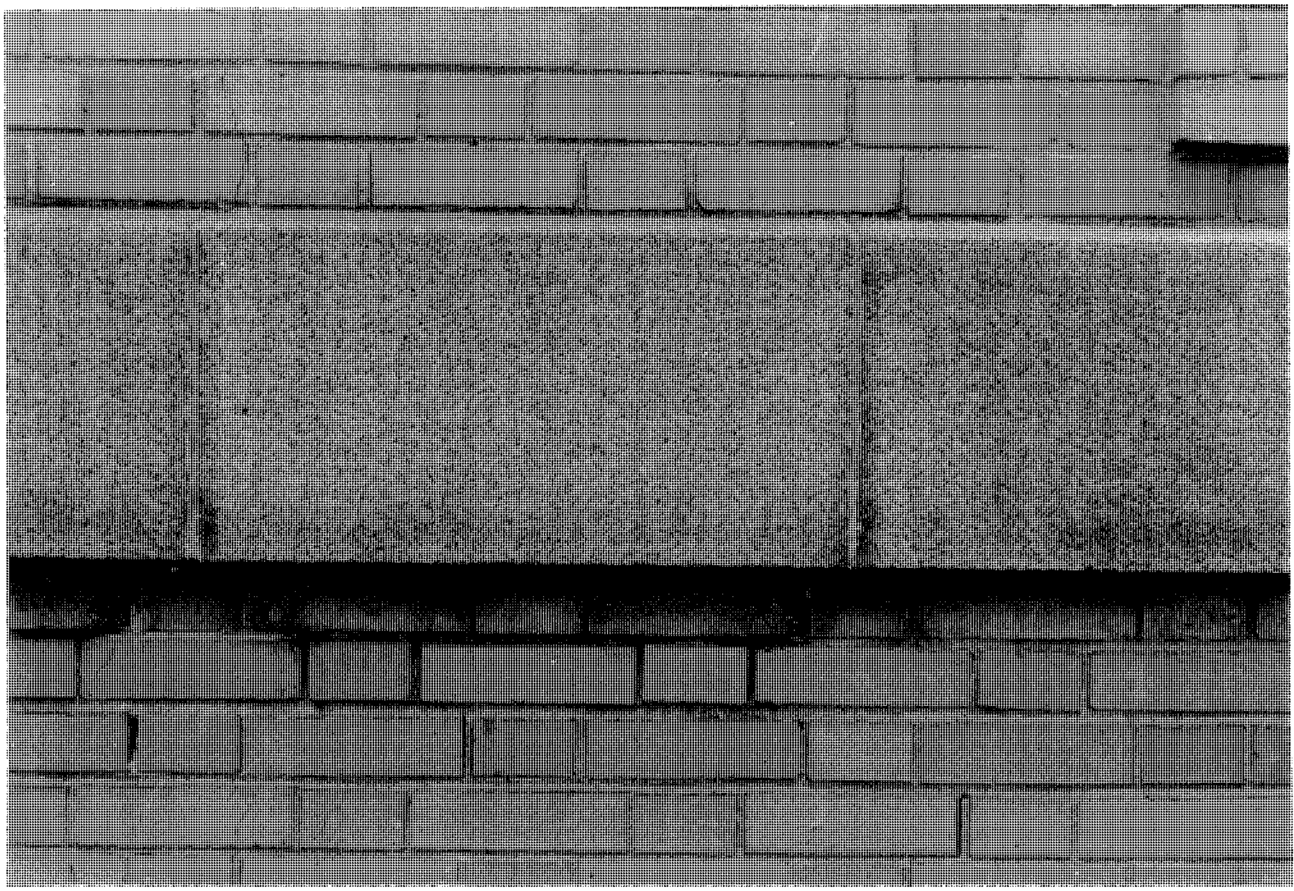


Figure 5-10

Location: North Elevation of Building 5 at West End
Problem: Open or caulked joints in granite water table
Cause of Problem: Susceptibility of vertical joints to water run-off; improper maintenance procedures
Suggested Remedy: Cut and point (see Chapter VII. Mortar Analysis for a discussion of replacement mortar)

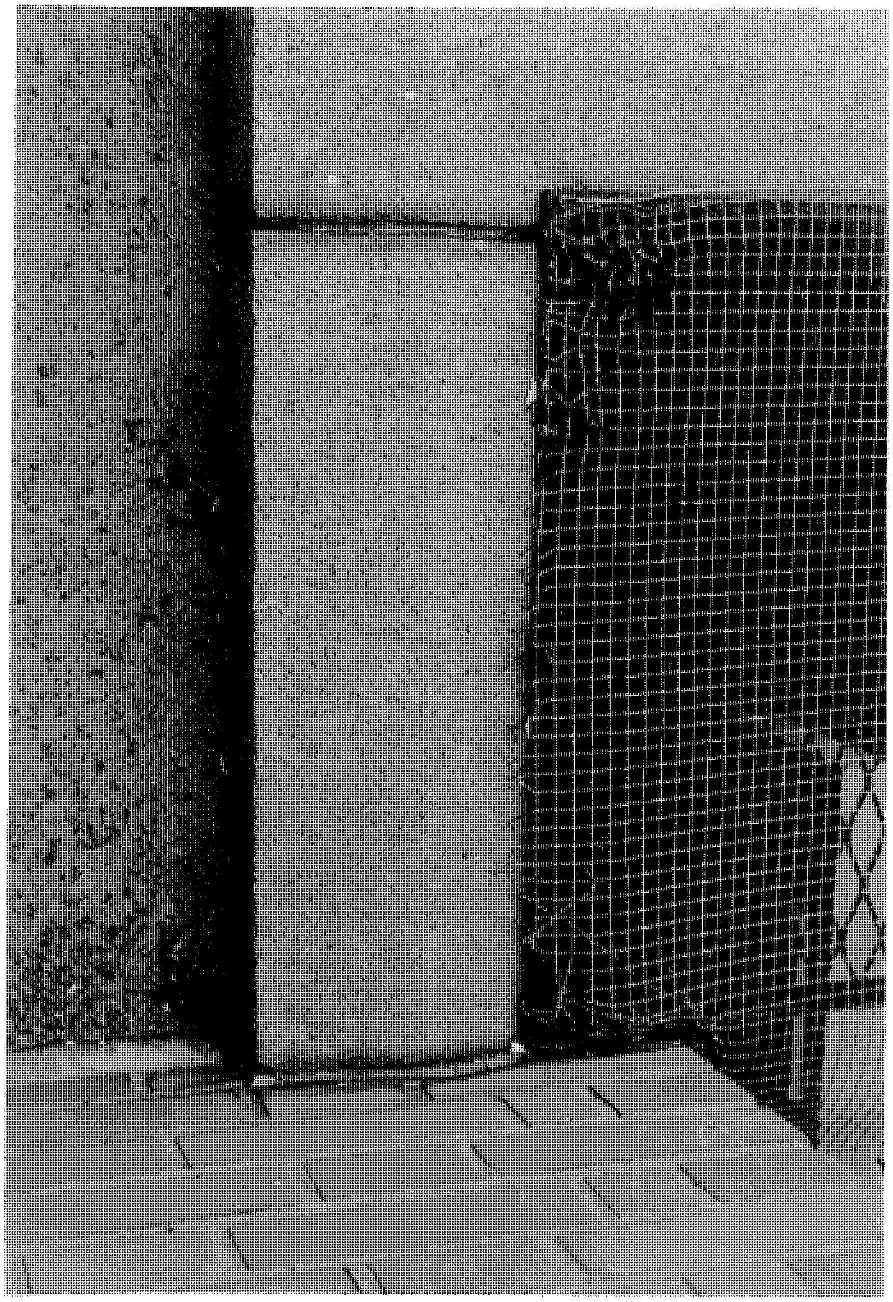


Figure 5-11

Location: West Elevation of Building 5 at North End
Problem: Open joints in granite window well
Cause of Problem: Susceptibility of vertical joints to water run-off; improper maintenance procedures
Suggested Remedy: Cut and point (see Chapter VII. Mortar Analysis for a discussion of replacement mortar)

Figure 5-12

Location: West Elevation of Building 5 at North End
Problem: Bitumen on granite
Cause of Problem: Sloppy application of waterproofing material for drain
Suggested Remedy: Poultice cleaning with solvent (see Chapter VIII. Materials Cleaning Analysis for details of treatment)

Figure 6-1

Location: North Elevation of Building 6 at West End
Problem: Stress cracks and open mortar joints
Cause of Problem: Freezing water in open joints of water table and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile

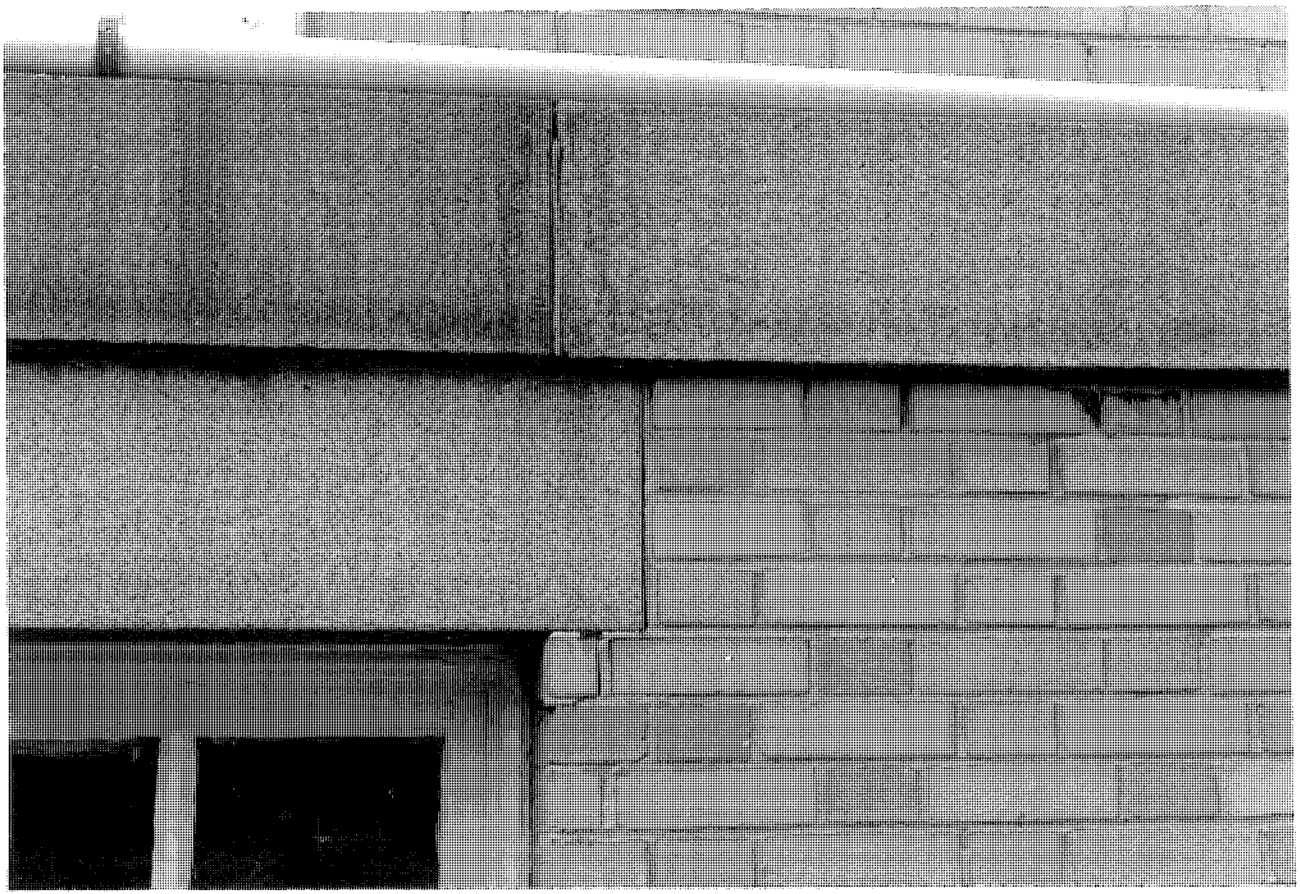


Figure 6-2

Location: North Elevation of Building 6 at West End
Problem: Stress cracks and open mortar joints
Cause of Problem: Freezing water in open joints of water table and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

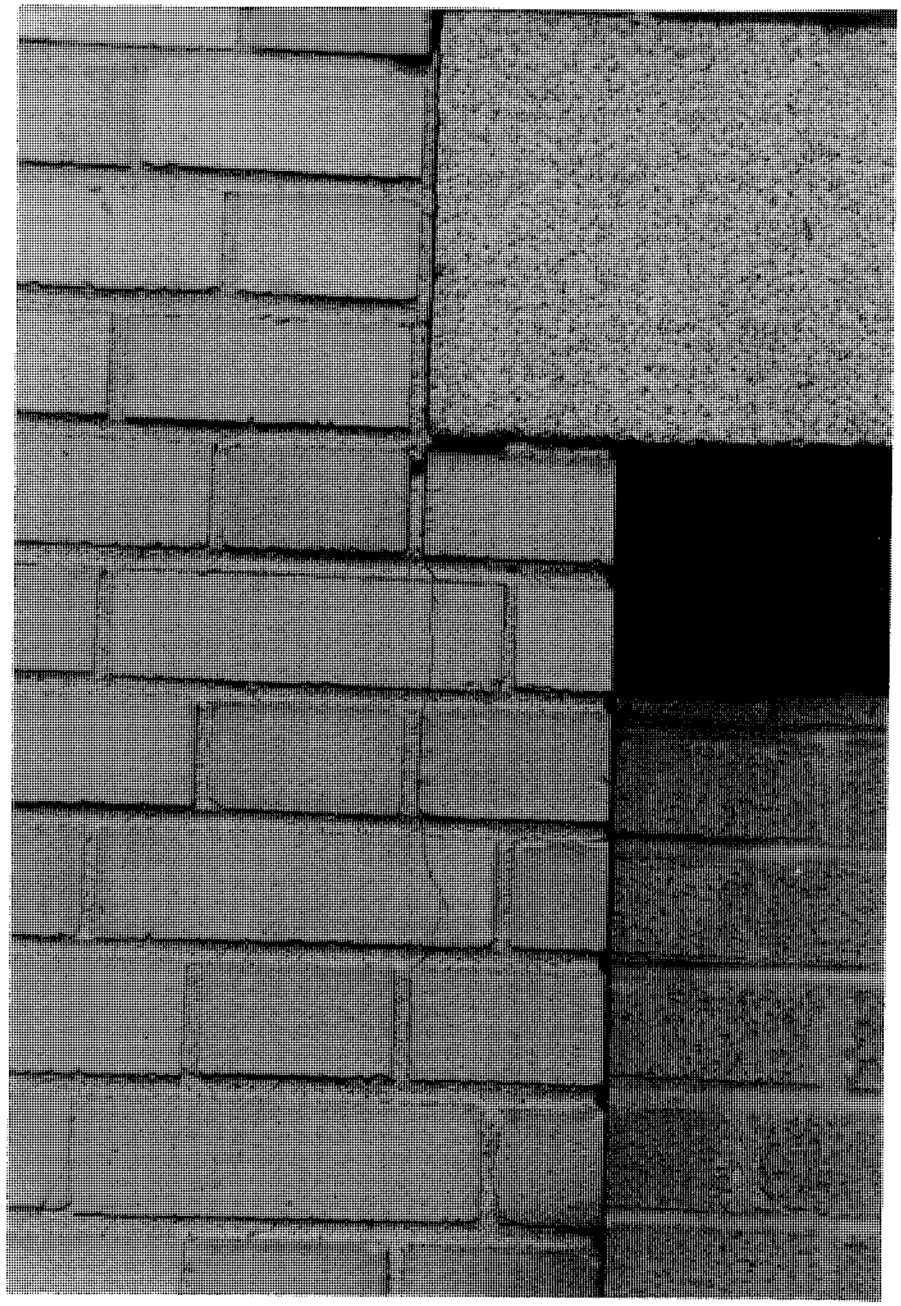


Figure 6-3

Location: East Elevation of Building 6 at North End
Problem: Stress cracks and open mortar joints
Cause of Problem: Freezing water in open joints of water table and/or rusting iron anchors in window lintels and sills.
Suggested Remedy: Remove brickwork and assess for rusting iron anchors. If anchors are rusted they should be replaced with stainless steel anchors; brick should then be replaced to match existing texture, color and size and reset in mortar to match surrounding pointing in color, texture, and profile.

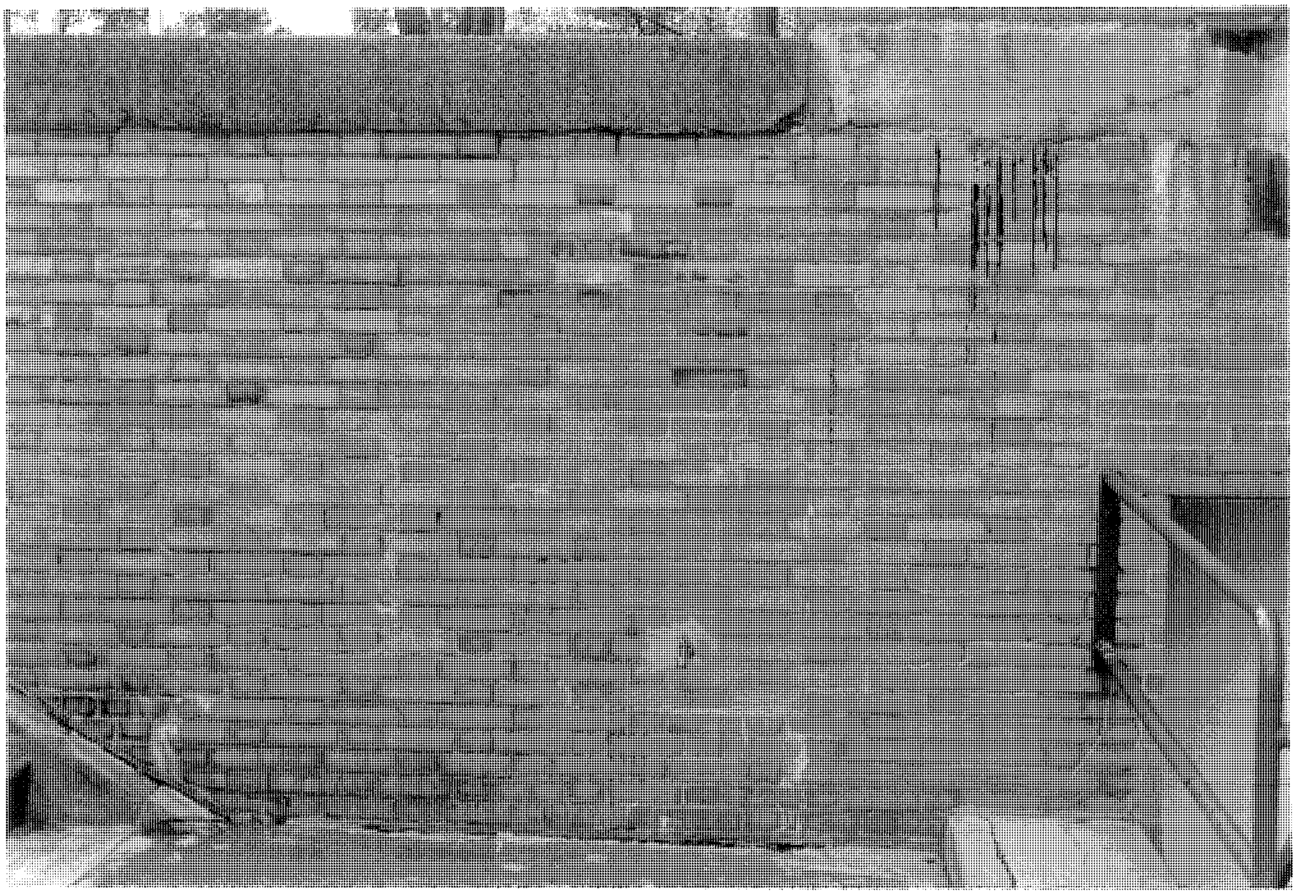


Figure 6-4

Location: West Wall of Entryway on North Elevation of Building 6
Problem: Open mortar joints and efflorescence in brick
Cause of Problem: Water penetration through concrete slab
Suggested Remedy: Cut and point; waterproof concrete slab or replace concrete slab

Figure 6-5

Location: South Elevation of Building 6 at East End
Problem: Damaged brick
Cause of Problem: Water penetration and freezing near metal anchors
Suggested Remedy: Remove anchors and fill with pointing mortar

Figure 6-6

Location: West Wall of Entryway on North Elevation of Building 6
Problem: Damaged concrete capstones
Cause of Problem: Water penetration and freezing; rusting of iron railings
Suggested Remedy: Demolish and rebuild

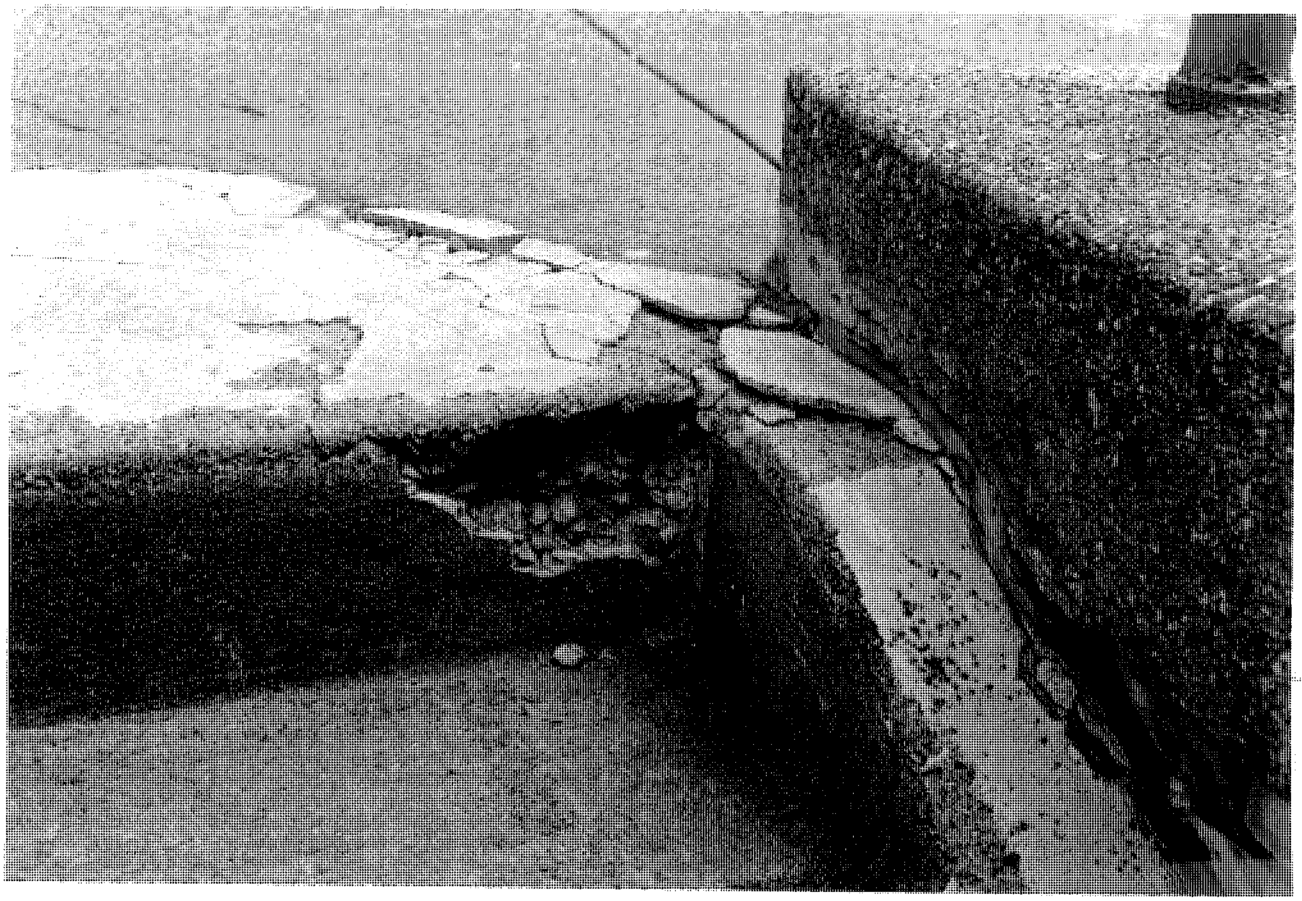


Figure 6-7

Location: West Side of Entryway on North Elevation of Building 6
Problem: Damaged concrete
Cause of Problem: Water penetration and freezing
Suggested Remedy: Demolish and rebuild

Figure 6-8

Location: West Wall of Entryway on North Elevation of Building 6
Problem: Damaged concrete
Cause of Problem: Water penetration and freezing
Suggested Remedy: Demolish and rebuild

Figure 7-1

Location: West Elevation of Building 7 at South End
Problem: Bitumen waterproofing (and/or paint) on brick
Cause of Problem: Poor maintenance procedures
Suggested Remedy: Poultice with solvents

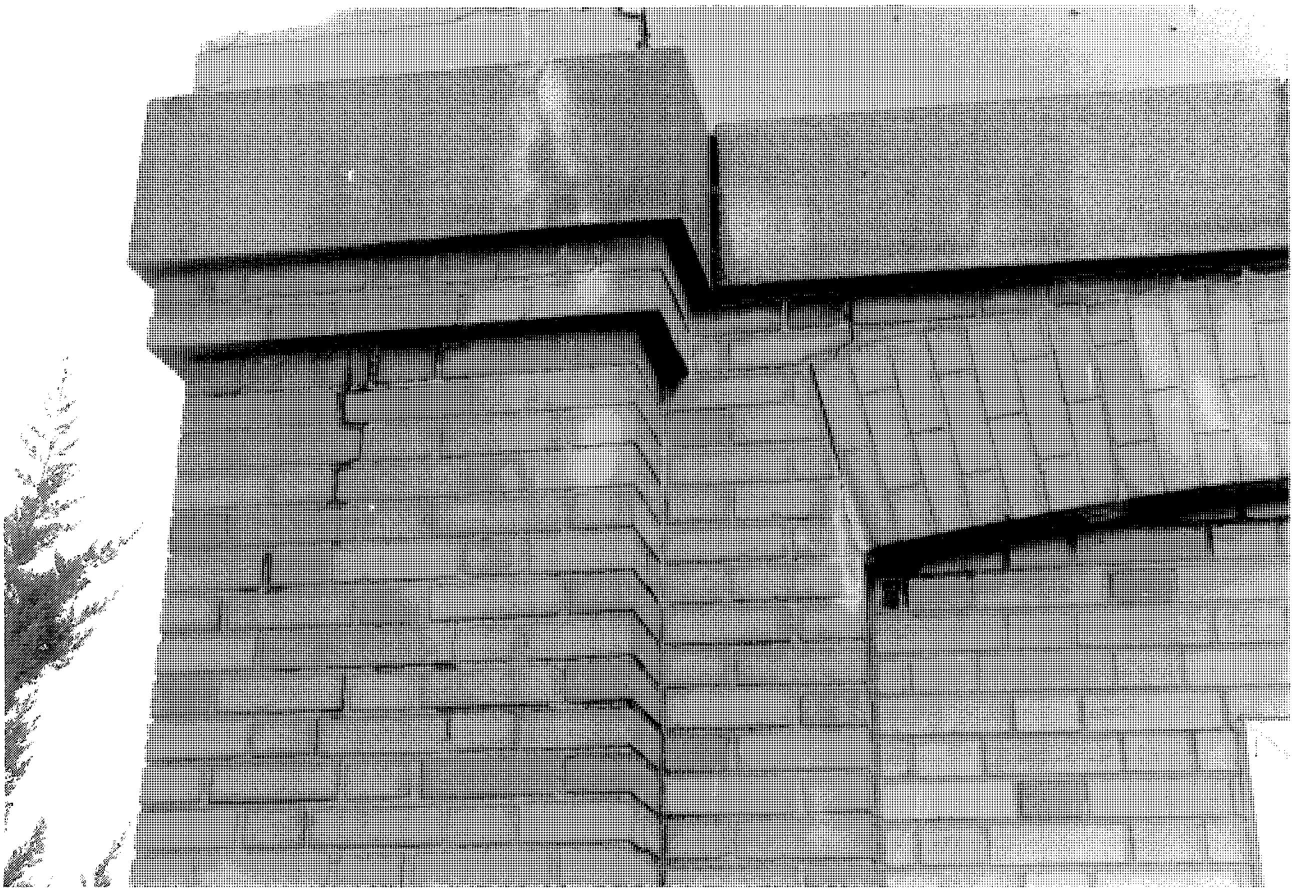


Figure 7-2

Location: South Elevation of Building 7 at West End
Problem: Open mortar joints in brick
Cause of Problem: Water penetration and freezing
Suggested Remedy: Cut and point

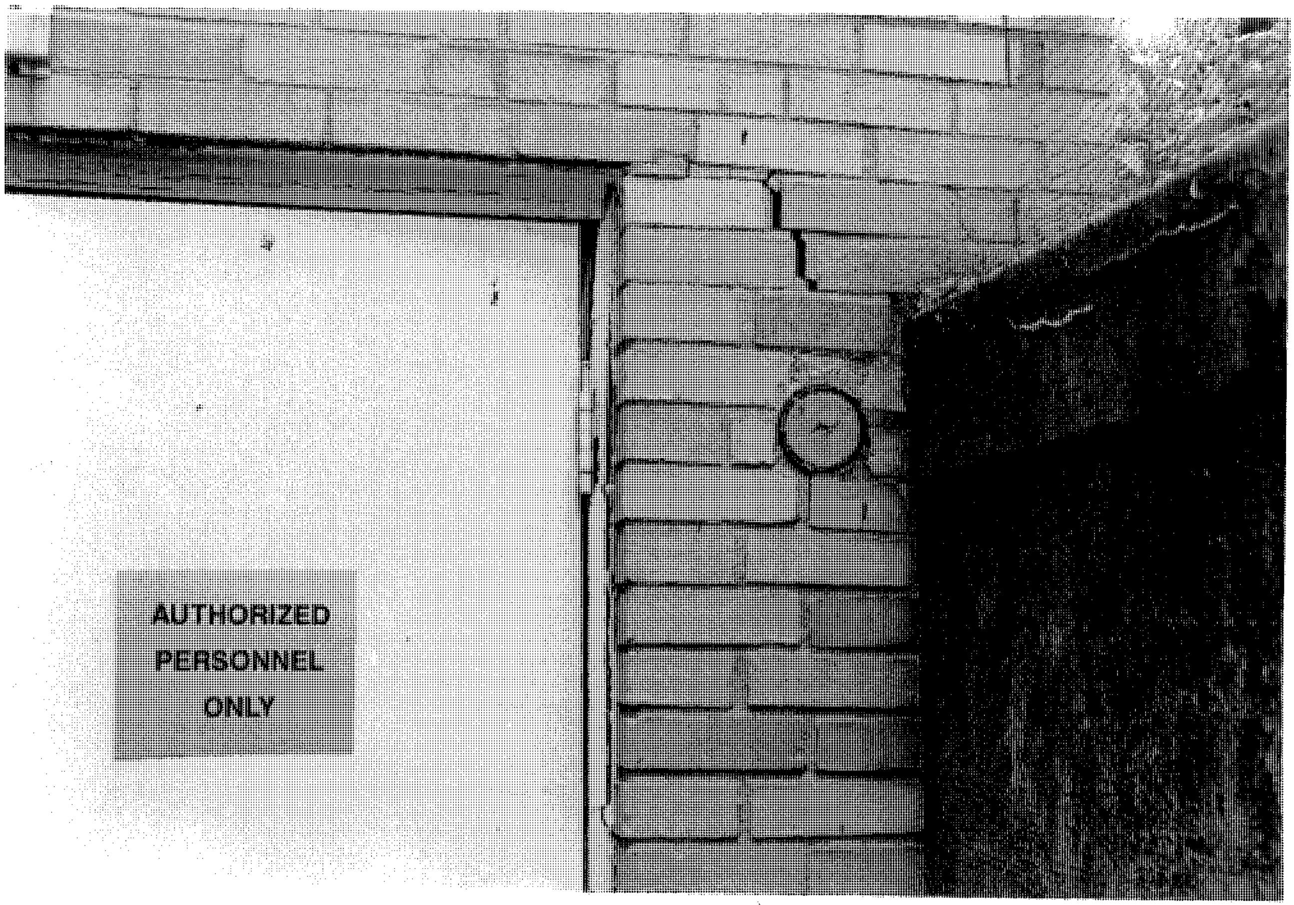


Figure 7-3

Location: North Side of Entryway on West Elevation of Building 7
Problem: Open mortar joints in brick
Cause of Problem: Water penetration and freezing; rusting of door lintel
Suggested Remedy: Remove brick and assess condition of lintel; replace if necessary and reset brick with mortar to match existing in color, texture and profile

Figure 7-4

<u>Location</u>: North Elevation of Building 7 in Central Area
<u>Problem</u>: Open mortar joints
<u>Cause of Problem</u>: Water penetration and freezing
<u>Suggested Remedy</u>: Cut and point

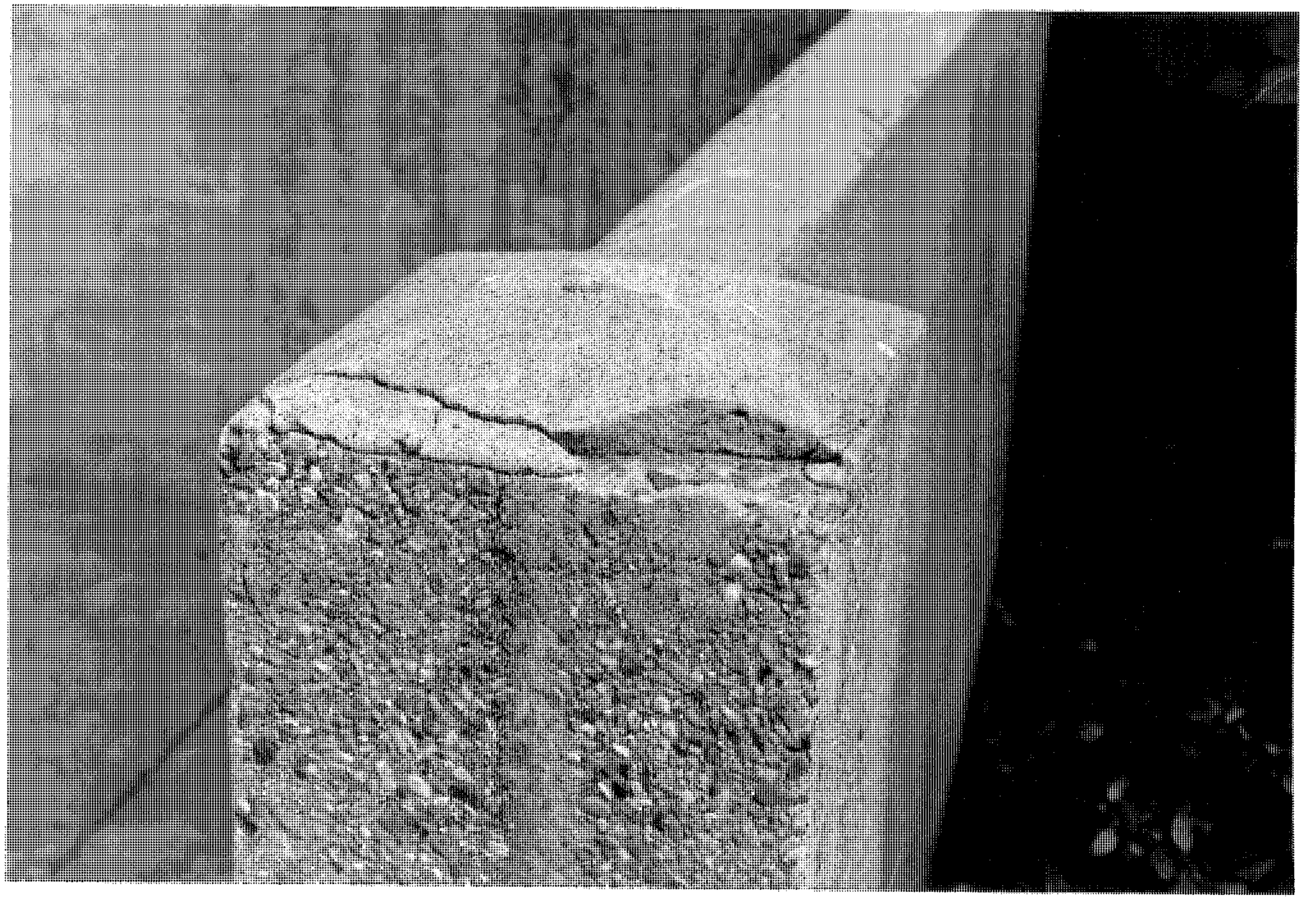


Figure 7-5

Location: East Elevation of Building 7 at North End (patio wall)
Problem: Damaged concrete
Cause of Problem: Water penetration and freezing
Suggested Remedy: Repair with concrete patching material

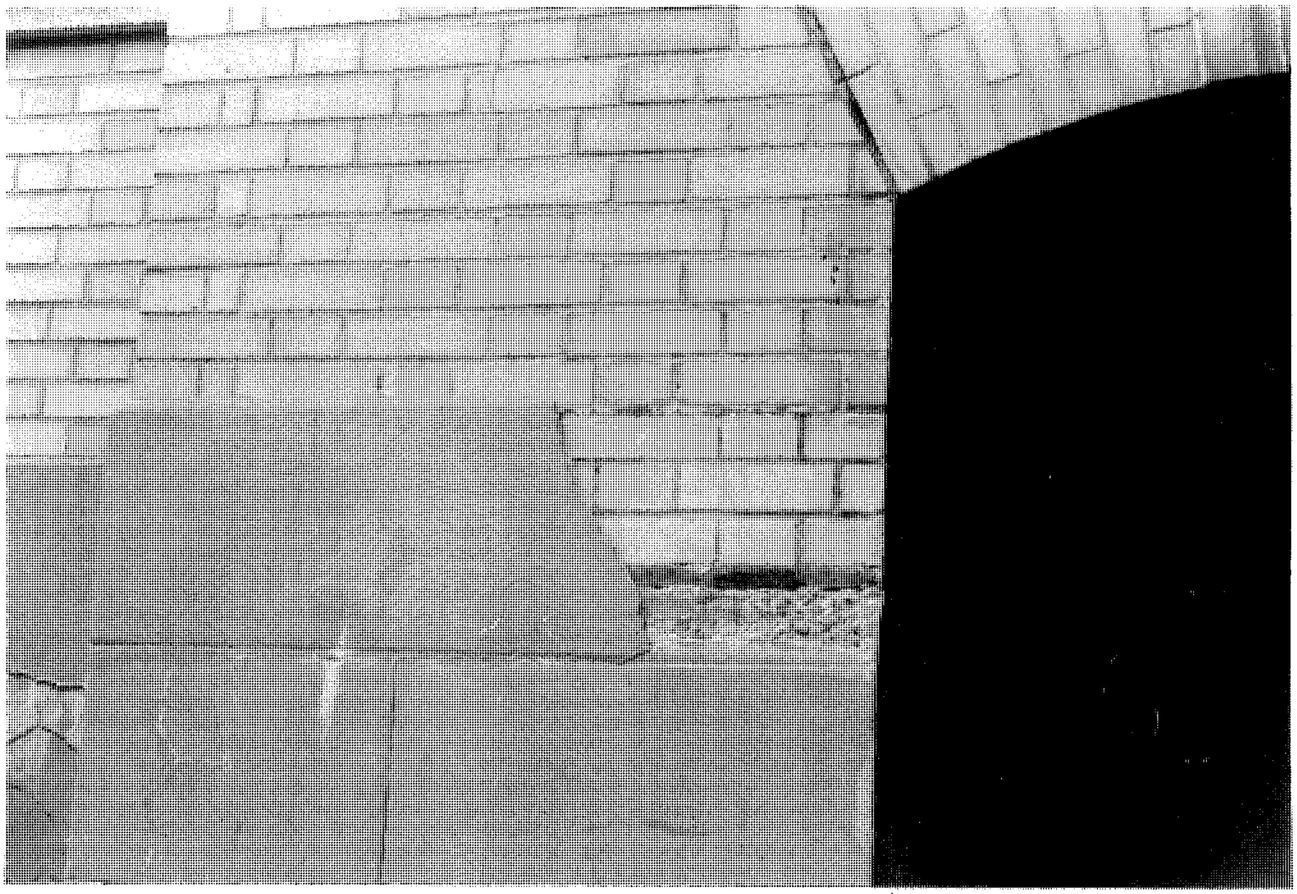


Figure 7-6

Location: South Elevation of Building 7 at West End
Problem: Damaged and failing stucco
Cause of Problem: Water penetration and freezing
Suggested Remedy: Repair with new stucco

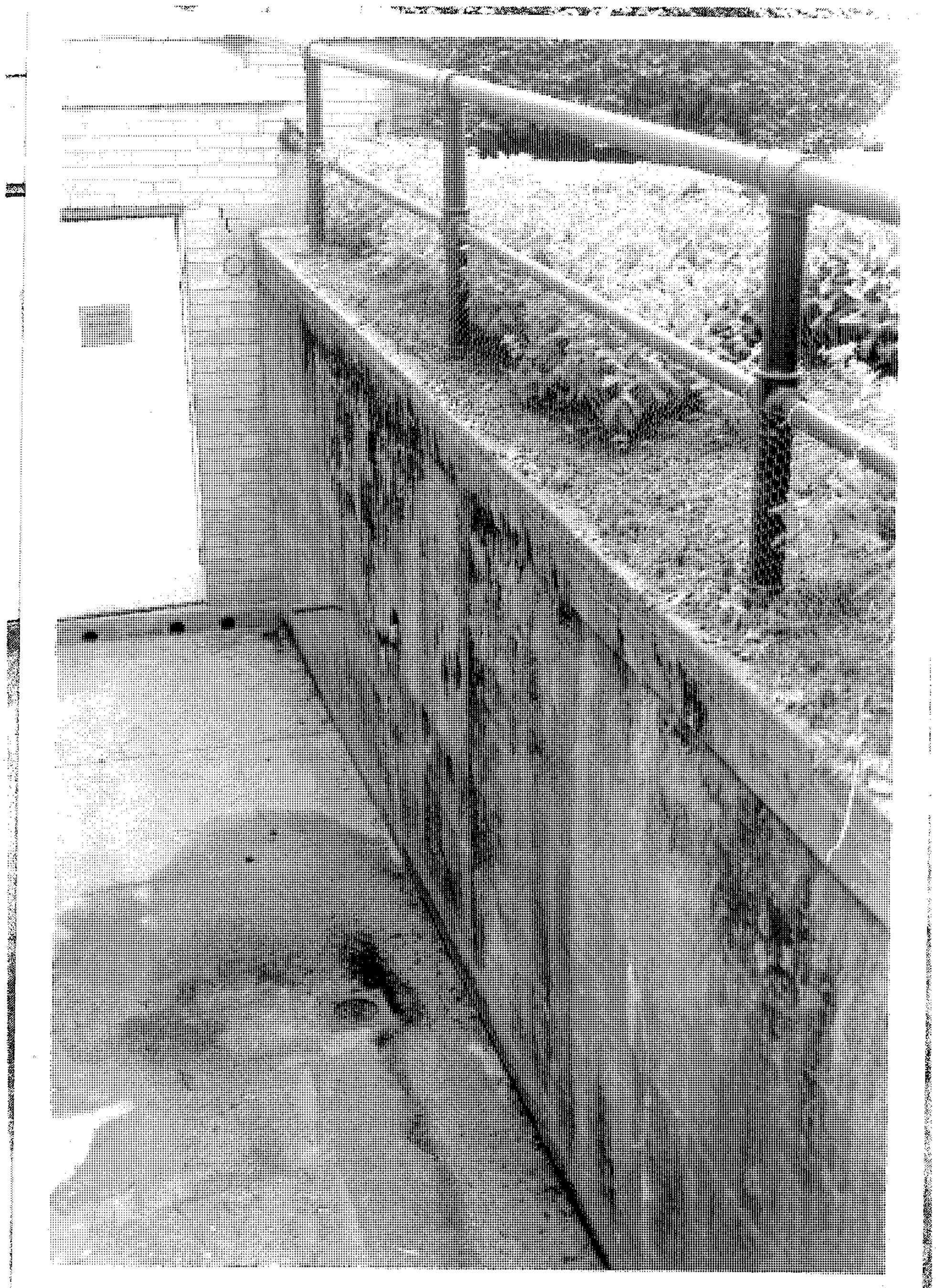


Figure 7-7

Location: West Elevation of Building 7 along North Areaway
Problem: Bulging and efflorescing concrete retaining wall
Cause of Problem: Water penetration and freezing; pressure from soil
Suggested Remedy: Demolish and rebuild

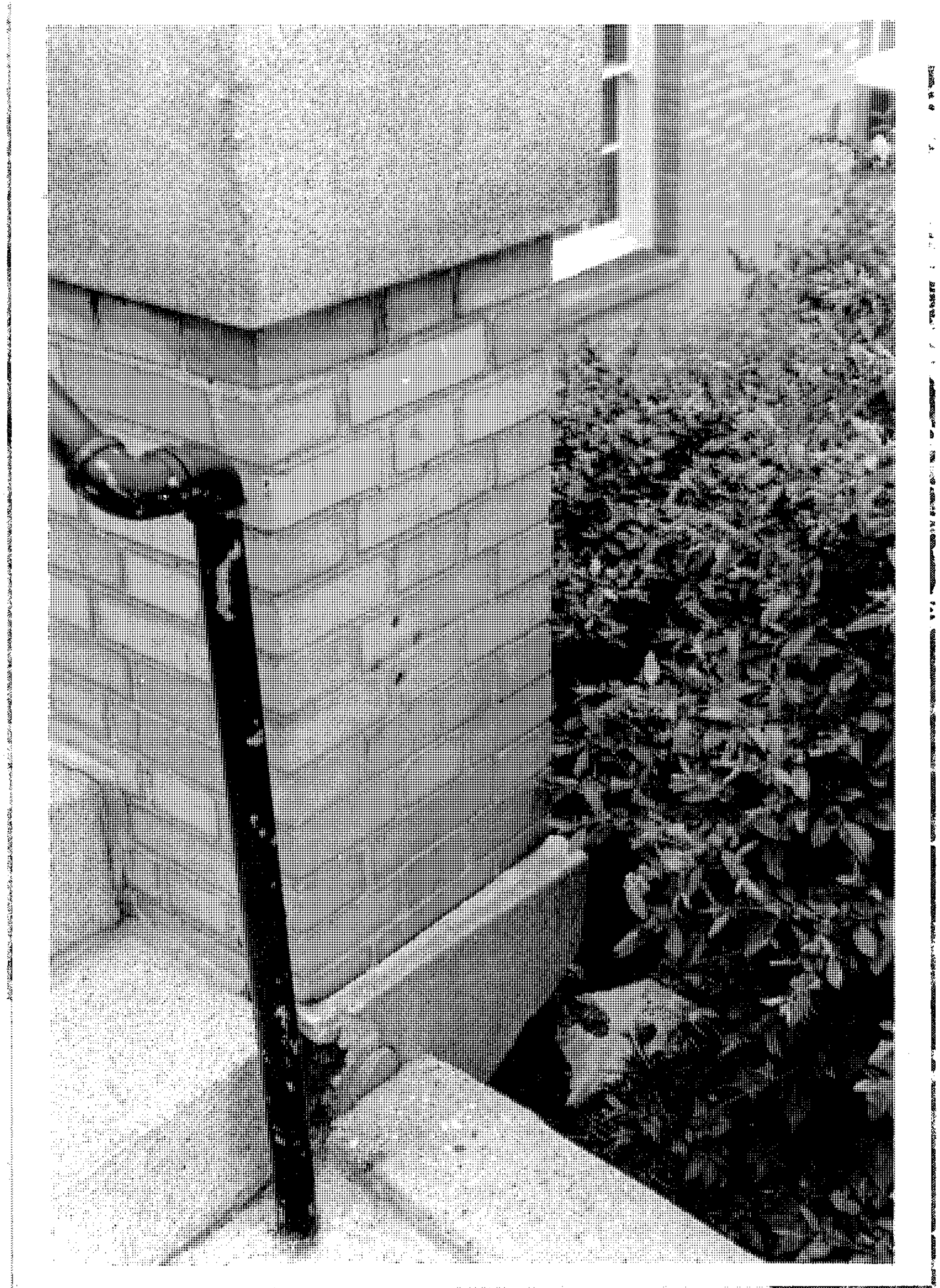


Figure 7-8

Location: West Elevation of Building 7 at Central Entryway
Problem: Damaged and deteriorating concrete piers
Cause of Problem: Water penetration and freezing
Suggested Remedy: Repair with concrete patching material

Figure 7-9

Location: North Elevation of Building 7 at West End (Walkway Wall)
Problem: Damaged and deteriorating concrete capstone
Cause of Problem: Water penetration and freezing
Suggested Remedy: Remove and replace

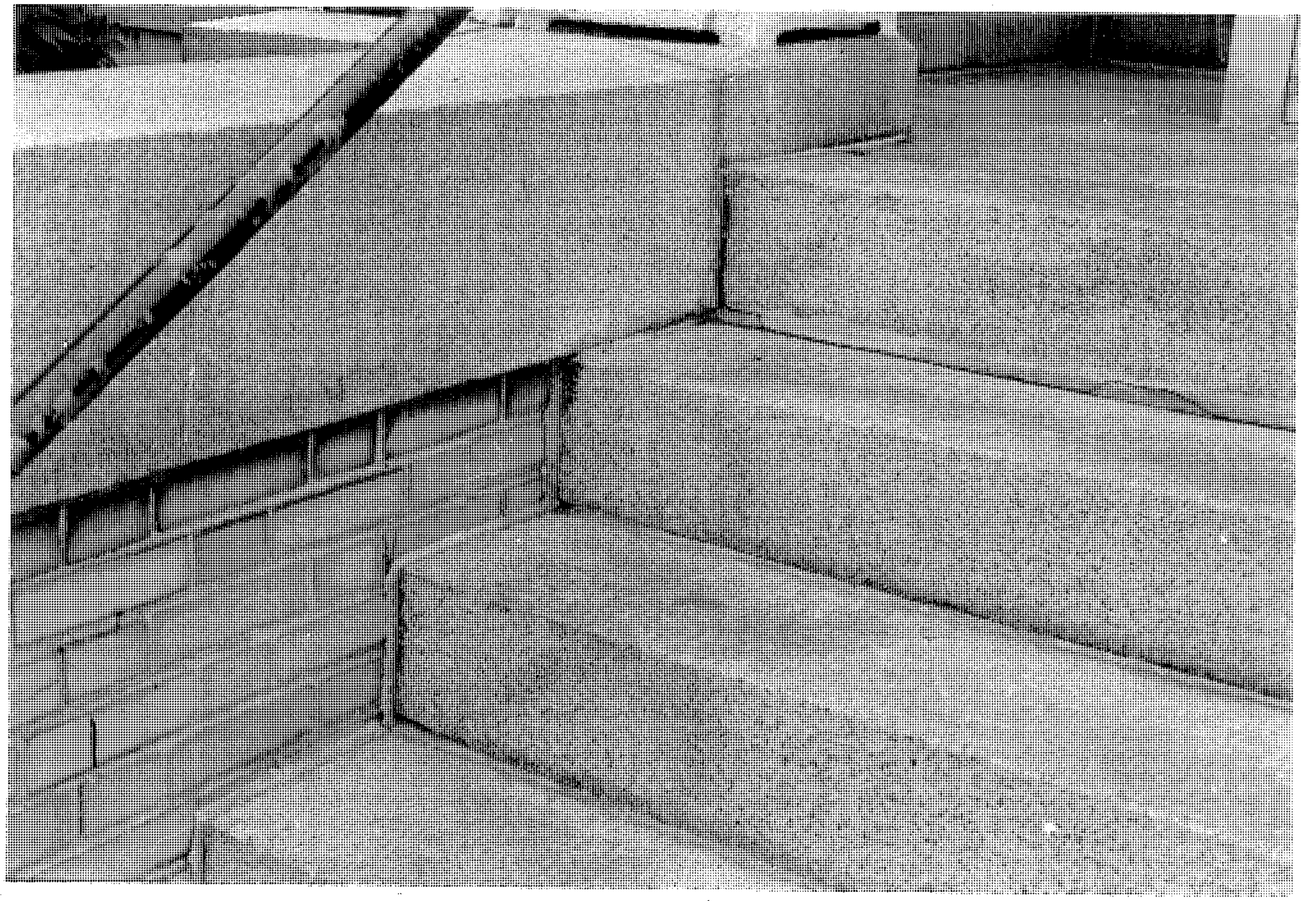


Figure 7-10

Location: West Elevation of Building 7 at Central Entryway
Problem: Open or caulked joints
Cause of Problem: Water penetration and freezing; improper maintenance procedures
Suggested Remedy: Remove, cut and point

Chapter 7

SUMMARY

This mortar analysis addresses the brick and stone water table pointing mortars found on Buildings 1, 3-7 of the Potomac Annex. Generally, the sampled mortars are in good condition and most appear to be original to the buildings. Aesthetically, it appears that the brick and water table pointing mortars for Buildings 1,5,6,& 7 were identical. The mortars found on Buildings 3 & 4, which indicate a different color range than the remaining buildings' mortars, appear to be original except for the water table pointing mortar of Building 4. The pointing mortar joint profiles (both vertical and horizontal) for all buildings are slightly concave. This chapter describes the analytical protocol used to study the mortars. Each mortar is considered separately and the physical and aesthetic characteristics of each are described and documented. All original mortars are to be replicated according to the results of this analysis.

INTRODUCTION

The purpose of mortar analysis is to determine the compositions of existing mortars used in Buildings 1,3,4,5,6, and 7 at the Potomac Annex. This information is utilized in developing the specification for the mortar to be used in repointing work at these buildings.

Repointing masonry is essential in order to ensure that the building facades are water-tight. The composition of the mortar is important for several reasons. Mortar can be classified as "hard" or "soft", according to the amount of cement in its composition. This classification also reflects the compressive strength of the mortar (providing the aggregate content is held constant). Repointing mortar should be of the same or slightly less compressive strength than the original mortar. Too hard a mortar can cause the brick to crack because the bricks are held too rigidly in place. The aggregate colors the mortar and provides texture.

When undertaking any new repointing campaign, it is important to attempt to reproduce the color, texture, and profile existing pointing. Color and texture can be derived from the original mortar composition, while the profile comes from tooling the joint in the same manner as the original. The color and texture of the original mortar may be reproduced with mortars which are identical in composition or with mortars whose compositions are different from the original mortars.

ANALYTICAL PROTOCOL

Samples were removed from Buildings 1,3,4,5,6, and 7 using a small hammer and chisel. Samples were analyzed by several methods. Before removal, both the color of the mortar and the joint profile were noted.

X-Ray Diffraction

- ✔ approximately 100 milligrams of each sample is ground in an agate mortar and pestle to a fine powder.
- ✔ the fine powder is sprinkled on double-sticky tape which itself is adhered to a petrographic glass slide.
- ✔ the slide is placed in the sample holder of the Philips 1710 diffractometer.

The diffractometer operates at 40 kilivolts and 30 milliamps and scans are obtained from 3-63 degrees of Bragg angle. The scans are obtained by the Sietronics software which collects the diffractograms and determines the position and intensity of the resulting peaks. These data are digitally transferred to the Fein-Marquart Search-Match program for phase identification.

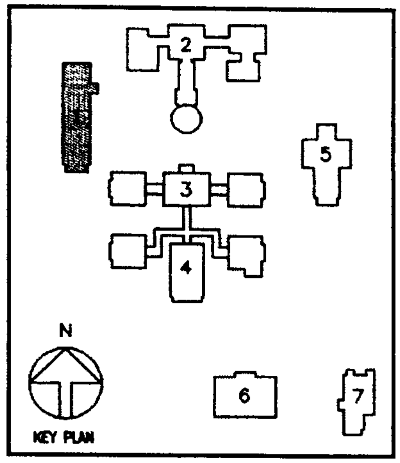
Wet Chemical Methods

- ✔ samples are dried in a convection oven at 80 degrees centigrade for 12 hours, equilibrated to room temperature and relative humidity (approximately 50% RH and 20 degrees Celsius) and weighed.
- ✔ samples are lightly crushed so as not to crush the aggregate and thereby change the sizes of these particles.
- ✔ samples are transferred to erlenmeyer flask and digested in excess 1 molar hydrochloric acid for 1 hour noting effervescence if it occurs.
- ✔ acid insoluble residue are obtained by filtration and washing with distilled water.
- ✔ residues are dried to constant weight at 80 degrees centigrade in a convection oven and equilibrated to room temperature and relative humidity and weighed.
- ✔ color and granulation (by sieving) of the resulting residue is noted.
- ✔ calculation/estimation of the original mortar composition.

Acid-soluble fractions in mortars comprise calcite - from lime or in the aggregate - or gypsum which may be present due to the conversion of calcite to gypsum by acid rain or sulfur dioxide in combination with water. It is not often that aggregates comprise calcite.

Acid-insoluble fractions in mortar usually comprise the aggregate and cement components (or less acid-soluble lime components).

Building 1 - Brick Pointing Mortar



Designation: 1POTM (Figure 7-1)
Location: Northeast corner of Building 1 at eye level
Integrity: Appears to be original
Description: White-grey with fine aggregate; some dark inclusions
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 1/2" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite (see uPDSM Report 1POTM at the back of this chapter.)
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	27
60	38
100	22
140	6
180	1
200	2
Pan	4

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is in generally good condition and is well bonded except in step or stress cracks

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: quartz-sand with a sieve ratio similar to the above analysis. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: ½" wide, 1/16" deep, concave - both vertical and horizontal

Building 1 - Granite Water Table Pointing Mortar

Designation: 1POTMWT (Figure 7-2)
Location: Northeast basement corner of Building 1 at eye level
Integrity: Appears to be original
Description: White-grey with fine aggregate and some dark inclusions
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, muscovite mica, feldspar (see uPDSM Report 1POTMWT at the back of this chapter.)
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	33
60	47
100	13
140	3
180	0
200	2
Pan	4

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly lime and sand. The sand is more varied than 1POTM and contains some feldspar and mica. Some yellow ochre appears to be present and cement appears to be absent.

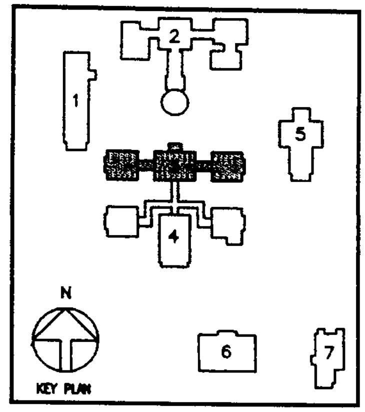
Deterioration: The mortar is lost in many areas due to movement and hardness of granite; more frequent repointing may be required at the water table.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: quartz sand, by volume. The sand should contain muscovite mica and some mafic minerals and have a sieve ratio similar to the above analysis. Mineral oxide pigments may be added to attain the proper color.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Glossary located at end of document.

Building 3 - Brick Pointing Mortar



Designation: 3POTM (Figure 7-3)
Location: Southeast corner of Building 3
Integrity: Appears to be original
Description: Grey-to-light tan with fine aggregate
Munsell Color Notation - Mortar: 10 YR 8/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite (see uPDSM Report 3POTM at the back of this chapter.)
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:1.7 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	14
60	39
100	27
140	7
180	4
200	3
Pan	7

Munsell Color Notation - Acid Insolubles: 10 YR 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is in generally good condition except in areas of step or stress cracks.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: quartz sand by volume; the sand should contain muscovite mica with a sieve ratio similar to the above analysis. Mineral oxide pigments may be added to attain the proper color.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Building 3 - Limestone Water Table Pointing Mortar

Designation: 3POTMWT (Figure 7-4)
Location: Southeast corner of Building 3
Integrity: Appears to be original
Description: White-grey with fine to medium aggregate
Munsell Color Notation - Mortar: 5 Y 8.5/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, (see uPDSM report 3 POTMWT at the back of this chapter
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds.

Volumetric Analysis: 1:2.7 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	32
60	46
100	15
140	3
180	1
200	2
Pan	2

Munsell Color Notation - Acid Insolubles: 10 YR 7/4

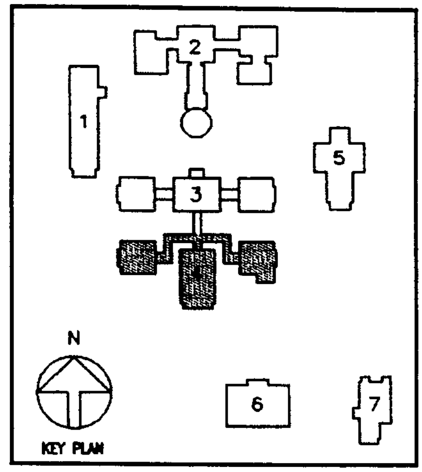
Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: Mortar in the water table joints is often missing or has been replaced.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: :sand (by volume) using sand similar to the above sieve analysis.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Building 4: Brick Pointing Mortar



Designation: 4POTM (Figure 7-5)
Location: Northwest corner of Building 4
Integrity: Appears to be original
Description: Grey-to-light tan with fine aggregate
Munsell Color Notation - Mortar: 10 YR 8/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite (see uPDSM report 4POTM at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:1.7 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	13
60	41
100	26
140	8
180	4
200	4
Pan	6

Munsell Color Notation - Acid Insolubles: 10 YR 8/1

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is in generally good condition and is well bonded except in areas of step or stress cracks.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: quartz sand (by volume) with a sieve ratio similar to the above analysis. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Glossary located at end of document.

Building 4 - Limestone Water Table Pointing Mortar

Designation: 4POTMWT (Figure 7-6)
Location: Northwest corner of Building 4
Integrity: Appears to be non-original
Description: Tan with medium aggregate
Munsell Color Notation - Acid Insolubles: 2.5 Y 8.5/2

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz (see uPDSM report 4POTMWT at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:8 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	7
40	45
60	29
100	11
140	3
180	1
200	2
Pan	1

Munsell Color Notation - Acid Insolubles: 10 YR 6/4

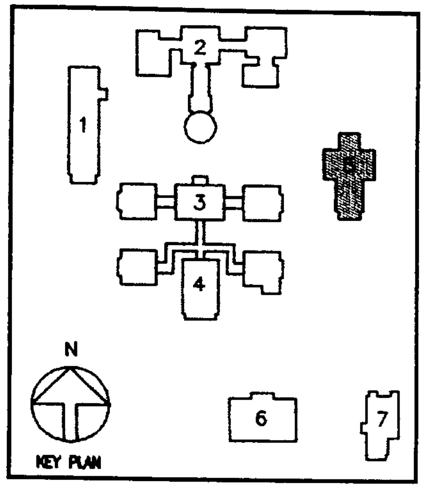
Comments: The mortar appears to be mostly quartz-sand and lime, but much of the lime has been lost. Weak/non-crystalline materials are probably iron oxides such as yellow ochre present in the sand.

Deterioration: Much of the water table mortar has been lost and the existing pointing mortar appears to be non-original. The losses are due to the high level of run-off over the vertical joints of the water table.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: quartz sand by volume. The sand should match that of 3POTMWT.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Building 5 - Brick Pointing Mortar



Designation: 5POTM (Figure 7-7)
Location: Northeast corner of Building 5
Integrity: Appears to be original
Description: White-grey with fine aggregate and some dark inclusions
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 7/16" - ½" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, gypsum, feldspar (see uPDSM Report 5POTM at the back of this chapter.)
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	29
60	34
100	23
140	5
180	2
200	4
Pan	3

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is generally in good condition and is well bonded except in areas of step or stress cracks. Acid rain has converted some of the lime to gypsum although this does not appear to be a significant problem.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand, by volume, with a sieve ratio similar to the above analysis. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 7/16" wide, 1/16" deep, concave - both vertical and horizontal

Building 5 - Granite Water Table Pointing Mortar

Designation: 5POTMWT (Figure 7-8)
Location: Northeast corner of Building 5
Integrity: Appears to be non-original
Description: Tan with medium aggregate
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite (see uPDSM Report 5POTMWT at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2.5 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	7
40	24
60	42
100	21
140	4
180	1
200	1
Pan	1

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

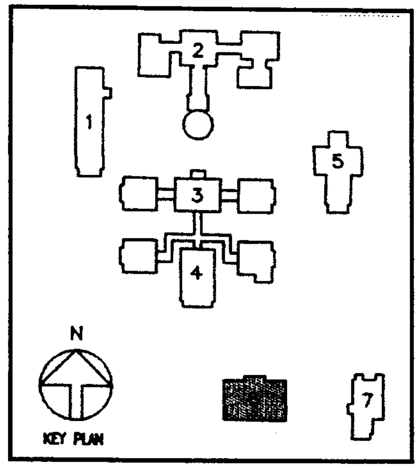
Deterioration: The mortar is lost in many areas due to movement and hardness of the granite; more frequent repointing may be required in the water table.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand with a sieve ratio similar to 5POTM. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Glossary located at end of document.

Building 6 - Brick Pointing Mortar



Designation: 6POTM (Figure 7-9)

Location: North facade of Building 6, west of entrance, near first basement window

Integrity: Appears to be original

Description: White-grey with fine aggregate and some dark inclusions
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 7/16" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, gypsum (see uPDSM Report 6POTM at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	26
60	40
100	24
140	4
180	-
200	3
Pan	3

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is in generally good condition and is well bonded except in areas of step or stress cracks. Acid rain has converted some of the lime to gypsum, although this does not appear to be a significant problem.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand with a sieve ratio similar to the above analysis. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 7/16" wide, 1/16" deep, concave - both vertical and horizontal

Building 6 - Granite Water Table Pointing Mortar

Designation: 6POTMWT (Figure 7-10)
Location: North facade of Building 6, west of entrance, near first basement window
Integrity: Appears to be non-original
Description: Tan with medium aggregate
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, clay, mica (see uPDSM Report 6POTMWT at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:1.5 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	35
60	38
100	14
140	7
180	1
200	1
Pan	4

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: This is a replacement mortar with a composition that is different from other mortars at the site.

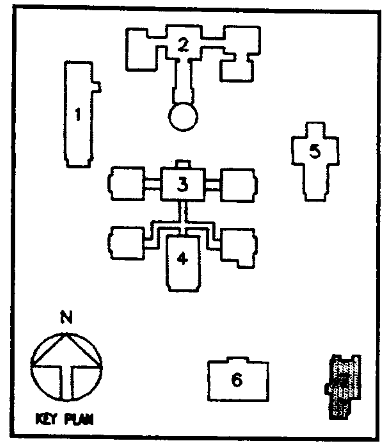
Deterioration: The mortar is lost in many areas due to movement and hardness of the granite; more frequent repointing may be required in the water table.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand with a sieve ratio similarto 6POTM. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Glossary located at end of document.

Building 7 - Brick Pointing Mortar



Designation: 7POTM (Figure 7-11)
Location: Northwest corner of Building 7
Integrity: Appears to be original
Description: White-grey with fine aggregate, some dark inclusions
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 7/16" - ½" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, muscovite mica (see uPDSM Report 7POTM at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:2 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	-
40	28
60	35
100	20
140	8
180	2
200	4
Pan	3

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is in generally good condition and is well bonded except in areas of step and stress cracks.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand with a sieve ratio similar to the above analysis. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 7/16" wide, 1/16" deep, concave - both vertical and horizontal

Building 7 - Granite Water Table Pointing Mortar

Designation: 7POTMWT (Figure 7-12)
Location: Northwest corner of Building 7
Integrity: Appears to be non-original
Description: Grey with medium aggregate
Munsell Color Notation - Mortar: 5 Y 9/1

Profile: 3/8" width, 1/16" depth, concave

Analyses: X-ray Diffraction: quartz, calcite, muscovite mica (see uPDSM Report 7POTMWT at the back of this chapter.
Wet Chemistry: vigorous efflorescence upon addition of acid; solution becomes yellow-green with acid indicating the presence of reactive iron compounds
Volumetric Analysis: 1:1.5 lime:acid insolubles

Sieve Analysis of Acid Insolubles:

Mesh Size	Weight Percent
10	6
40	36
60	39
100	9
140	3
180	0
200	2
Pan	5

Munsell Color Notation - Acid Insolubles: 2.5 Y 8/2

Comments: The mortar appears to be mostly quartz-sand and lime.

Deterioration: The mortar is lost in many areas due to movement and hardness of the granite; more frequent repointing may be required in the water table.

Repointing Composition: 1:1:6 (by volume) ratio of hydrated lime: Portland Cement: sand with a sieve ratio similarto 5POTM. The proper color can be achieved with mineral oxide pigments.

Recommended Profile: 3/8" wide, 1/16" deep, concave - both vertical and horizontal

Glossary located at end of document.

REPLICATION

When repointing, it is important to match the existing mortars' aesthetic and physical characteristics and the existing joint profile. When contemplating removal of existing deteriorated pointing mortar, only the most careful and sensitive methods should be used. Generally, removal of joint mortar by hand is preferable; however, electric powered tools may be utilized by specially trained masons. A guideline specification for joint removal with saws is referenced in the GSA-NCR Preservation Notebook - 04500: Masonry Restoration Methods of executing new mortar joints are referenced in the Specifications in Chapter 10 of this document.

Since the sand component for each of these replication mixes represents the majority of the material used and the sand in a mortar has a significant impact on the color a mortar will ultimately impart, it is very important to match as closely as possible the color, grain shape, grain size, and grain size distribution of the original sands. Also, the sand for the mixes should be clean, and free from loam, sit, soluble salts, and organic matter, and conform to ASTM C-44. Additional refinements to the mortar recipe may be necessary to achieve an acceptable color to match existing mortar. Pigments may be added if they are alkali resistant oxides manufactured for use in cement mixes. Careful color matching of the mortar is particularly important when partially repointing mortar. Sample mortars and mock-up panels should be approved by the Contracting Officer before general repointing work begins.

Figure 7-2

Building 1 - Granite Pointing Mortar

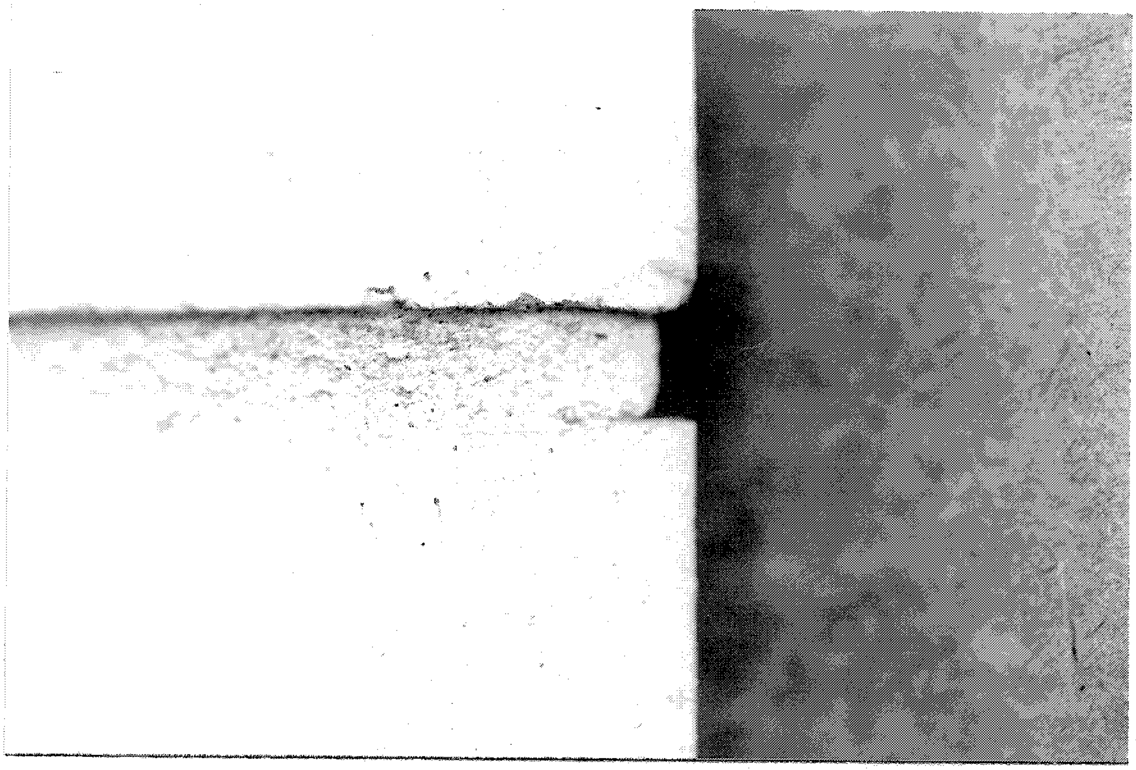


Figure 7-1

Building 1 - Brick Pointing Mortar

Figure 7-2

Building 1 - Granite Pointing Mortar

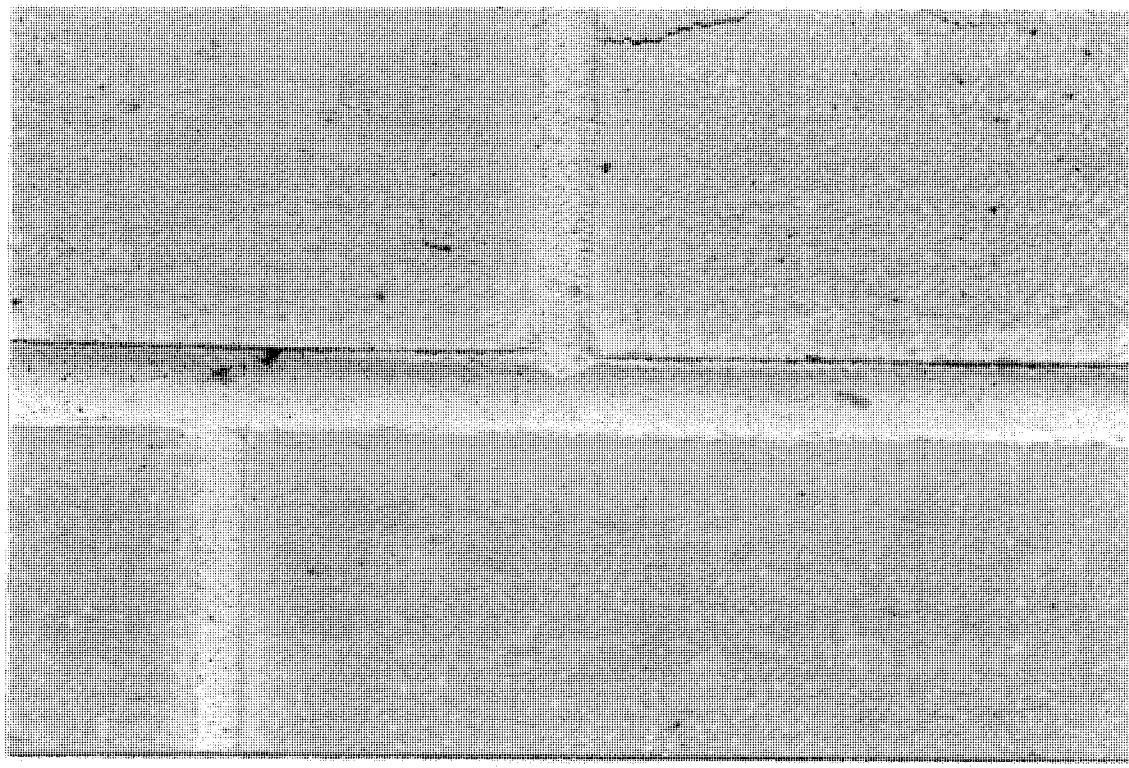


Figure 7-3

Building 3 - Brick Pointing Mortar

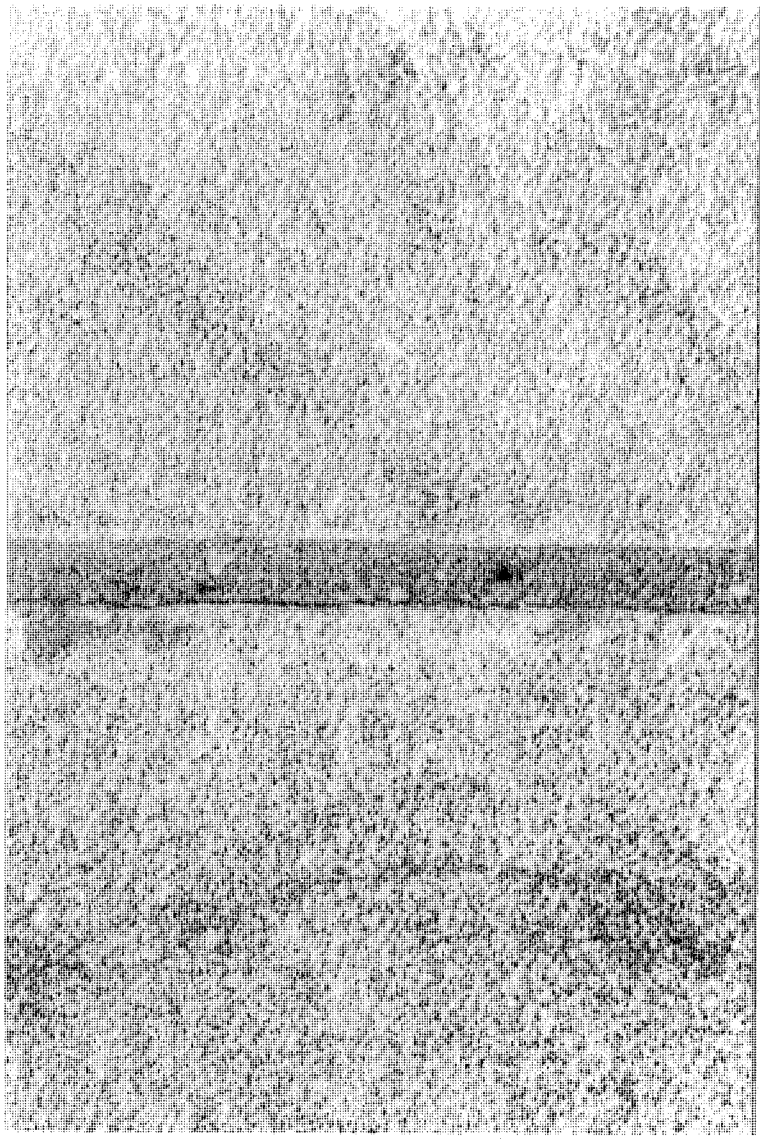


Figure 7-4

Building 3 - Limestone Pointing Mortar

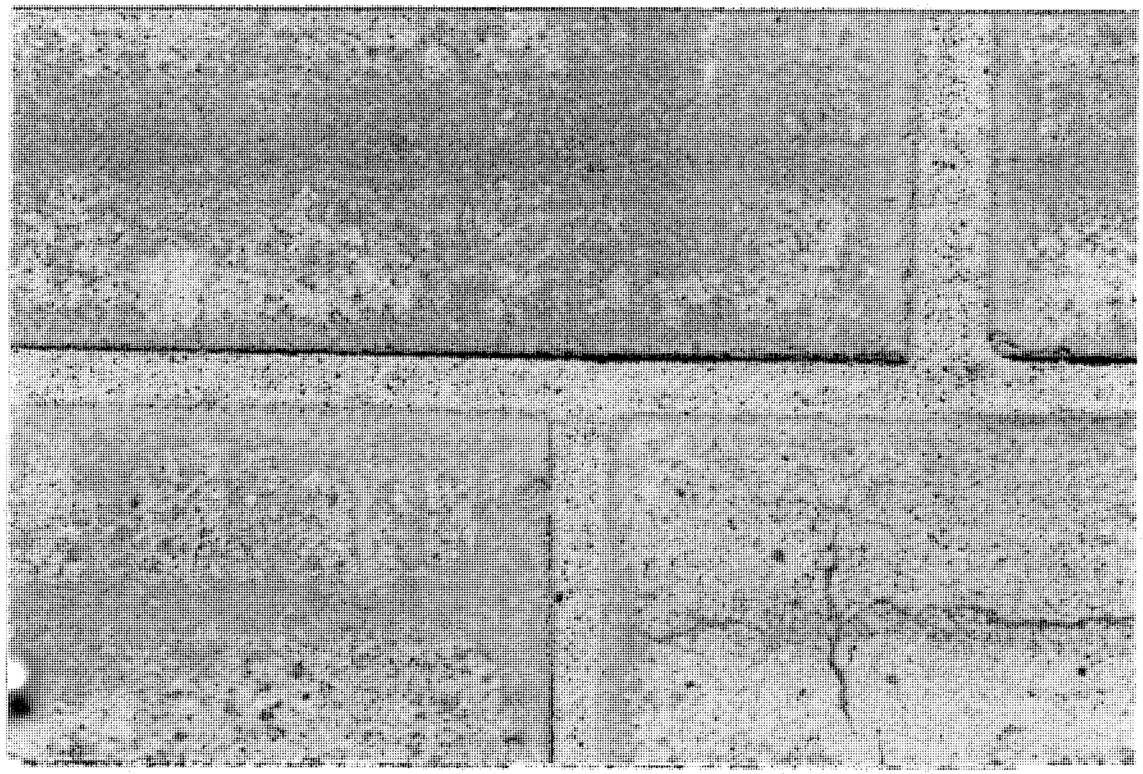


Figure 7-5

Building 4 - Brick Pointing Mortar

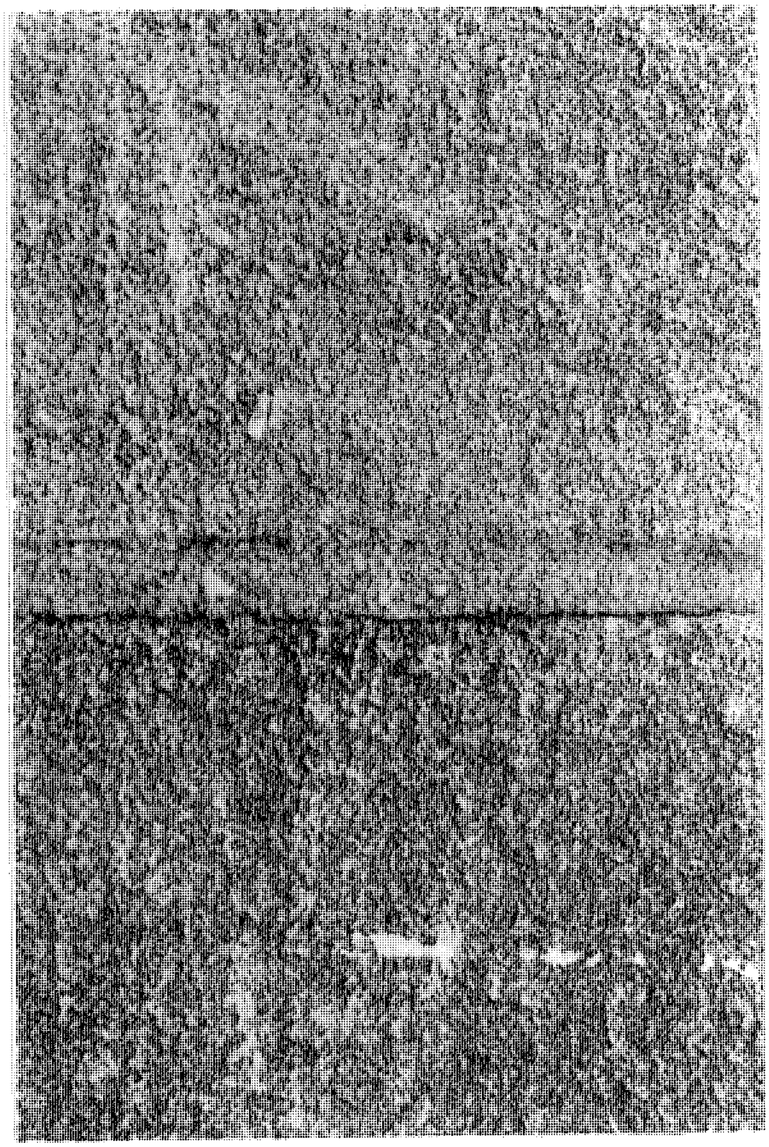


Figure 7-6

Building 4 - Limestone Pointing Mortar

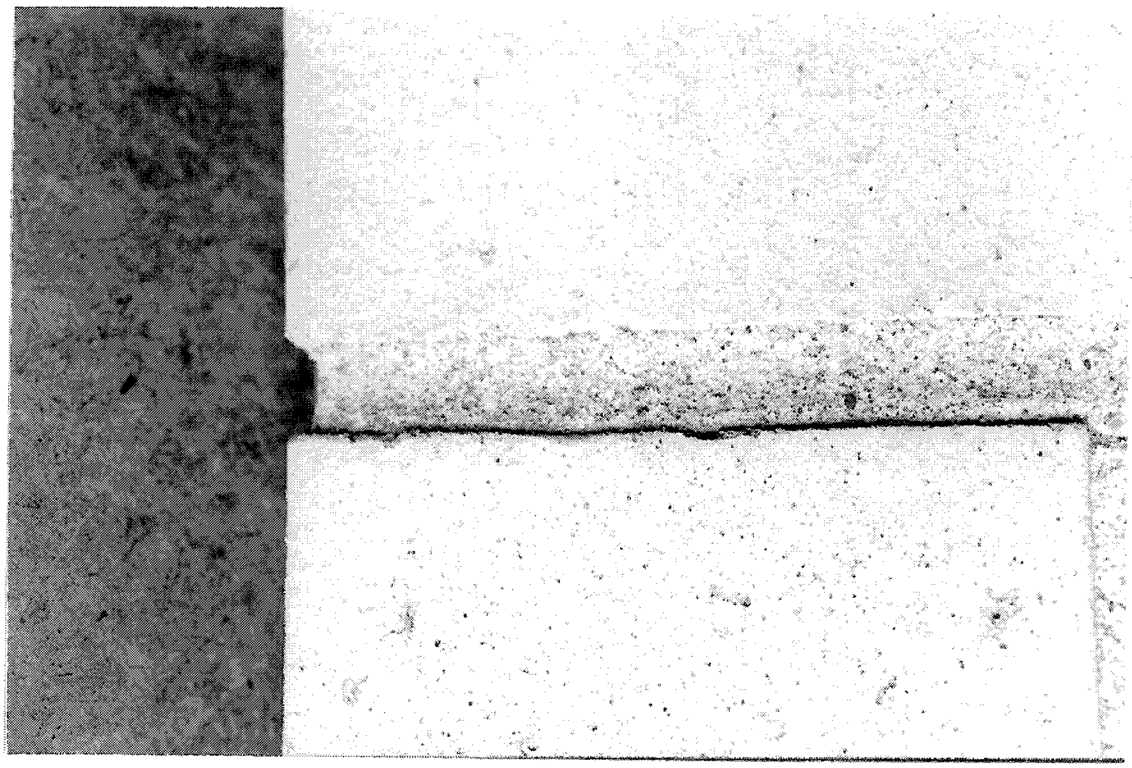


Figure 7-7

Building 5 - Brick Pointing Mortar

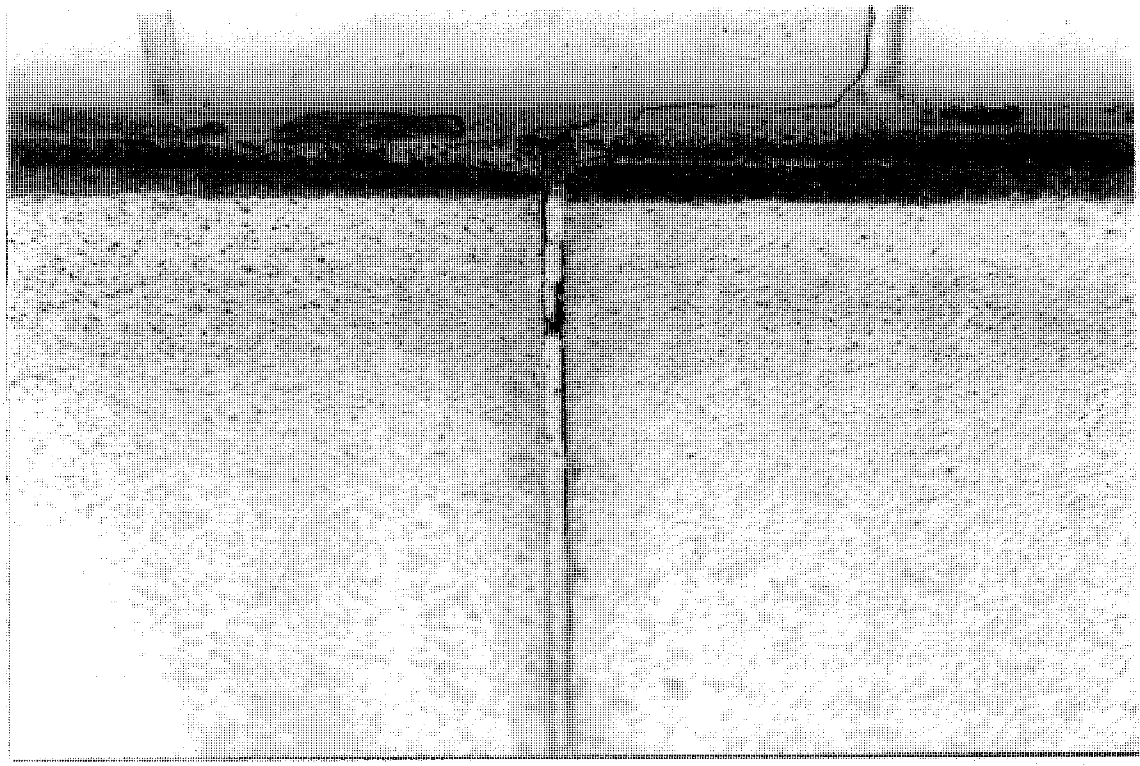


Figure 7-8

Building 5 - Granite Pointing Mortar

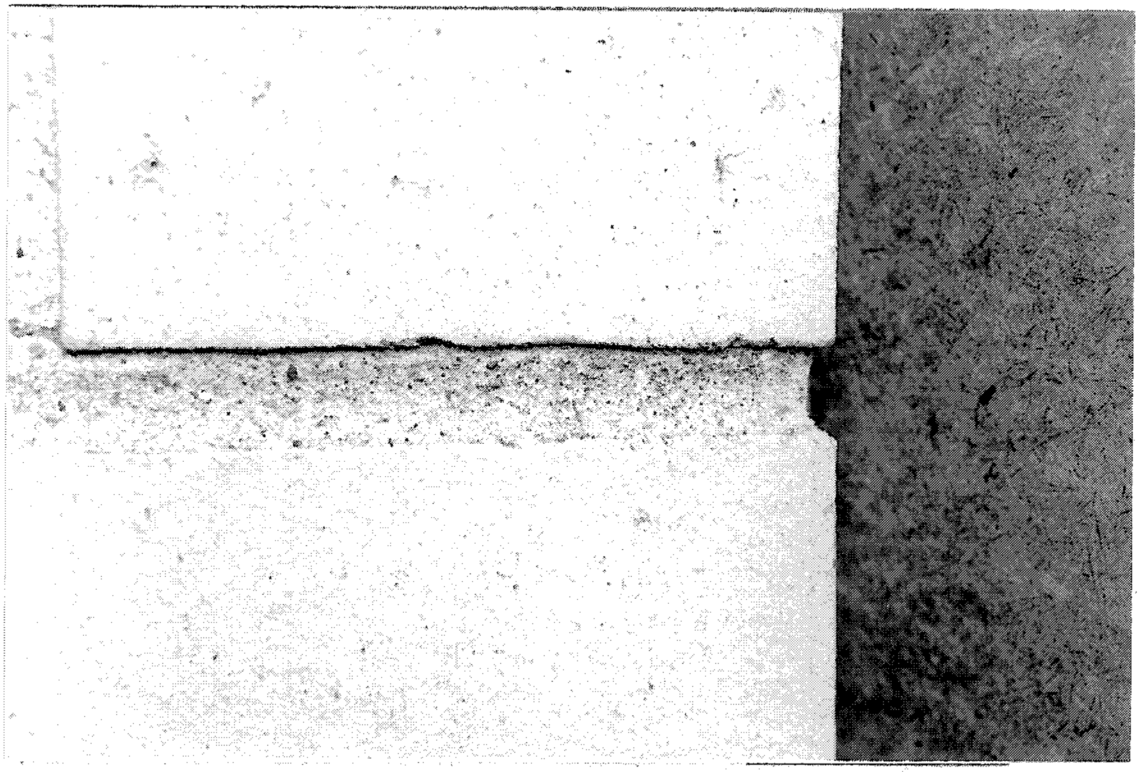


Figure 7-9

Building 6 - Brick Pointing Mortar

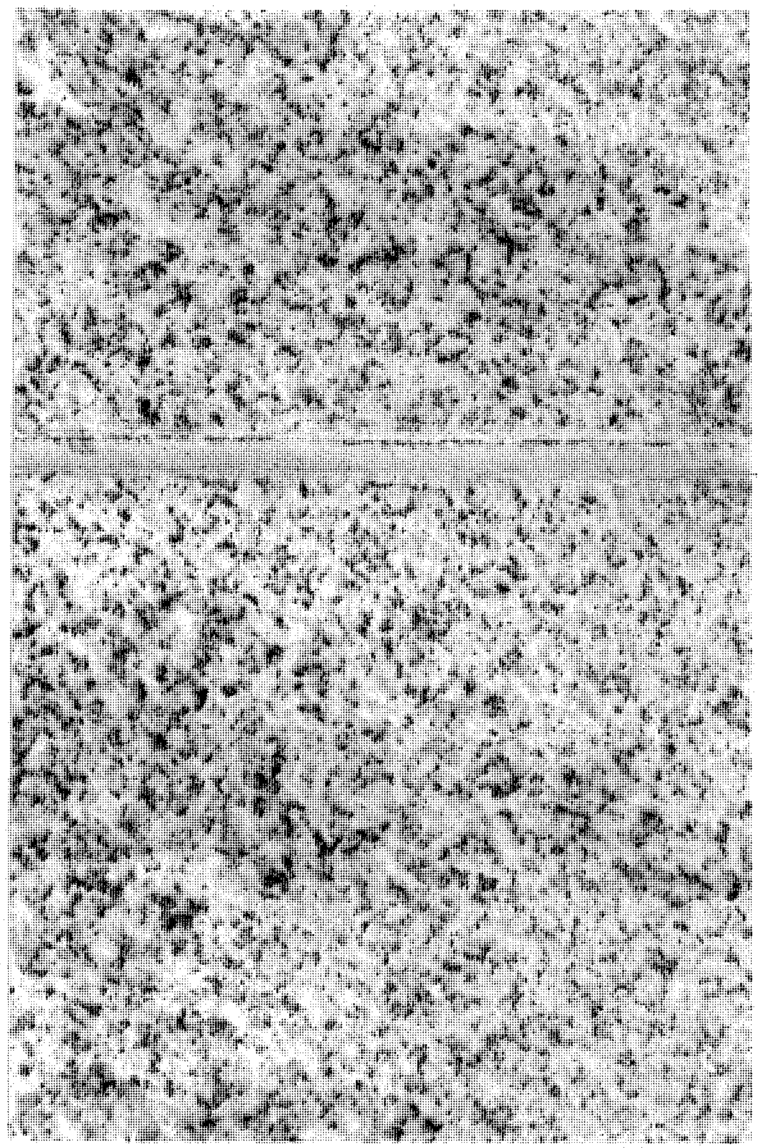


Figure 7-10

Building 6 - Granite Pointing Mortar

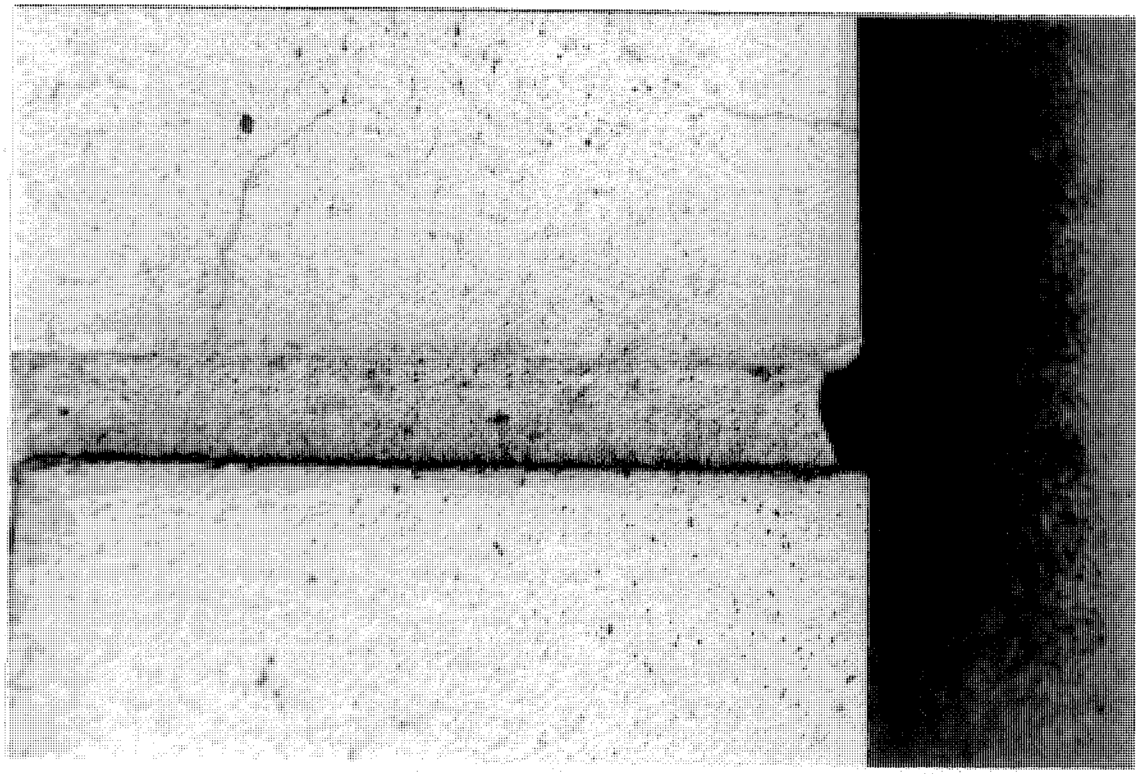


Figure 7-11

Building 7 - Brick Pointing Mortar

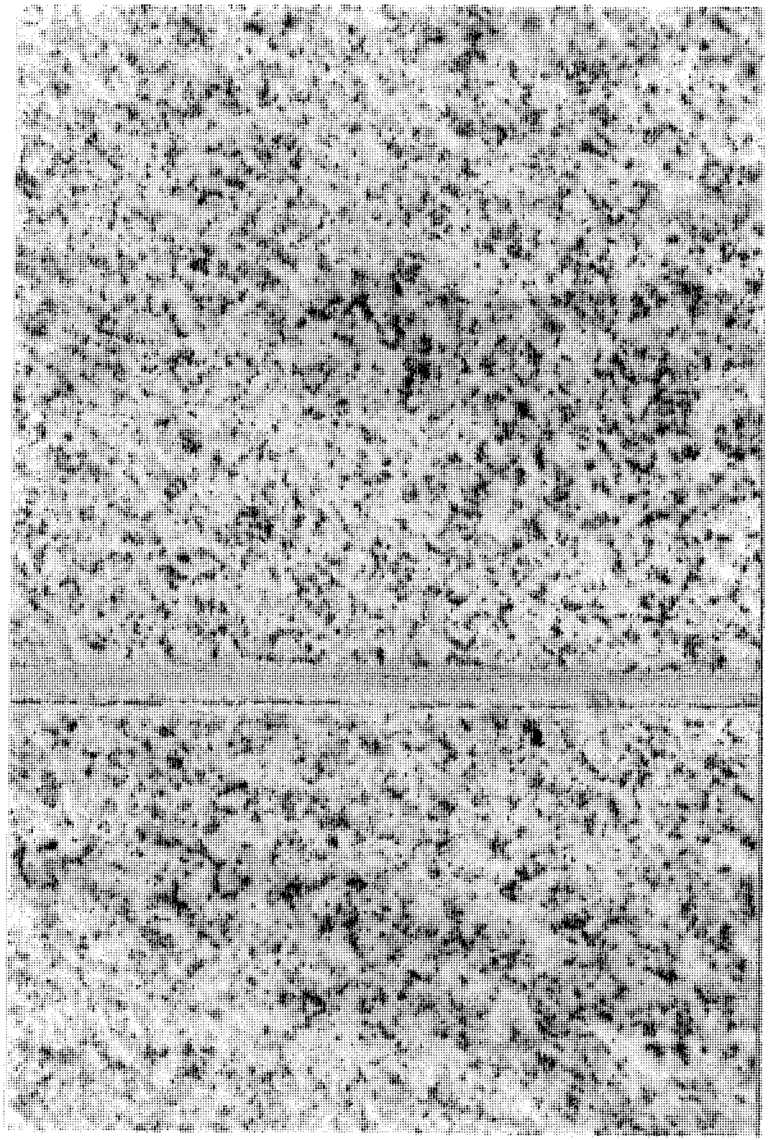
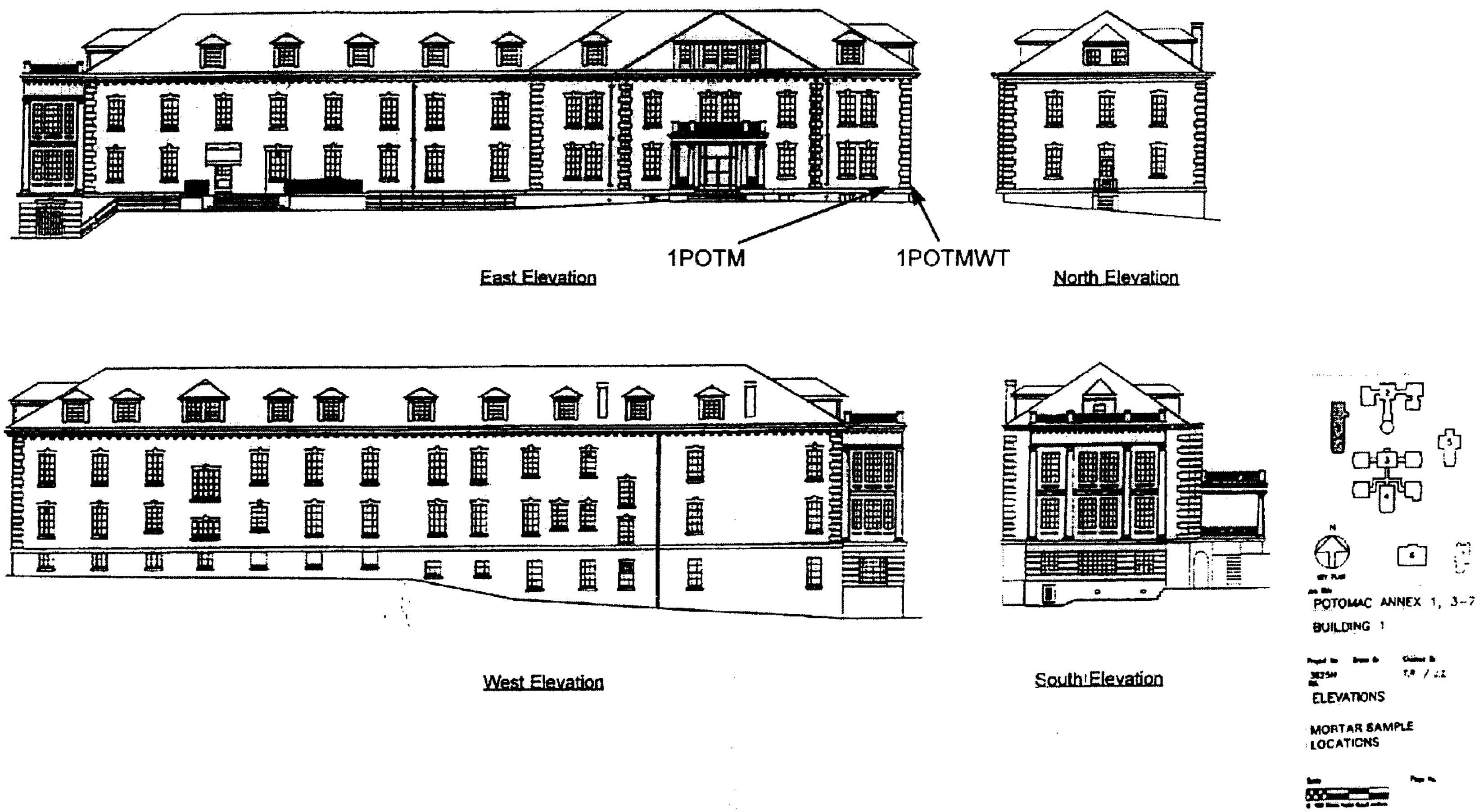
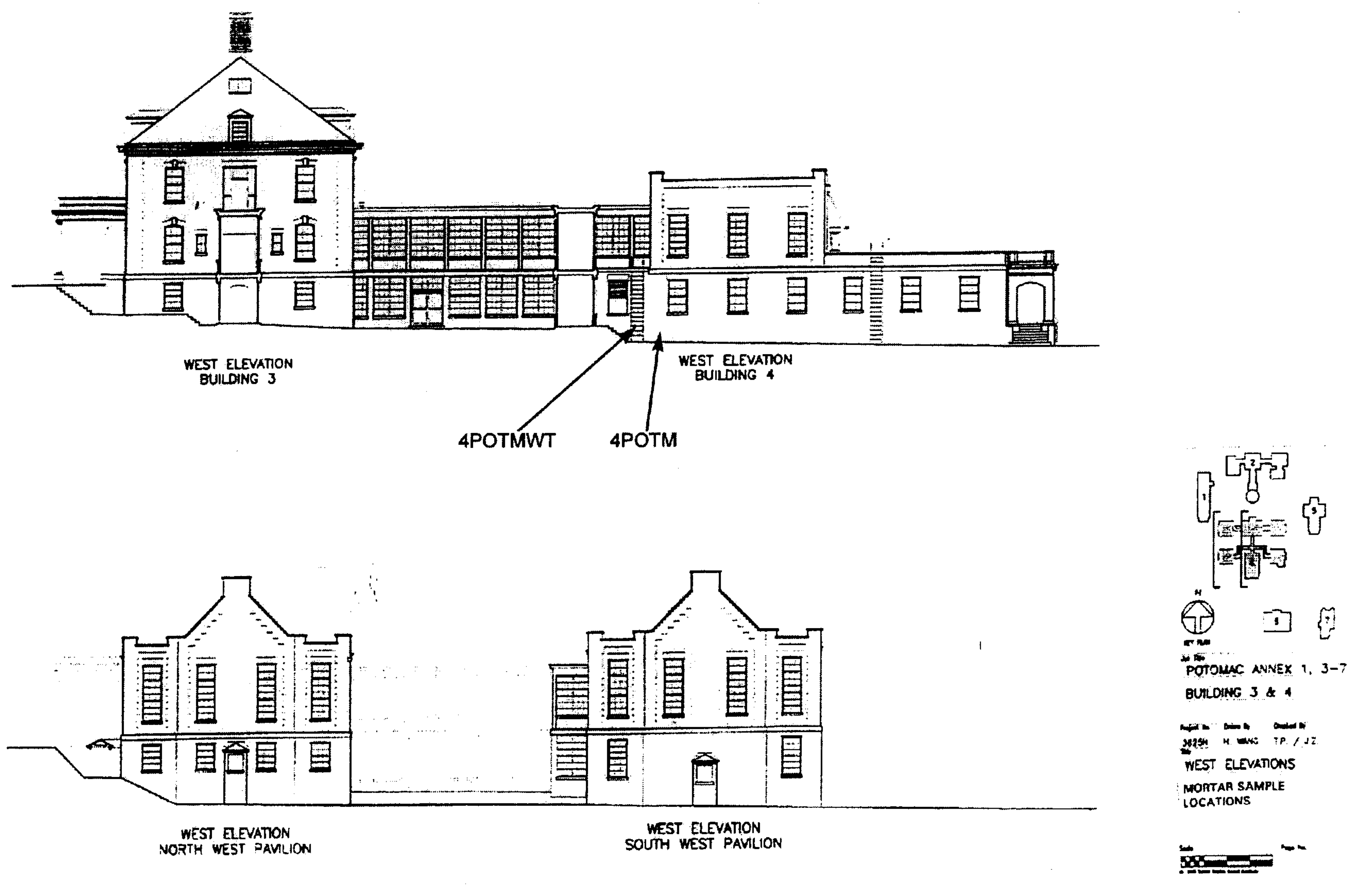


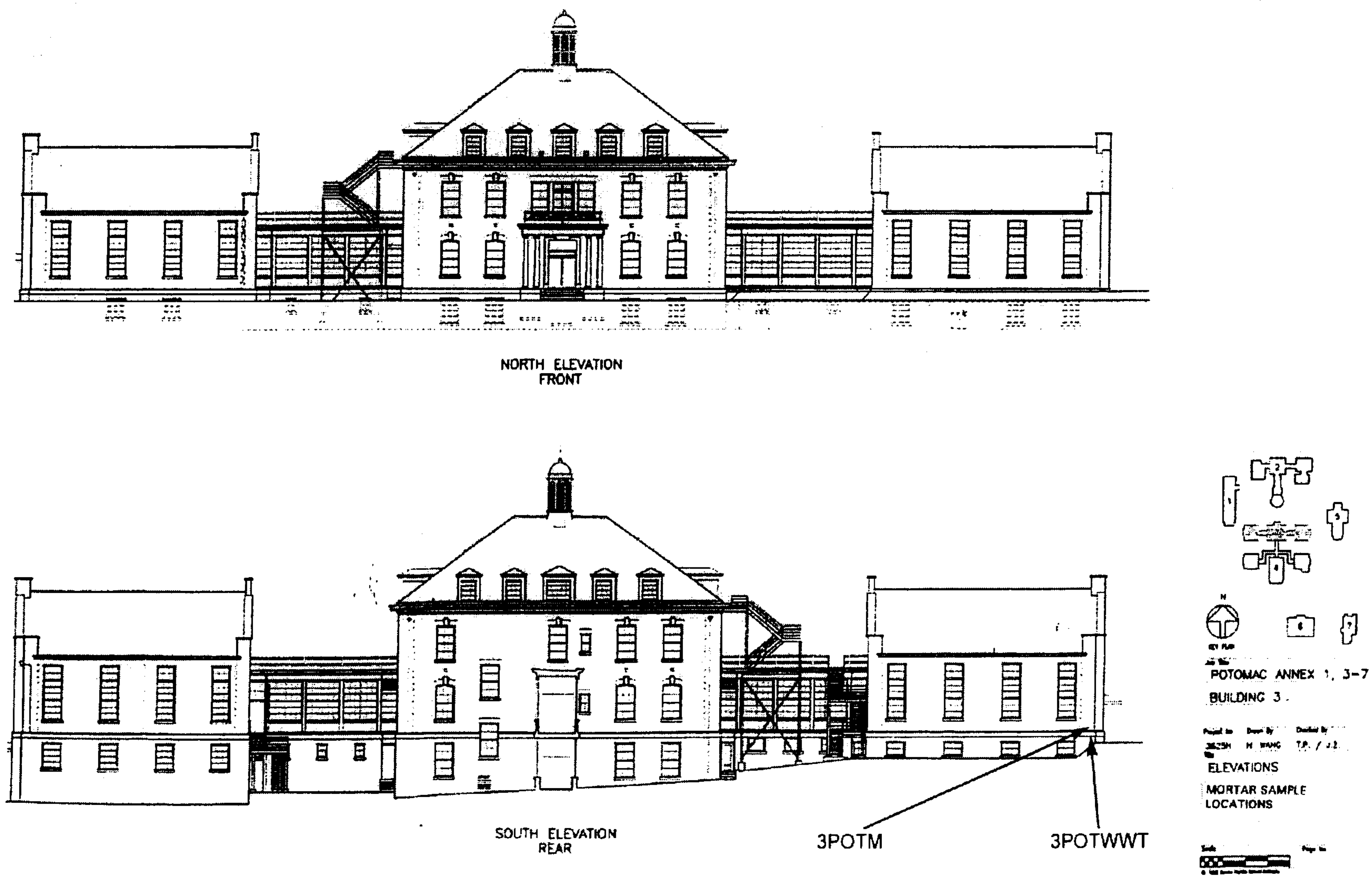
Figure 7-12

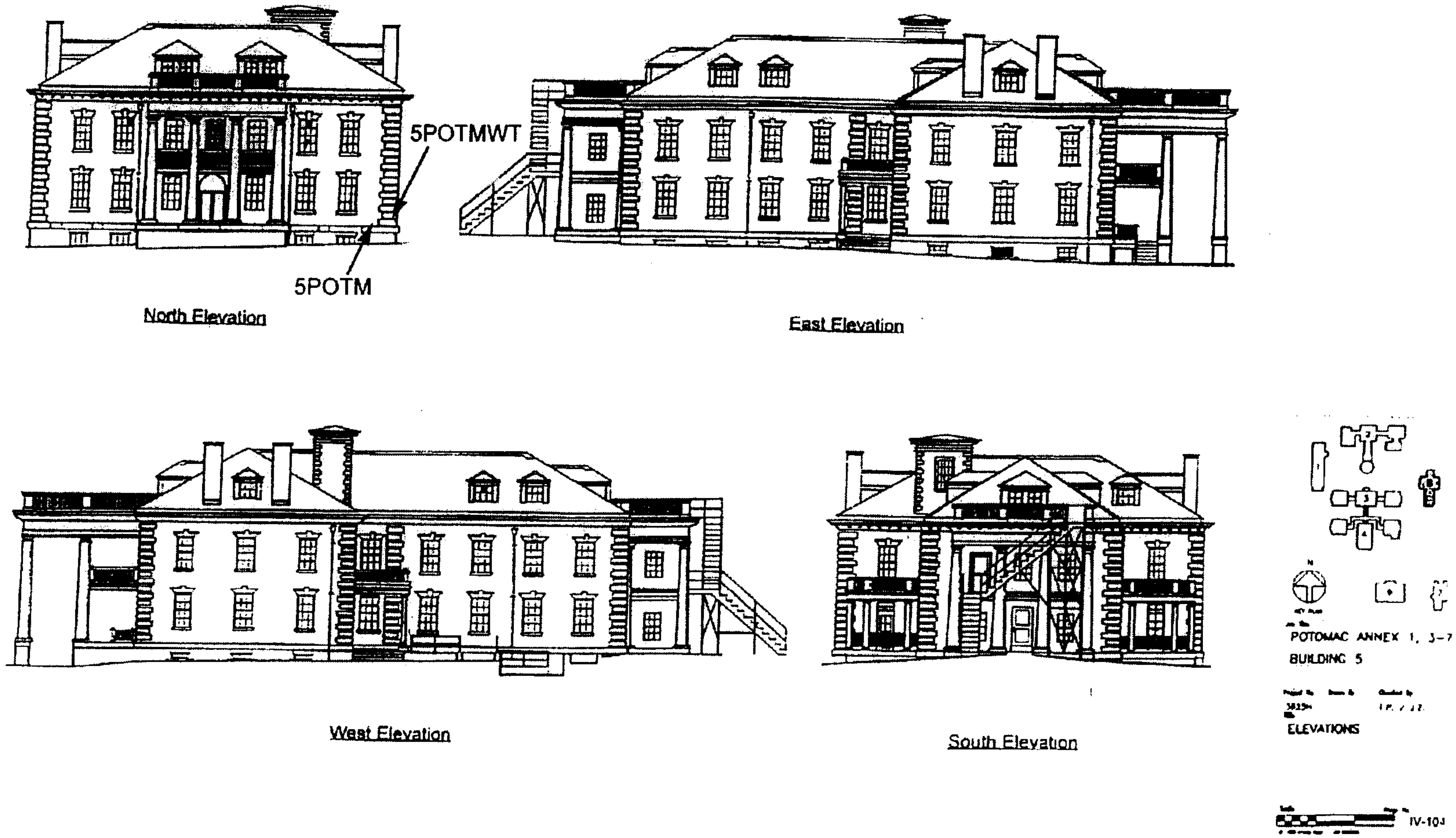
Building 7 - Granite Pointing Mortar

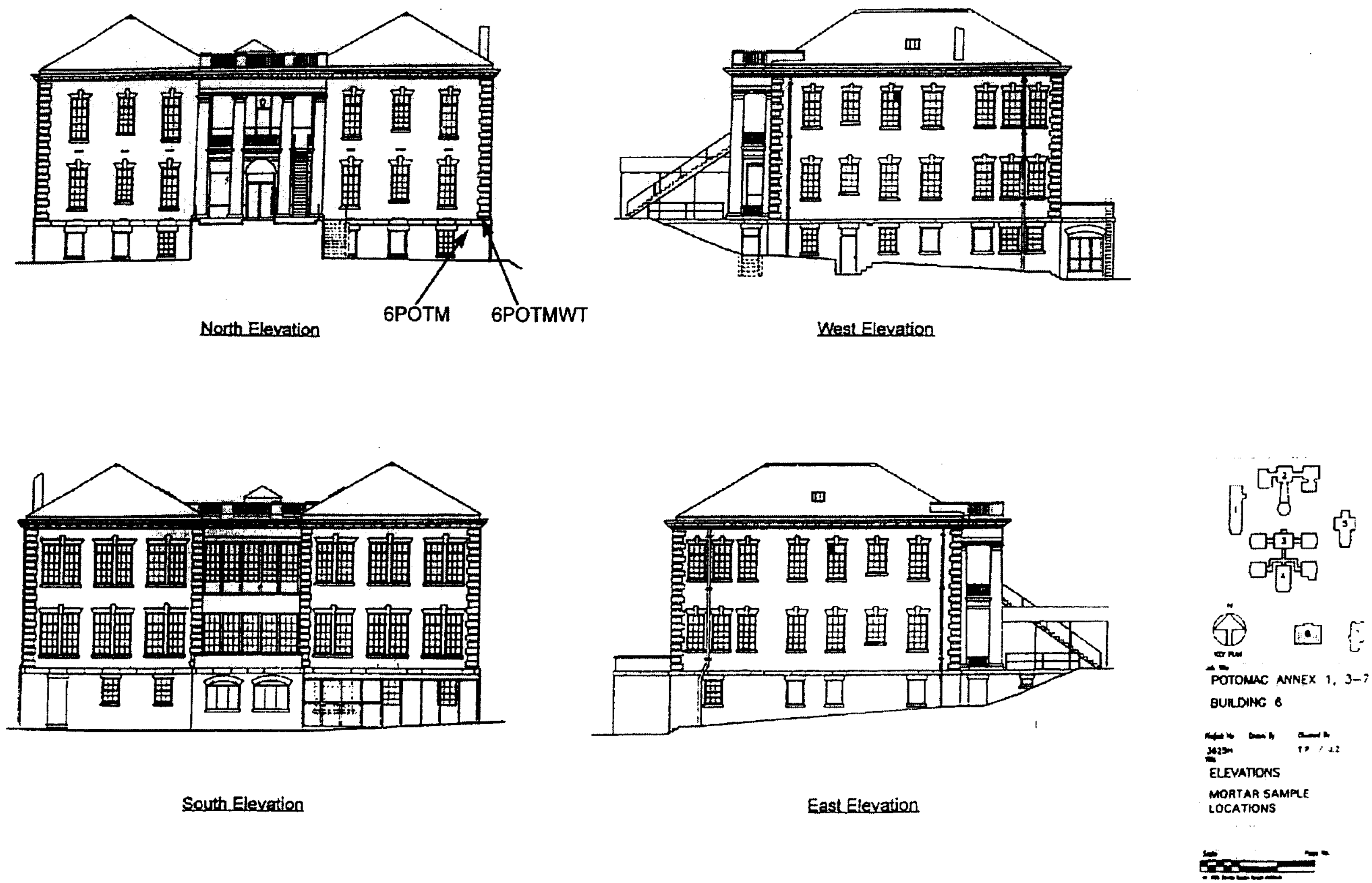
MORTAR SAMPLE LOCATIONS

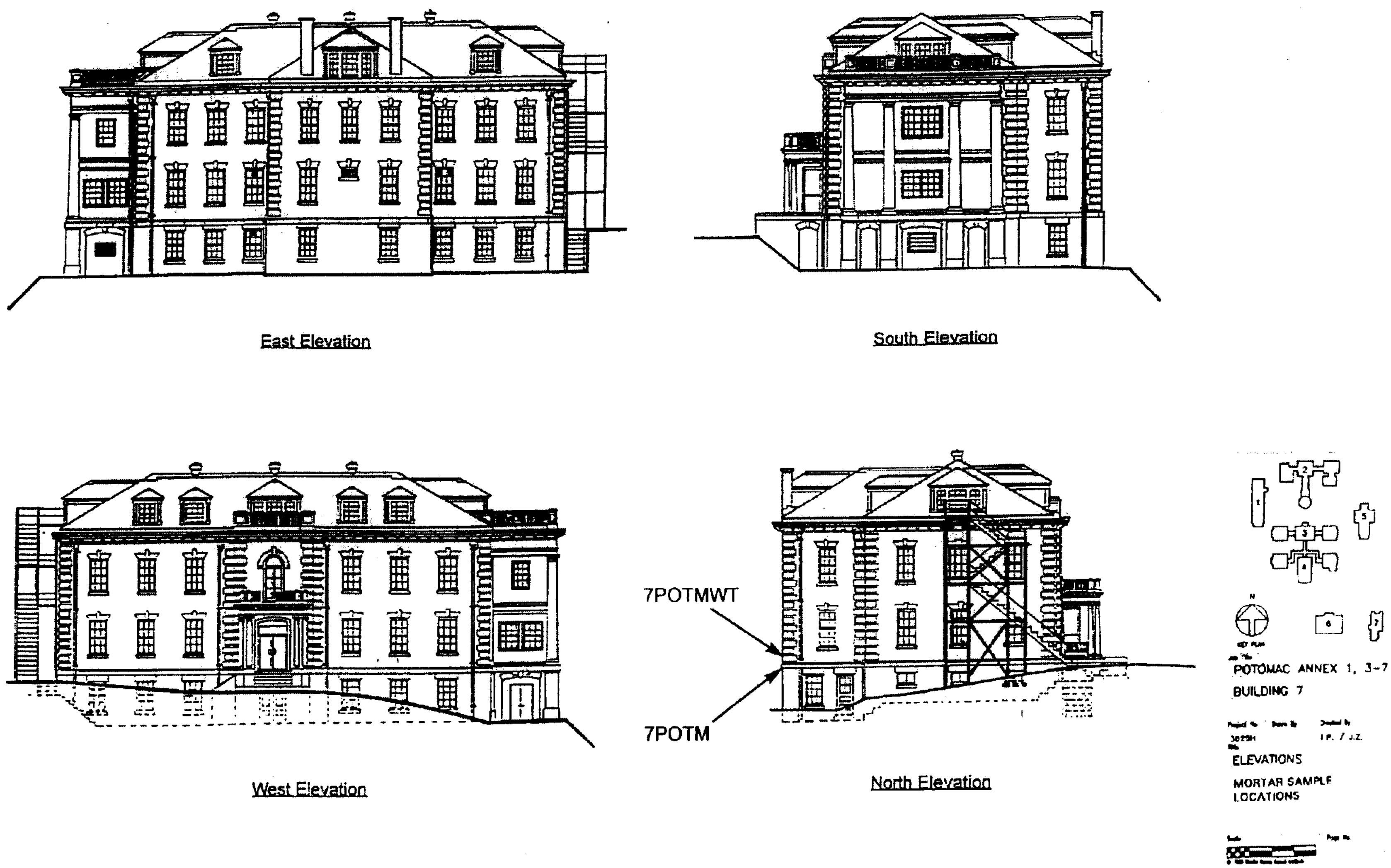



WEST ELEVATION
BUILDING 3
WEST ELEVATION
BUILDING 4
4POTMWT
4POTM
WEST ELEVATION
NORTH WEST PAVILION
WEST ELEVATION
SOUTH WEST PAVILION
POTOMAC ANNEX 1, 3-7
BUILDING 3 & 4
3625H
H. WANG
T.P. / J.Z.
WEST ELEVATIONS
MORTAR SAMPLE
LOCATIONS


NORTH ELEVATION
FRONT
SOUTH ELEVATION
REAR
3POTM
3POTWWT
POTOMAC ANNEX 1, 3-7
BUILDING 3
ELEVATIONS
MORTAR SAMPLE
LOCATIONS


5POTMWT
5POTM
North Elevation
East Elevation
West Elevation
South Elevation
POTOMAC ANNEX 1, 3-7
BUILDING 5
ELEVATIONS
IV-103


6POTM
6POTMWT
North Elevation
West Elevation
South Elevation
East Elevation
POTOMAC ANNEX 1, 3-7
BUILDING 6
ELEVATIONS
MORTAR SAMPLE
LOCATIONS


East Elevation
South Elevation
7POTMWT
7POTM
West Elevation
North Elevation
POTOMAC ANNEX 1, 3-7
BUILDING 7
ELEVATIONS
MORTAR SAMPLE LOCATIONS

1POTMWT - uPDSM REPORT

µPDSM Report 1potmwt 11:05,11/26/96

Input Pattern : Building 1 - granite water table pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
9.950	4	3.854	4	2.6790	3	2.2351	7	1.9796	2	1.6710	3
4.985	2	3.341	100	2.4927	4	2.1263	5	1.9134	4	1.5406	16
4.255	19	3.193	3	2.4545	6	2.0934	4	1.8740	4	1.5369	8
4.026	1	3.036	30	2.2807	8	1.9936	3	1.8166	13		

23 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
33-1161*	176	10/1	95	*Silicon Oxide / Quartz, syn = SiO2 Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474
24-0027D	74	7/1	19	Calcium Carbonate / Calcite = CaCO3 Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474
7-0042I	30	3/1	4.5	*Potassium Aluminum Silicate Hydroxide / Muscovite-3T = (K,Na)(Al,Mg,Fe)2(Si3.1Al0.9)O10(OH)2 Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474
41-1480I	17	3/0	2.5	*Sodium Calcium Aluminum Silicate / Albite, calcian, ordered = (Na,Ca)Al(Si,Al)3O8 Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474

Summary Report:

	Full	Resid	33-1161: 95%		24-0027: 19%		7-0042: 5%		41-1480: 3%	
d	I	I	d	I	d	I	d	I	d	I
9.950	4	None					9.97	4.5		
4.985	2	None					4.99	2.5		
4.255	19	None	4.257	21						
4.026	1	None							4.0314	0.68
3.854	4	None			3.852	5.6	[3.873	0.45]	[3.8718	0.15]
3.341	100	None	3.342	95			[3.331	4.5]	[3.3694	0.23]
3.193	3	None							3.1973	1.7
" "	"								3.1817	2.5
3.036	30	None			3.030	19				
2.6790	3	3								
							<2.564	1.1>		
2.4927	4	None			2.495	1.4	[2.499	0.54]	[2.4919	0.05]
2.4545	6	None	2.457	7.6			[2.457	0.36]	[2.4454	0.03]
2.2807	8	None	2.282	7.6	[2.284	3.5]			[2.3001	0.08]
2.2351	7	None	2.237	3.8			[2.254	0.27]		
2.1263	5	None	2.127	5.7			[2.136	0.54]	[2.1338	0.10]
2.0934	4	None			2.094	5.2			[2.1058	0.12]
1.9936	3	None					1.999	2.0	[1.9993	0.03]
" "	"								[1.9869	0.03]
1.9796	2	None	1.9792	3.8			[1.966	0.36]	" "	"
1.9134	4	None			1.9261	0.8				
" "	"				1.9071	3.3				
1.8740	4	None			1.8726	6.6	[1.885	0.09]	[1.8801	0.08]
1.8166	13	None	1.8179	13					[1.8270	0.17]
1.6710	3	None	1.6719	3.8						
			<1.6591	1.9>	<1.6040	2.9>				
1.5406	16	None	1.5418	8.5					[1.5343	0.03]
1.5369	8	8								

* = Obscured <..> = Missing [..] = Previously Removed

1POTM - uPDSM REPORT

μPDSM Report 1potm 12:33,11/3/95

Input Pattern: Building 1 - brick pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
4.232	21	2.7250	1	2.4500	2	2.1220	2	1.9060	1	1.8160	4
3.329	100	2.6190	1	2.2770	4	2.0870	1	1.8730	1	1.6690	1
3.031	5	2.4900	1	2.2320	1	1.9770	1	1.8360	1	1.5360	1

18 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
33-1161*	129	11/0	39	*Silicon Oxide / Quartz, syn = SiO2
	Ierr:400,500	derr:4.0	Bground:1	dmax/min:29.24/1.474
24-0027D	41	5/1	5.4	Calcium Carbonate / Calcite = CaCO3
	Ierr:400,500	derr:4.0	Bground:1	dmax/min:29.24/1.474

Summary Report:

d	Full I	Resid I	33-1161: 39% d	I	24-0027: 5% d	I
4.232	21	None	4.257	8.7		
					<3.852	1.6>
3.329	100	None	3.342	39		
3.031	5	None			3.030	5.4
2.7250	1	1				
2.6190	1	1				
2.4900	1	None			2.495	0.38
2.4500	2	None	2.457	3.2		
2.2770	4	None	2.282	3.2	[2.284	0.97]
2.2320	1	None	2.237	1.6		
2.1220	2	None	2.127	2.4		
2.0870	1	None			2.094	1.5
1.9770	1	None	1.9792	1.6		
1.9060	1	None			1.9071	0.92
1.8730	1	None			1.8726	1.8
1.8360	1	1				
1.8160	4	None	1.8179	5.5		
1.6690	1	None	1.6719	1.6		
"	"	"	1.6591	0.8		
1.5360	1	None	1.5418	3.5		

* = Obscured <..> = Missing [..] = Previously Removed

3POTMWT - uPDSM REPORT

µPDSM Report 3potmwt 11:08,11/26/96

Input Pattern : Building 3 - limestone water table pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
4.251	11	3.032	10	2.4404	4	2.1263	2	1.9149	2	1.6716	5
3.847	1	2.5008	1	2.2729	6	2.0925	2	1.8748	2	1.6010	1
3.341	100	2.4558	4	2.2340	2	1.9747	2	1.8139	5	1.5401	9

18 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
33-1161*	161	12/1	65	*Silicon Oxide / Quartz, syn = SiO2
	Ierr:400,500	derr:4.0	Bground:1	dmax/min:17.67/1.474
5-0586*	58	7/0	9.5	*Calcium Carbonate / Calcite, syn = CaCO3
	Ierr:400,500	derr:4.0	Bground:1	dmax/min:17.67/1.474

Summary Report:

	Full	Resid	33-1161: 65%		5-0586: 10%	
d	I	I	d	I	d	I
4.251	11	None	4.257	14		
3.847	1	None			3.86	1.1
3.341	100	None	3.342	65		
3.032	10	None			3.035	9.5
2.5008	1	None			2.495	1.3
2.4558	4	None	2.457	5.2		
2.4404	4	4				
2.2729	6	None	2.282	5.2	[2.285	1.7]
2.2340	2	None	2.237	2.6		
2.1263	2	None	2.127	3.9		
2.0925	2	None			2.095	1.7
1.9747	2	None	1.9792	2.6		
1.9149	2	None			1.927	0.48
" "	"				1.913	1.6
1.8748	2	None			1.875	1.6
1.8139	5	None	1.8179	9.0		
" "	"		1.8021	0.6		
1.6716	5	None	1.6719	2.6		
			<1.6591	1.3>		
1.6010	1	None	1.6082	0.6	[1.604	0.76]
1.5401	9	None	1.5418	5.8		

* = Obscured <..> = Missing [..] = Previously Removed

3POTM - uPDSM REPORT

μPDSM Report 3potm 9:48,12/3/96

Input Pattern: Building 3 - brick pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
4.251	16	3.036	18	2.2351	3	1.9119	3	1.6716	3		
3.844	3	2.4927	3	2.1263	3	1.9073	3	1.5415	6		
3.341	100	2.4545	13	2.0907	3	1.8748	3	1.5373	3		
3.248	4	2.2796	6	1.9779	3	1.8179	7				

19 lines in pattern.

Identified Phases:

JCPDS# SI ML/X At% Identity . . .

33-1161* 176 10/0 80 *Silicon Oxide / Quartz, syn = SiO2
Ierr:400,500 derr:4.0 Bground:3 dmax/min:17.57/1.474

5-0586* 81 6/0 19 *Calcium Carbonate / Calcite, syn = CaCO3
Ierr:400,500 derr:4.0 Bground:3 dmax/min:17.57/1.474

Summary Report:

	Full	Resid	33-1161: 80%		5-0586: 19%	
d	I	I	d	I	d	I
4.251	16	None	4.257	18		
3.844	3	None			3.86	2.3
3.341	100	None	3.342	80		
3.248	4	4				
3.036	18	None			3.035	19
2.4927	3	None			2.495	2.7
2.4545	13	None	2.457	6.4		
2.2796	6	None	2.282	6.4	[2.285	3.4]
2.2351	3	None	2.237	3.2		
2.1263	3	None	2.127	4.8		
2.0907	3	None			2.095	3.4
1.9779	3	None	1.9792	3.2		
1.9119	3	None			1.913	3.2
1.9073	3	3				
1.8748	3	None			1.875	3.2
1.8179	7	None	1.8179	11		
1.6716	3	None	1.6719	3.2		
1.5415	6	None	1.5418	7.2		
1.5373	3	3				

* = Obscured <..> = Missing [..] = Previously Removed

5POTMWT - uPDSM REPORT

μPDSM Report 5potmwt 11:14,11/26/96

Input Pattern Building 5 - granite water table pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
4.271	40	3.040	19	2.2404	4	1.9763	12	1.6727	4	1.5420	18
4.211	15	2.4968	3	2.1263	5	1.9157	5	1.6677	4		
3.870	1	2.4532	5	2.1177	7	1.8769	5	1.6593	5		
3.353	100	2.2818	12	2.0934	4	1.8172	19	1.6061	2		

21 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
5-0490D	226	12/0	99	Silicon Oxide / Quartz, low = SiO2
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:17.67/1.474
33-1161*	40	3/0	58	*Silicon Oxide / Quartz, syn = SiO2
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:17.67/1.474
5-0586*	78	7/0	19	*Calcium Carbonate / Calcite, syn = CaCO3
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:17.67/1.474

Summary Report:

	Full	Resid	5-0490: 99%		33-1161: 58%		5-0586: 19%	
d	I	I	d	I	d	I	d	I
4.271	40	None	4.26	35				
4.211	15	None			4.257	13		
3.870	1	None					3.86	2.3
3.353	100	None	3.343	99	[3.342	58]		
3.040	19	None					3.035	19
2.4968	3	None					2.495	2.6
2.4532	5	None	2.458	12	[2.457	4.6]		
2.2818	12	None	2.282	12.	[2.282	4.6]	[2.285	3.4]
2.2404	4	None	2.237	6.0	[2.237	2.3]		
2.1263	5	None	2.128	8.9				
2.1177	7	None			2.127	3.5		
2.0934	4	None					2.095	3.4
1.9763	12	None	1.980	6.0	[1.9792	2.3]		
1.9157	5	None					1.927	0.9
" "	"						1.913	3.2
1.8769	5	None					1.875	3.2
1.8172	19	None	1.817	17	[1.8179	8.1]		
1.6727	4	None	1.672	7.0				
1.6677	4	None			1.6719	2.3		
1.6593	5	None	1.659	3.0	[1.6591	1.2]		
1.6061	2	None	1.608	1.0	[1.6082	0.6]	[1.604	1.5]
1.5420	18	None	1.541	15	[1.5418	5.2]		

* = Obscured <..> = Missing [..] = Previously Removed

5POTM - uPDSM REPORT

µPDSM Report 5potm 0:38,1/11/80

Input Pattern: Building 5 - brick pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
7.523	4	3.184	3	2.7760	2	2.2340	2	1.9110	4	1.5400	5
6.144	2	3.060	7	2.6750	2	2.1230	6	1.8730	3	1.5350	3
4.237	25	3.024	41	2.4880	4	2.0910	4	1.8140	12	1.5220	[illegible]
3.846	7	2.9460	2	2.4500	9	2.0440	1	1.6700	2		
3.333	100	2.8610	3	2.2730	14	1.9770	2	1.6040	1		

28 lines in pattern.

Identified Phases:

JCPDS# SI ML/X At% Identity . . .

33-1161* 178 13/0 83 *Silicon Oxide / Quartz, syn = SiO2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

5-0586* 92 9/2 30 *Calcium Carbonate / Calcite, syn = CaCO3
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

21-0816* 37 5/1 8.7 *Calcium Sulfate Hydrate / Gypsum = CaSO4.2H2O
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

41-1481I 16 4/0 3.6 Sodium Calcium Aluminum Silicate / Anorthite, sodian, disordered = (Ca,Na)(Si,Al)4O8
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

Summary Report:

	Full	Resid	33-1161: 83%		5-0586: 30%		21-0816: 9%		41-1481: 4%	
d	I	I	d	I	d	I	d	I	d	I
7.523	4	None					7.61	3.9		
6.144	2	2								
4.237	25	None	4.257	18			[4.28	7.8]		
3.846	7	None			3.86	3.6	[3.80	0.70]	[3.9037	0.29]
3.333	100	None	3.342	83					[3.3644	0.36]
3.184	3	None					3.17	0.35*	3.2052	2.8
" "	"								3.1772	3.6
3.060	7	None					3.07	2.6	[3.0324	0.40]
3.024	41	None			3.035	30			" "	"
2.9460	2	None							2.9511	0.54
" "	"								2.9331	0.36
2.8610	3	None			2.845	0.9	[2.871	8.7]	[2.8324	0.36]
2.7760	2	None					2.788	1.7	[2.7860	0.04]
2.6750	2	None					2.684	4.4	[2.6519	0.25]
2.4880	4	None			2.495	4.2	[2.496	1.7]		
" "	"						[2.475	0.17]		
2.4500	9	None	2.457	6.6			[2.454	0.52]		
2.2730	14	None	2.282	6.6	[2.285	5.4]			[2.2789	0.11]
2.2340	2	None	2.237	3.3			[2.220	0.52]	[2.2323	0.07]
2.1230	6	None	2.127	5.0					[2.1391	0.36]
2.0910	4	None			2.095	5.4	[2.087	1.2]	[2.0979	0.25]
							<2.073	1.7>		
2.0440	1	None					2.048	0.35		
1.9770	2	None	1.9792	3.3					[1.9869	0.07]
					<1.927	1.5>				
1.9110	4	None			1.913	5.1	[1.900	0.35]		
1.8730	3	None			1.875	5.1	[1.880	0.52]	[1.8801	0.11]
1.8140	12	None	1.8179	12			[1.812	0.35]	[1.8131	0.07]
" "	"		1.8021	0.8						
1.6700	2	None	1.6719	3.3			[1.664	0.35]		
" "	"		1.6591	1.7						
					<1.626	1.2>				
1.6040	1	None	1.6082	0.8	[1.604	2.4]			[1.6050	0.07]
1.5400	5	None	1.5418	7.5						
1.5350	3	3								
1.5220	1	None			1.525	1.5	[1.521	0.17]		
" "	"				1.518	1.2				

* = Obscured <..> = Missing [..] = Previously Removed

6POTMWT - uPDSM REPORT

2.27
2.23
2.1?
2.09
1.97
1.91
1.87
1.81
1.81
1.66
1.65
1.65
1.54
1.53

μPDSM Report 6potmwt 11:17,11/26/96

Input Pattern Building 6 - granite water table pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
5.447	2	3.034	7	2.4545	3	1.9763	1	1.6699	3		
4.255	11	2.7744	2	2.2796	3	1.9119	2	1.6577	2		
3.847	2	2.6884	1	2.2329	6	1.8748	1	1.6544	1		
3.336	100	2.6272	2	2.1272	1	1.8179	8	1.5406	5		
3.234	1	2.4914	1	2.0916	1	1.8132	5	1.5373	3		

25 lines in pattern.

Identified Phases:

JCPDS# SI ML/X At% Identity . . .

33-1161* 174 11/0 58 *Silicon Oxide / Quartz, syn = SiO2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474

5-0586* 63 6/0 8.5 *Calcium Carbonate / Calcite, syn = CaCO3
Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474

2-0056D 9 3/8 1.4 Potassium Aluminum Silicate Hydroxide / Illite = KAl2Si3AlO10(OH)2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474

10-0492I 2 4/3 3.2 *Potassium Magnesium Aluminum Silicate Hydroxide / Phlogopite-3T = KMg3(Si3Al)O10(OH)2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:17.67/1.474

Summary Report:

d	Full I	Resid I	33-1161: 58% d	I	5-0586: 9% d	I	2-0056: 1% d	I	10-0492: 3% d	I
							<9.96	1.4>	<10.10	3.2>
5.447	2	2								
							<4.97	1.1>		
							<4.47	1.4>		
4.255	11	None	4.257	13			[4.30	0.28]		
3.847	2	None			3.86	1.0	[3.87	0.84]		
							<3.75	1.1>	<3.408	1.4>
							<3.44	1.1>		
3.336	100	None	3.342	58			[3.32	1.4]	[3.354	3.2]
3.234	1	None					3.22	1.1		
3.034	7	None			3.035	8.5				
							<2.99	1.1>		
2.7744	2	None					2.77	0.84		
2.6884	1	None							2.710	0.45
2.6272	2	None							2.643	0.32
"	"	"							2.618	0.96
							<2.56	1.4>		
2.4914	1	None			2.495	1.2	[2.50	0.28]	[2.511	1.6]
2.4545	3	None	2.457	4.6			[2.45	0.56]		

6POTM - uPDSM REPORT

1.9100
1.8710
1.8150
" "
1.6690
" "
1.6560
" "
1.6200
1.6000
1.5460
1.5390
1.5190
" "
1.5080
1.4970
" "

μPDSM Report 6potm 1:22,1/11/80

Input Pattern : Building 6 - brick pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
7.564	1	3.025	39	2.2100	1	1.9870	1	1.6690	1	1.5390	3
4.227	35	2.4840	4	2.1610	1	1.9740	1	1.6560	1	1.5190	1
3.974	2	2.4470	2	2.1220	11	1.9100	4	1.6200	1	1.5080	1
3.834	5	2.2770	9	2.0900	4	1.8710	5	1.6000	1	1.4970	1
3.328	100	2.2300	1	2.0520	1	1.8150	5	1.5460	1		

29 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
33-1161*	168	13/0	64	*Silicon Oxide / Quartz, syn = SiO_2
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:29.24/1.474
24-0027D	104	9/0	24	Calcium Carbonate / Calcite = $CaCO_3$
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:29.24/1.474
33-1161*	10	2/0	15	*Silicon Oxide / Quartz, syn = SiO_2
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:29.24/1.474
33-0311*	5*	5/3	6.2	*Calcium Sulfate Hydrate / Gypsum, syn = $CaSO_4.2H_2O$
	Ierr:400,500		derr:4.0	Bground:1 dmax/min:29.24/1.474

Summary Report:

	Full	Resid	33-1161: 64%		24-0027: 24%		33-1161: 15%		33-0311: 6%	
d	I	I	d	I	d	I	d	I	d	I
7.564	1	None							7.63	6.2
4.227	35	None	4.257	14			[4.257	3.3]	[4.283	6.2]
3.974	2	2								
3.834	5	None			3.852	7.0			[3.799	1.1]
3.328	100	None	3.342	64			[3.342	15]		
									<3.065	4.7>
3.025	39	None			3.030	24				
									<2.873	2.8>
									<2.685	2.2>
2.4840	4	None			2.495	1.7			[2.495	0.68]
2.4470	2	None	2.457	5.1			[2.457	1.2]	[2.452	0.37]
2.2770	9	None	2.282	5.1	[2.284	4.3]	[2.282	1.2]	[2.291	0.06]
2.2300	1	None	2.237	2.6			[2.237	0.6]		
2.2100	1	None							2.219	0.93
2.1610	1	1								
2.1220	11	None	2.127	3.8			[2.127	0.9]		
2.0900	4	None			2.094	6.5			[2.086	1.6]
" "	"								[2.074	0.93]
2.0520	1	None							2.048	0.37
1.9870	1	None					1.9792	0.6	[1.992	0.25]
1.9740	1	None	1.9792	2.6					[1.963	0.19]

7POTMWT - uPDSM REPORT

µPDSM Report 7potmwt   11:20,11/26/96

Input Pattern : Building 7 - granite water table pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
9.950	13	3.319	28	2.6931	2	2.2383	4	1.8769	7	1.5770	3
4.973	6	3.252	3	2.5171	2	2.1272	7	1.8206	10	1.5411	12
4.263	21	3.191	2	2.4968	5	2.0943	5	1.7349	4	1.5373	5
3.850	4	3.038	40	2.4571	40	1.9302	3	1.6727	2		
3.346	100	2.7794	2	2.2829	10	1.9134	6	1.6051	2		

28 lines in pattern.

Identified Phases:

JCPDS#	SI	ML/X	At%	Identity . . .
5-0490D	173	10/2	92	Silicon Oxide / Quartz, low = SiO_2
	Ierr:400,500			derr:4.0 Bground:2 dmax/min:17.67/1.474
24-0027D	116	8/0	38	Calcium Carbonate / Calcite = $CaCO_3$
	Ierr:400,500			derr:4.0 Bground:2 dmax/min:17.67/1.474
6-0263I	58	9/*	12	*Potassium Aluminum Silicate Hydroxide / Muscovite-2M1 = $KAl_2(Si_3Al)O_{10}(OH,F)_2$
	Ierr:400,500			derr:4.0 Bground:2 dmax/min:17.67/1.474

Summary Report:

d	Full I	Resid I	-0490: 92% d	I	24-0027: 38% d	I	6-0263: 12% d	I
9.950	13	None					9.95	11
4.973	6	None					4.97	3.6
							<4.47	2.4>
4.263	21	None	4.26	32			[4.30	0.5]
3.850	4	None			3.852	11	[3.88	1.7]
							<3.73	2.2>
							<3.48	2.4>
3.346	100	None	3.343	92			[3.34	3.0]
3.319	28	None					3.32	12
3.252	3	3						
3.191	2	None					3.19	3.6
3.038	40	None			3.030	38		
							<2.987	4.2>
							<2.859	3.0>
2.7794	2	None					2.789	2.4
2.6931	2	2						
							<2.566	6.6>
2.5171	2	None					2.505	1.0
2.4968	5	None			2.495	2.6	[2.491	1.7]
2.4571	40	None	2.458	11			[2.465	1.0]
							<2.384	3.0>
2.2829	10	None	2.282	11	[2.284	6.8]		
2.2383	4	None	2.237	5.5			[2.254	1.2]
2.1272	7	None	2.128	8.3			[2.132	2.4]
2.0943	5	None			2.094	10		
			<1.980	5.5>			<1.993	5.4>
1.9302	3	None			1.9261	1.5	[1.941	0.5]
1.9134	6	None			1.9071	6.4		
1.8769	7	None			1.8726	13	[1.871	0.5]
1.8206	10	None	1.817	16			[1.822	0.5]
1.7349	4	None					1.746	0.5
"	"	"					1.731	1.0
1.6727	2	None	1.672	6.4			[1.662	1.4]
			<1.659	2.8>			<1.646	3.0>
1.6051	2	None	1.608	0.9	[1.6040	5.6]	[1.603	0.7]
1.5770	3	None			1.5821	0.8	[1.573	0.5]
1.5411	12	None	1.541	14				
1.5373	5	None					1.541	0.5
							<1.504	3.6>

* = Obscured   <..> = Missing   [..] = Previously Removed

7POTM - uPDSM REPORT

»*hh ÌPDSM Report 7potm 14:54,5/295

Input Pattern : Building 7 - brick pointing mortar

d	I	d	I	d	I	d	I	d	I	d	I
9.952	4	3.033	69	2.4530	11	2.0930	9	1.6710	1		
4.445	1	2.7820	3	2.2820	13	1.9770	4	1.6200	2		
4.244	35	2.7340	2	2.2340	5	1.9130	9	1.5980	3		
3.851	5	2.6230	4	2.1940	1	1.8720	8	1.5400	11		
3.341	100	2.4910	7	2.1270	4	1.8160	6	1.5200	2		

25 lines in pattern.

Identified Phases:

JCPDS# SI ML/X At% Identity . . .

33-1161* 174 11/1 96 *Silicon Oxide / Quartz, syn = SiO_2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

24-0027D 111 9/0 43 Calcium Carbonate / Calcite = $CaCO_3$
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

7-0042I 17 4/3 5.4 *Potassium Aluminum Silicate Hydroxide / Muscovite-3T = (K,Na)(Al,Mg,Fe)2(Si3.1Al0.9)O10(OH)2
Ierr:400,500 derr:4.0 Bground:1 dmax/min:29.24/1.474

Summary Report:

d	Full I	Resid I	33-1161: 96% d	33-1161: 96% I	24-0027: 43% d	24-0027: 43% I	7-0042: 5% d	7-0042: 5% I
9.952	4	None						
							9.97	5.4
							<4.99	3.0>
4.445	1	None					4.49	1.1
" "	"						4.46	1.1
4.244	35	None	4.257	21				
3.851	5	None			3.852	12	[3.873	0.54]
3.341	100	None	3.342	96			[3.331	5.4]
3.033	69	None			3.030	43		
2.7820	3	3						
2.7340	2	2						
2.6230	4	4						
							<2.564	1.4>
2.4910	7	None			2.495	3.0	[2.499	0.65]
2.4530	11	None	2.457	7.7			[2.457	0.43]
2.2820	13	None	2.282	7.7	[2.284	7.7]		
2.2340	5	None	2.237	3.8			[2.254	0.32]
2.1940	1	None					2.197	0.22
2.1270	4	None	2.127	5.8			[2.136	0.65]
2.0930	9	None			2.094	12		
							<1.999	2.4>
1.9770	4	None	1.9792	3.8			[1.966	0.43]
1.9130	9	None			1.9261	1.7		
" "	"				1.9071	7.3		
1.8720	8	None			1.8726	15	[1.885	0.11]
1.8160	6	None	1.8179	13				
1.6710	1	None	1.6719	3.8				
			<1.6591	1.9>				
1.6200	2	None			1.6259	0.9	[1.614	0.22]
1.5980	3	None	1.6082	1.0	[1.6040	6.5]		
1.5400	11	None	1.5418	8.6				
1.5200	2	None			1.5247	1.3	[1.521	0.32]

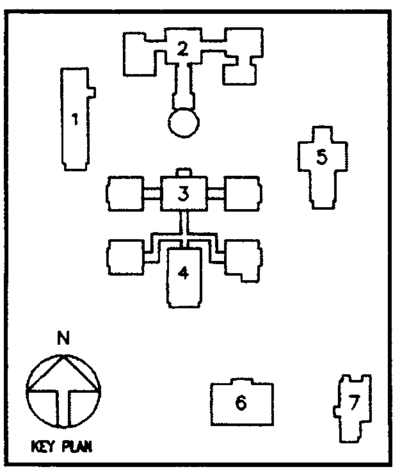
* = Obscured <..> = Missing [..] = Previously Removed

Chapter 8

PURPOSE OF CLEANING

The primary purposes of cleaning are to preserve a building's materials and features and to recapture the building's aesthetic balance, which may be disguised by soiling that has altered the hue, value, or chroma of these elements. Generally, the soiling issues for the Potomac Annex Buildings are minimal-to-moderate and their impact is largely cosmetic. However, if these conditions are allowed to persist, the eventual damage to building materials is likely. The least destructive cleaning method shall be used in all cases even when such methods will not restore materials to their appearance when new. This materials cleaning analysis addresses various soiling issues observed at the Potomac Annex Buildings. Most soiling types occurred consistently on several of the buildings; for this reason, existing soiling issues are broken down into those occurring on buildings 1,5,6,& 7 and those occurring on Buildings 3 & 4. For each grouping of buildings, the existing soiling conditions are first summarized and then cleaning tests results are discussed. Generally, the degree of soiling for each cleaning issue varies only slightly, so that the recommendations associated with the following cleaning tests are sufficient to remove both the "worst" and "least damaging" degrees of soiling. The specifications for these cleaning methods can be found in Chapter 10.

BUILDINGS 1, 5, 6 and 7: SUMMARY OF EXISTING SOILING ISSUES



The existing problems of cleaning on these similar buildings are the following:

Light soiling of the brick (Figure 8-1)
Light soiling of the granite elements (Figure 8-1)
Soiling by gypsum and flyash of the undersides of granite (and brick) elements and window lintels and sills (Figure 8-2)
Soiling of granite and brick by bitumen-based materials (Figure 8-3)
Rust Stains on Granite

These conditions and problems have also been documented in *Chapter 6. Materials Conservation Analysis*. The "before" and "after" conditions for each cleaning test are shown below. The recommended appearance after cleaning will also be indicated for those cases in which a clean appearance is attainable by existing cleaning technologies.

BUILDINGS 1, 3, 5, 6 AND 7: CLEANING TESTS

Light Soiling of Brick

A representative area of soiling of the brick was chosen on the east elevation of Building 6 near the northeast corner (note location of elevation drawing of Building 6).

The condition of the brick can be seen in Figure 8-4. Two methods of cleaning were chosen: 1) Application of detergent (ProSoCo's 1026) followed by low-pressure power wash; 2) Application of alkaline pre-wash followed by an acid after-wash with low-pressure power wash after each step. The conditions for each test are outlined below.

Method 1

1. Application of detergent using natural bristle brushes with a dwell time of 10 minutes
2. Removal of detergent and soiling with low pressure power wash (approximately 400 psi)
3. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Method 2

1. Application of an alkaline pre-wash (ProSoCo's 766) diluted 3:1 by volume water:cleaner using natural bristle brushes with a dwell time of 20 minutes
2. Removal of pre-wash with low pressure power wash
3. Application of acid after-wash (PROSOCO'S Restoration Cleaner) diluted 3:1 by volume water:cleaning solution using natural bristle brushes with a dwell time of 5 minutes
4. Removal of after-wash with low pressure power wash
5. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Conclusion/Recommendation

The result of cleaning the light soiling of the brick with Method 1 is shown in Figure 8-5. This method achieved good cleaning results while being safe for the brick. The result of cleaning the light soiling of the brick with Method 2 is shown in Figure 6. This method also achieved good cleaning, but is more aggressive than Method 1. Therefore, the more gentle Method 1 is recommended for cleaning the brick on Building 1, 3, 5, 6 and 7.

Light Soiling of Granite

A representative area of soiling of the granite was chosen on the east elevation of Building 6 near the northeast corner (note location on elevation drawing of Building 6).

The condition of the granite can be seen in Figure 8-7. Two methods of cleaning were chosen: 1) Application of detergent (PROSOCO'S 1026) followed by low pressure power wash; 2) Application of alkaline pre-wash followed by an acid after-wash with low pressure power wash after each step. The conditions for each test are outlined below.

Method 1

1. Application of detergent using natural bristle brushes with a dwell time of 10 minutes
2. Removal of detergent and soiling with low pressure power wash (approximately 400 psi)
3. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi)

Method 2

1. Application of an alkaline pre-wash (PROSOCO'S 766) diluted 3:1 by volume water:cleaner using natural bristle brushes with a dwell time of 20 minutes
2. Removal of pre-wash with low pressure power wash
3. Application of acid after-wash (PROSOCO'S Restoration Cleaner) diluted 3:1 by volume water:cleaning using natural bristle brushes with a dwell time of 5 minutes
4. Removal of after-wash with low pressure power wash
5. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Conclusion/Recommendation

The result of cleaning the light soiling of the granite with Method 1 is shown in Figure 8-8; no cleaning of the granite was achieved by this method. The results of Method 2 are documented in Figure 9. Good cleaning of the granite was achieved by this method; therefore the appearance resulting in the application of Method 2, as represented by Figure 8-9, is the recommended cleaning technique.

Soiling of Granite (and Brick) Elements by Gypsum and Flyash

While these deposits are somewhat disfiguring, they are not, at this time, sufficient enough to cause damage to the brick or the granite. However, removal at this time may prevent future deterioration and the eventual need for more intrusive and potentially damaging cleaning methods.

Method

A representative area of this soiling of the granite was chosen on the east elevation of Building 6 (note location of elevation drawing of Building 6). The water misting method was used for cleaning this condition. The method consists in the application of a fine spray of water at low pressure for extended periods of time (4-24 hours). The method relies on the solubility of gypsum in water. Gypsum entraps flyash which imparts the dark coloration to the deposits. As the gypsum is dissolved the soiling is removed with it.

Conclusion/Recommendation

The result of cleaning the brick and granite with this method after 6 hours is shown in Figure 8-10 which shows an uncleaned area next to a cleaned area. The is a safe and effective method and the appearance after cleaning as seen in Figure 8-10 should be the representative appearance.

Soiling of Granite and Brick by Bitumen-Based Materials

A representative area of the bitumen-based soiling of granite and brick was identified on east elevation of Building 6 (Figure 8-11). This soiling is visually disfiguring and may lead to staining of the brick and granite if not removed. PROSOCO'S Asphalt and Tar Remover was tested from the removal of these deposits using the following method.

Method

1. Mix Asphalt and Tar Remover to a paste-like consistency with attapulgite
2. Apply paste to surface and cover with aluminum foil and secure with tape and allow a dwell time of 4 hours
3. Remove paste and dislodge bitumen-base soilant with paint scraper taking care not to damage the stone or brick substrate
4. Wash substrate with detergent and natural bristle scrub brush

Conclusion/Recommendation

The results of the cleaning tests are also shown in Figure 8-11 (uncleaned area on the left and cleaned area on the right). Good cleaning has been achieved with no damage to the substrate; this result may be considered as the representative cleaned substrate.

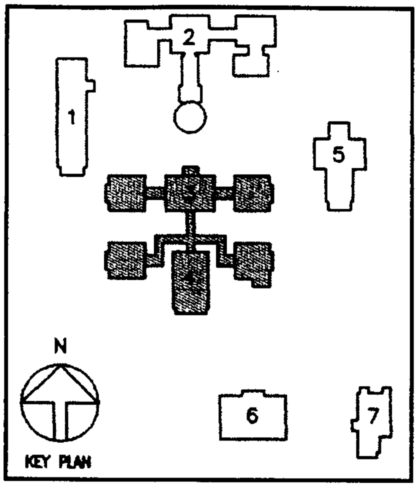
Rust Stains on Granite Band Course

While these deposits are somewhat disfiguring, they are not now sufficient to cause damage to the granite; rather, their impact is primarily cosmetic. However, removal at this time may prevent the future need for more intrusive and potentially damaging cleaning methods.

Method

Ammonium thioglycolate will effectively remove iron staining of marble, granite, and other stone. The method consists in the application in poultice form of a 10% solution of ammonium thioglycolate in water for 30 minutes. The poultice is then removed and the surface rinsed with low pressure water.

BUILDINGS 3 & 4: SUMMARY OF EXISTING PROBLEMS



The existing problems of cleaning on these similar buildings are the following:

Soiling of the brick (Figure 8-12)
Soiling of the limestone (Figure 8-13)
Rust stains on Limestone

These conditions and problems have also been documented in Chapter 6 Materials Conservation Analysis. The "before" and "after" conditions for each cleaning test are discussed below. The recommended appearance after cleaning will also be shown for those cases in which a cleaned surface appearance is attainable with existing cleaning technologies.

BUILDINGS 3 & 4: CLEANING TESTS

Soiling of Brick

As can be seen in Figure 8-13 the soiling of the brick on Buildings 3 and 4 is heavier than that of Buildings 1, 3, 5, 6 and 7. Similar cleaning methods used on Building 6 have been tested on a representative area of Building 3.

Method 1

1. Application of detergent using natural bristle brushes with a dwell time of 10 minutes
2. Removal of detergent and soiling with low pressure power wash (approximately 400 psi)
3. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi)

Method 2

1. Application of an alkaline pre-wash (PROSOCO'S 766) diluted 3:1 by volume water:cleaner using natural bristle brushes with a dwell time of 20 minutes
2. Removal of pre-wash with low pressure power wash
3. Application of acid after-wash (PROSOCO'S Restoration Cleaner) diluted 3:1 by volume water:cleaning using natural bristle brushes with a dwell time of 5 minutes
4. Removal of after-wash with low pressure power wash
5. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Method 3 (increased concentrations of cleaning solutions)

1. Application of an alkaline pre-wash (PROSOCO'S 766) diluted 1:1 by volume water:cleaner using natural bristle brushes with a dwell time of 20 minutes
2. Removal of pre-wash with low pressure power wash
3. Application of acid after-wash (PROSOCO'S Restoration Cleaner) diluted 1:1 by volume water:cleaning using natural bristle brushes with a dwell time of 5 minutes
4. Removal of after-wash with low pressure power wash
5. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Conclusion

The result of cleaning the soiling of the brick with Method 2 is shown in Figure 8-15 (the before condition is seen on the middle-left side of Figure 12). No cleaning has been achieved by this method. The result of cleaning the soiling of the brick with Method 1 is shown in Figure 8-14 (the before condition is seen on the left side of Figure 8-12). No cleaning has been achieved by this method. The result of cleaning the soiling of the brick with Method 3 is shown in Figure 16 (the before condition is seen on the middle right side of Figure 8-12). No cleaning has been achieved by this method.

Since none of these cleaning methods was successful, a second regimen of tests was performed. Their methodology and results are discussed below.

Analyses of Soilants on Brick

The poor results obtained by these three previous methods suggested that other cleaning methods might be required for the conditions of soiling on these brick surfaces. Therefore, analyses were performed on the brick to determine the nature of the soiling.

A sample was removed from Building 4 and examined with a scanning electron microscope and energy dispersive spectroscopy (SEM-EDS) to determine elemental compositions of the soilants. Materials on the interior and exterior surfaces of the brick were determined and compared.

Analyses of clean and darkened brick interiors revealed the body of the brick to consist of mainly silicon and aluminum with some potassium, iron, titanium, and traces of magnesium, calcium, and sulfur. The overall exterior surfaces of both clean and darkened brick were found to contain significantly higher levels of sulfur and calcium (i.e. gypsum). The darkened areas of the exterior surface, however, also showed a much higher level of iron.

Black particles were noticed on the surface of the brick which were found to contain high levels of iron (magnetite?). Black and dark red particles were also noted within the body of brick which contained higher levels of iron than the overall composition but not as high as the black particles on the surface.

Most of the darkening of the surface appeared to be associated with cracks and fissures on the exterior glassy surface of the brick. Analyses of black material from these cracks and fissures on the exterior glassy surface of the brick revealed high levels of calcium and sulfur (i.e. gypsum) as well as iron.

In cross-section the darkening of the brick generally was seen to extend about one-half a millimeter into the brick. Several areas were seen with green material at interface between the darkened exterior and the light interior. Analysis of some of this green material revealed high levels of potassium, calcium, sulfur and phosphorus. These elements, particularly phosphorus, are often associated with biological organisms. The green substance was not found on any of the surfaces of the samples.

Based on these analyses the soilants appear to be either unusual in their compositions - gypsum, iron oxide, biological growth - or lodged within cracks in the brick. Therefore, other cleaning tests were carried to address the possible sources of soiling: 1) Gypsum, 2) Iron oxide, 3) Biological growth. The methods also have long contact times and, therefore, might also address the problem of particles lodged in cracks in the brick.

Additional Cleaning Tests on Brick Soiling on Buildings 3 and 4

Method 4

The water misting method was used for cleaning the surface of the brick on the east elevation of Building 4. The method consists in the application of a fine spray of water at low pressure for extended periods of time (4-24 hours). The method relies on the solubility of gypsum in water. Gypsum entraps flyash which imparts the dark coloration to the deposits. As the gypsum is dissolved the soiling is removed with it.

Method 5

Ammonium thioglycolate is known to remove iron staining of marble and other stone. The method consists in the application in poultice form of a 10% solution of ammonium thioglycolate in water for 30 minutes. The poultice is then removed and the surface rinsed with low pressure water. This method would address the second source of soiling identified in the analysis of the brick - iron oxide or "rust".

Method 6

Biological growth is the last possible source the soiling identified in the analysis of the brick. These growths (or the decayed and dried black deposits from dead biological growths) can often be altered by oxidizing agents. Therefore, three solutions of hydrogen peroxide are prepared - 5, 10, and 20% v/v in water. Cotton matting is saturated with each of these solutions and placed on the brick surface for four hours. The surface is then rinsed with low-pressure water.

Conclusions/Recommendations

Figure 17 shows the brick before cleaning with method 4 (misting method) and Figure 18 result after 24 hours of misting. Little or no cleaning of the brick was achieved. For testing method 5, a representative area was chosen on the south elevation of Building. The poultice was applied as outlined above, and the result was poor, the poultice can be seen in Figure 19. The poor result of cleaning by Method 6 is seen in Figure 20.

None of the examined cleaning methods proved to be a successful soilant removal technique. At this time, no recommendation can be made to adequately clean the surfaces of the brick without unduly and irreparably damaging the bricks' surfaces. Given that the numerous cleaning methods yielded either marginal or disappointing results, it appears likely that this soiling issue is inorrectable.

Abrasive cleaning techniques should not be used since their application may likely damage the substrate beyond repair. Future testing, if it is deemed necessary, may consist of an application of PROSOCO's BIOKLEAN, which is specifically formulated for eliminating biological growth.

Soiling of Limestone

Soiling on the limestone is visually disfiguring, but does not represent a material deterioration hazard to the stone; the four following cleaning tests were performed:

Method 1

The water misting method was used for cleaning the limestone on a representative surface of the east elevation of Building 4 (note location on elevation drawing of Building 4). The method consists in the application of a fine spray of water at low pressure for extended periods of time (4-24 hours). The method relies on the solubility of gypsum in water. Gypsum entraps flyash which imparts the dark coloration to the deposits. As the gypsum is dissolved the soiling is removed with it.

Method 2

1. Application of detergent using natural bristle brushes with a dwell time of 10 minutes
2. Removal of detergent and soiling with low pressure power wash (approximately 400 psi)
3. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Method 3

1. Application of an alkaline pre-wash (PROSOCO'S 766) diluted 3:1 by volume water:cleaner using natural bristle brushes with a dwell time of 20 minutes

2. Removal of pre-wash with low pressure power wash
3. Application of acid after-wash (PROSOCO'S Restoration Cleaner) diluted 3:1 by volume water:cleaning using natural bristle brushes with a dwell time of 5 minutes
4. Removal of after-wash with low pressure power wash
5. Rinsing surfaces to remove remnants of detergent with low pressure water (approximately 60 psi

Method 4

Cleaning was also tested with PROSOCO'S 1217 poultice applied four 6 hours followed by low pressure power wash (approximately 400 psi).

Conclusions

Figure 17 shows the limestone (and the brick) before cleaning and Figure 18 after cleaning with Method 1 (the misting method). Little or no cleaning was achieved by this method after 24 hours. The result of cleaning the limestone with Method 2 on the north elevation of Building 4 are shown in Figure 21. Good cleaning was achieved by this method without harm to the substrate. The condition before cleaning is represented by the surrounding uncleaned areas.
The result of cleaning the limestone Method 3 are shown in Figure 22. Good results were obtained by this method although it is somewhat more aggressive than the detergent cleaning. The "before" cleaning condition is represented by the surrounding uncleaned area.
The result of cleaning with Method 4 is shown if Figure 23. Good results were obtained by this method which is intermediate in aggressiveness to detergent and alkali pre-wash - acid after-wash methods. "Before" cleaning conditions are represented by the surrounding uncleaned area.

Equally effective cleaning results are achieved by the least aggressive method - detergent cleaning/power wash (Method 2) - the results obtained by this method should be considered as the representative surface to be attained by cleaning.

Rust Stains on Limestone

While these deposits are somewhat disfiguring, they are not now sufficient to cause damage to the limestone; rather, their most significant impact is cosmetic. However, removal at this time may prevent the future need for more intrusive and potentially damaging cleaning methods.

Method

Ammonium thioglycolate will effectively remove iron staining of marble, granite, and other stone. The method consists in the application in poultice form of a 10% solution of ammonium thioglycolate in water for 30 minutes. The poultice is then removed and the surface rinsed with low pressure water.

Figure 8-1

The brick and granite on Buildings 1, 5, 6 and 7 is only lightly soiled as seen here on the elevation of Building 1.

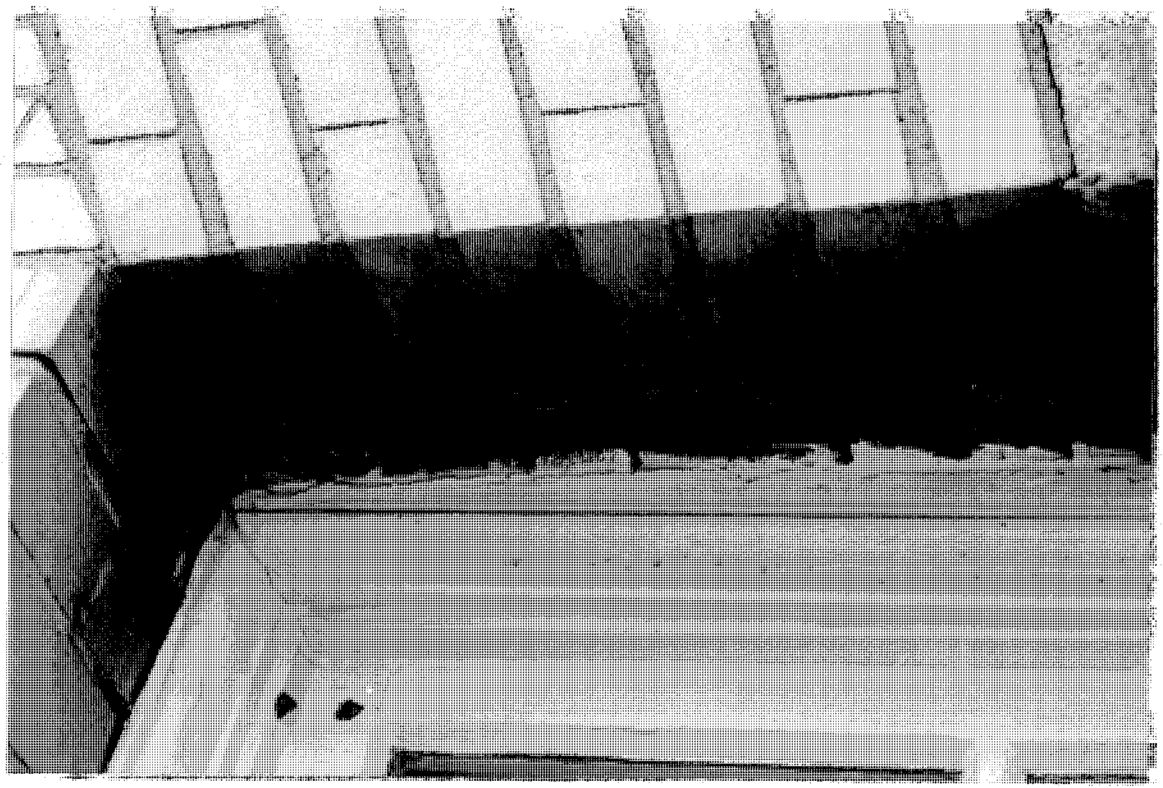


Figure 8-2

Gypsum and flyash have deposited on the undersides of window lintels and sills as seen here on the elevation of Building 3.

Figure 8-3

Bitumen-based materials have been accidentally splashed onto the brick and granite as seen here on the elevation of Building 7.

Figure 8-4

Condition of the lightly soiled brick on the east elevation of Building 5 before commencing cleaning tests.

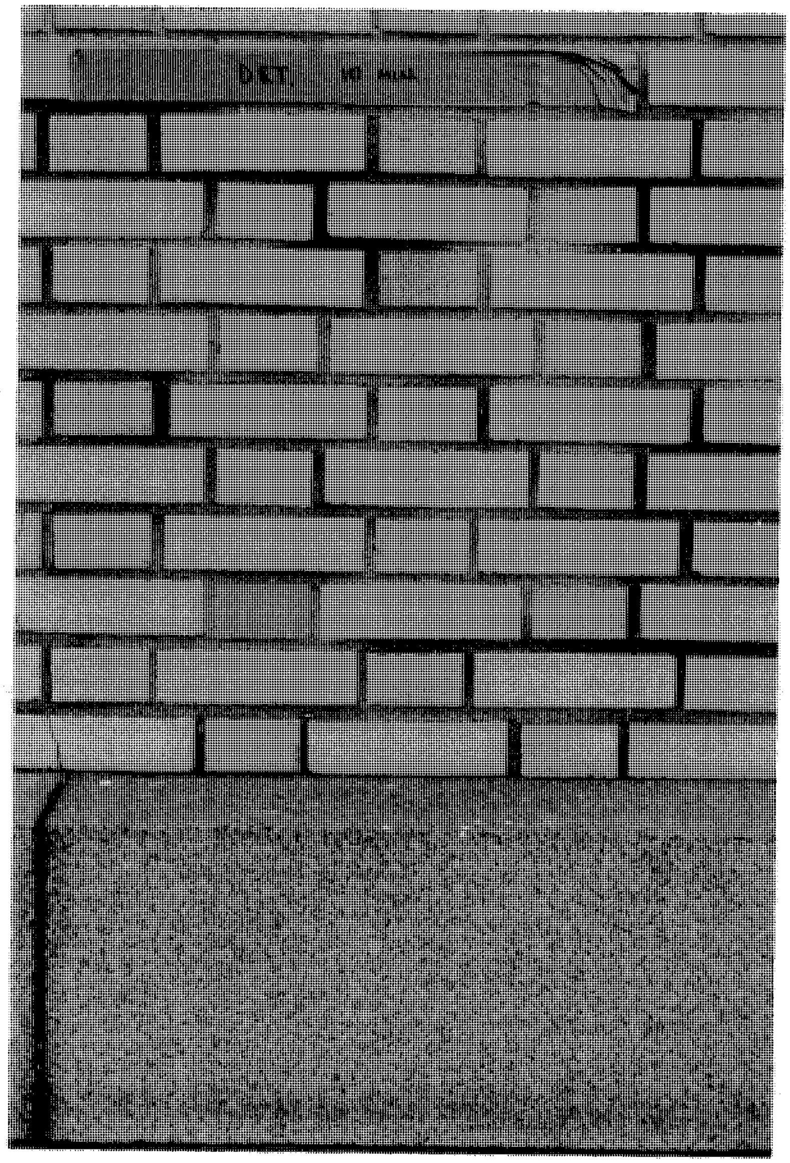


Figure 8-5

Condition of lightly soiled brick on the east elevation of Building 5 after cleaning with detergent (10 minute dwell time) and power wash (approximately 400 psi). Good results are obtained with little risk of damaging the brick.

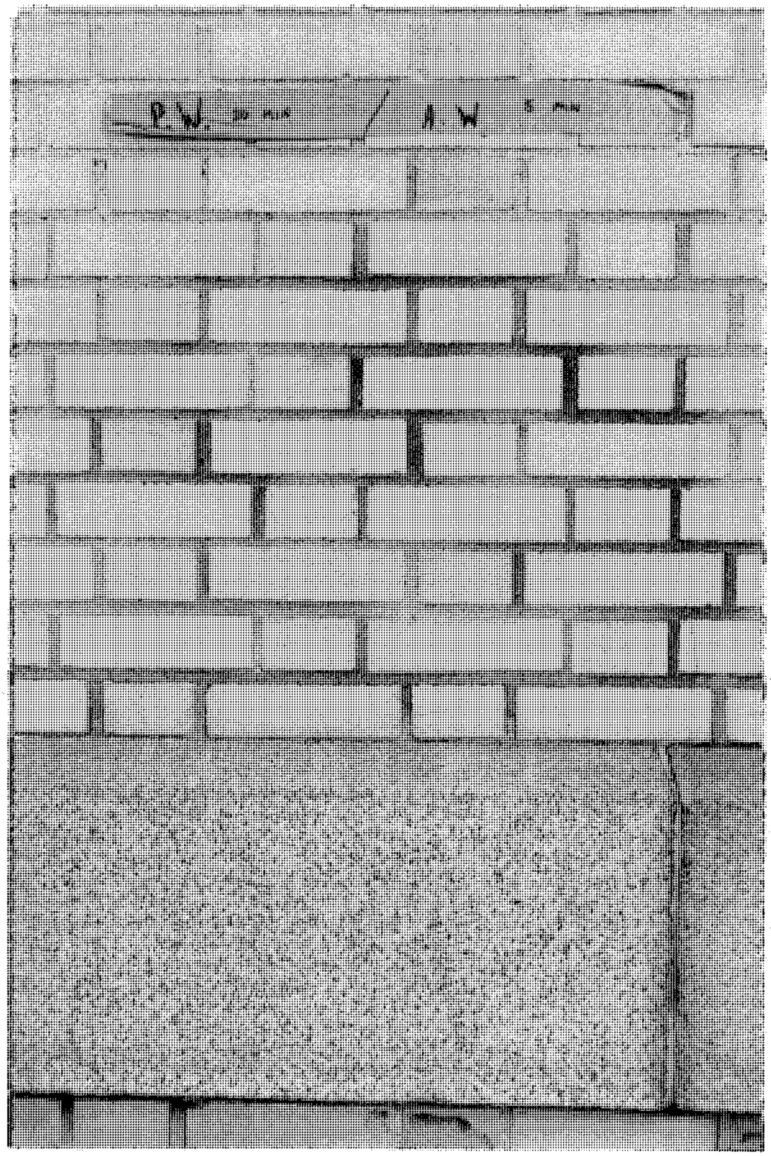


Figure 8-6

The light soiling of the brick on the east elevation of Building 5 was also cleaned by an alkaline pre-wash/acid after-wash system. The results of the cleaning are good but this system is more aggressive than the detergent cleaning which also achieved good results as seen in Figure 5. Therefore, the detergent cleaning is the recommended method for cleaning the lightly soiled brick on Buildings 1, 5, 6 and 7.

Figure 8-7

The granite water tables (as well as other granite elements) on Buildings 1, 5, 6 and 7 are lightly soiled as seen here on the east elevation of Building 5 before cleaning tests commenced.

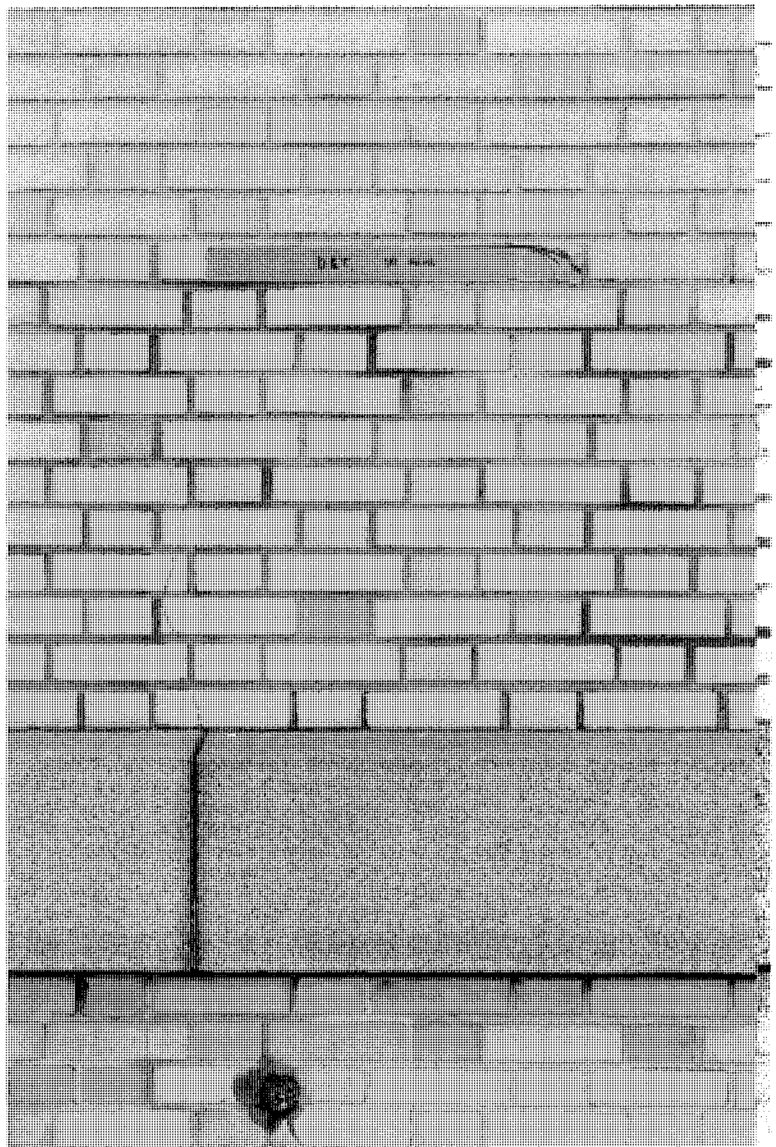


Figure 8-8

The detergent cleaning of the granite water table on the east elevation of Building 5 was unsuccessful.

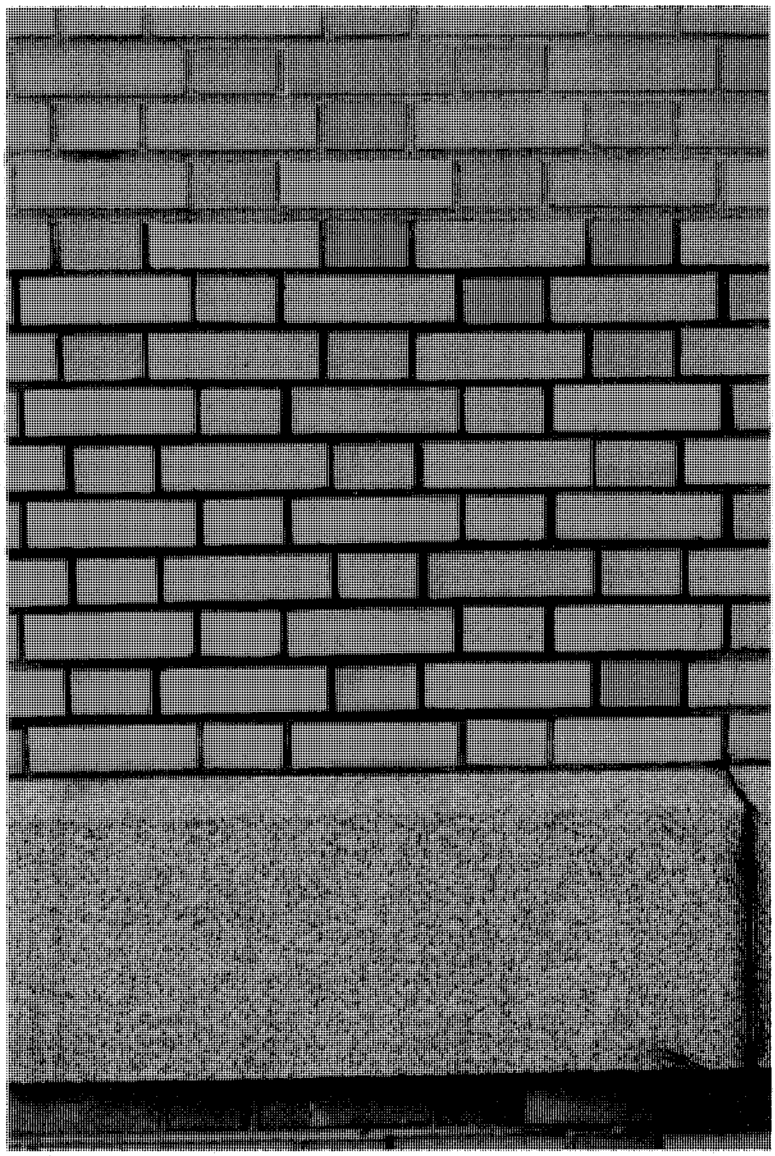


Figure 8-9

The lightly soiled granite was cleaned well by the alkaline pre-wash/acid after-wash system as seen here on the east elevation of Building 5. This method is recommended for the cleaning of all granite elements on Buildings 1, 5, 6 and 7.

Figure 8-10

The water misting method was used to remove gypsum and flyash from the undersides of window lintels as shown here on the east elevation of Building 5. Good results were obtained after 6 hours (before cleaning condition can be seen on the right). This is a safe and effective method for removing this soiling and is the recommended techniques for this condition.

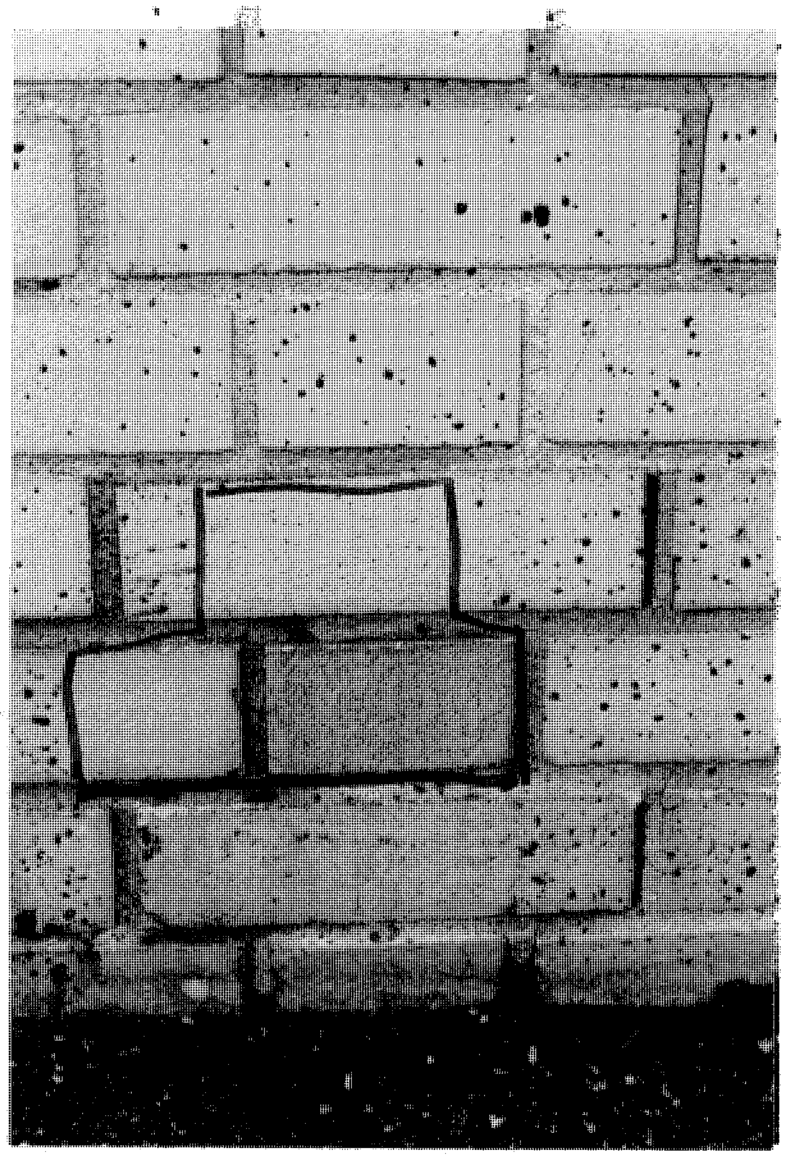


Figure 8-11

Bitumen-based deposits as shown here on the elevation of Building 5 were cleaned with PROSOCO'S Asphalt and Tar Remover - a solvent-based cleaner. The applied as a paste in attapulgite for 4 hours the deposit was then dislodged with paint scrapers taking care not to scrape the brick. The results shown here (uncleaned area on the left and cleaned area on the right) are good and this is the recommended method for removing these deposits.

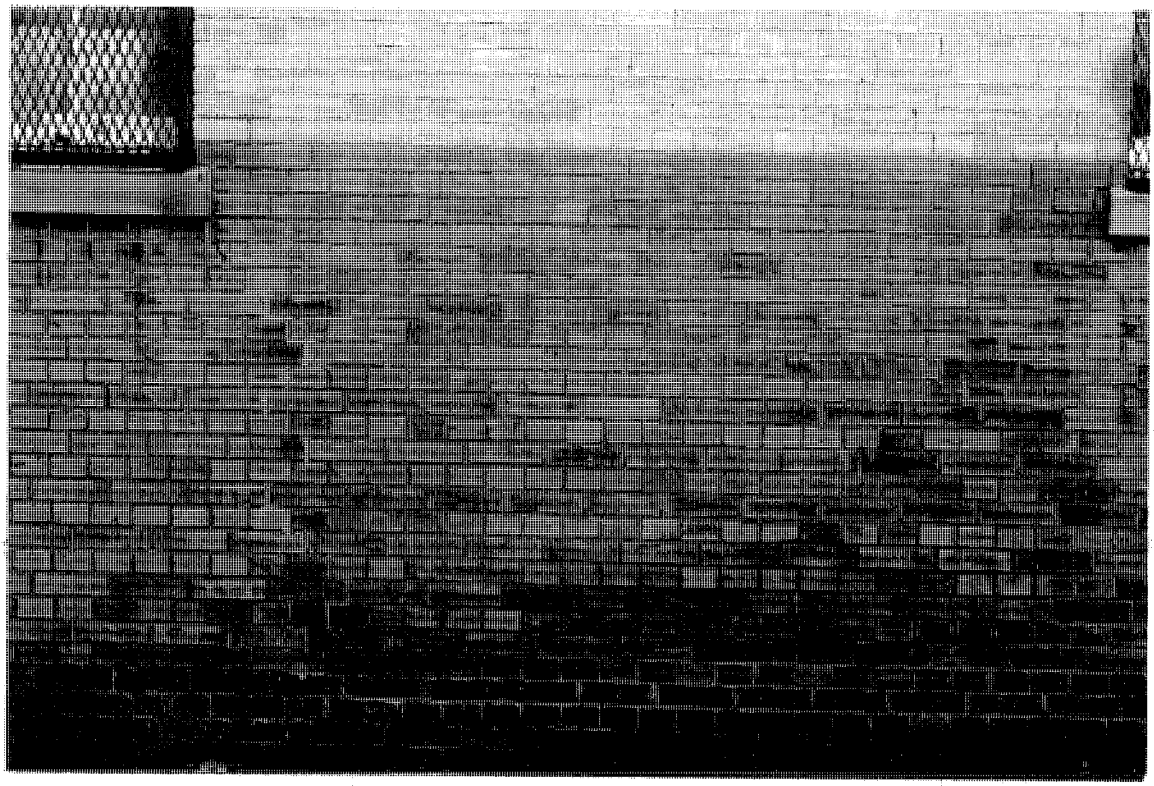


Figure 8-12

The soiling of the brick on Building 3 and 4 is more severe than on Buildings 1, 5, 6 and 7 as seen here on the elevation of Building3. The brick on Buildings 3 and 4 is also different from the brick on Building 1, 5, 6 and 7.

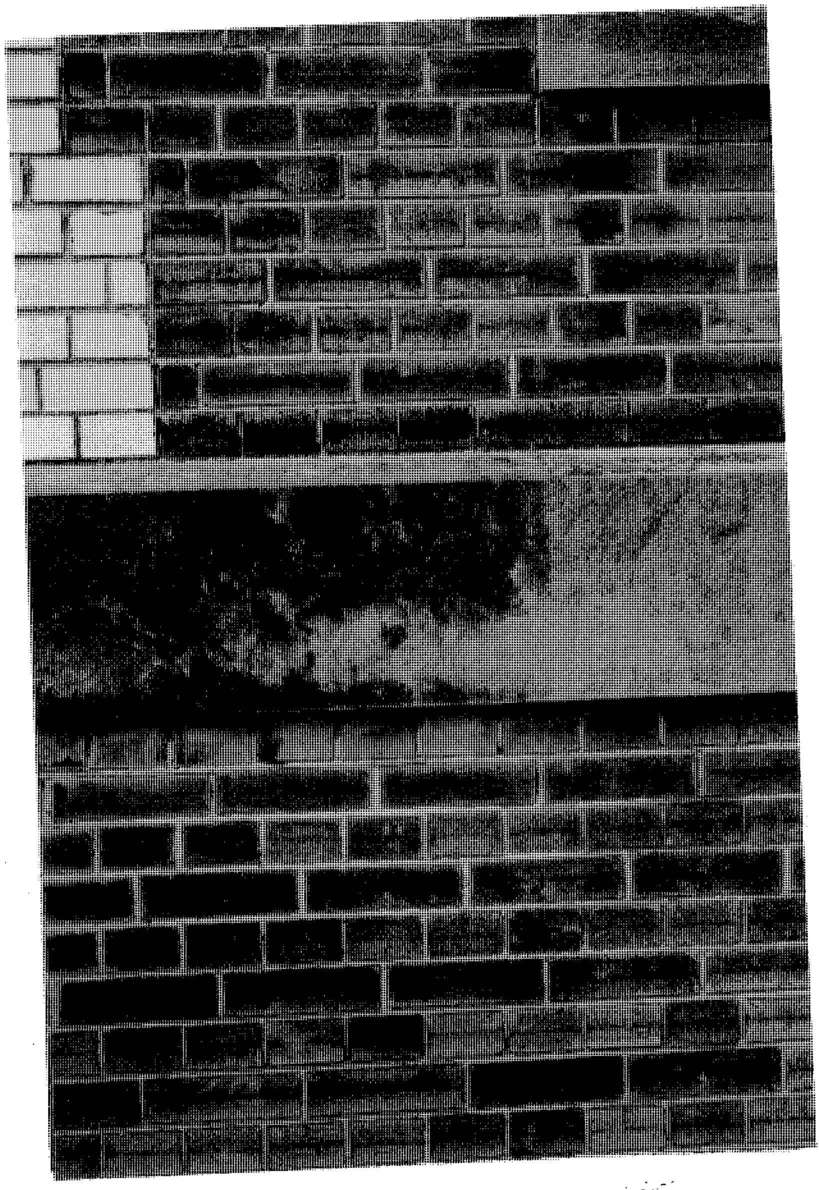


Figure 8-13

The water tables (and other decorative elements) on Buildings 3 and 4 are limestone. This limestone is moderately soiled as seen here on the elevation of Building 3.

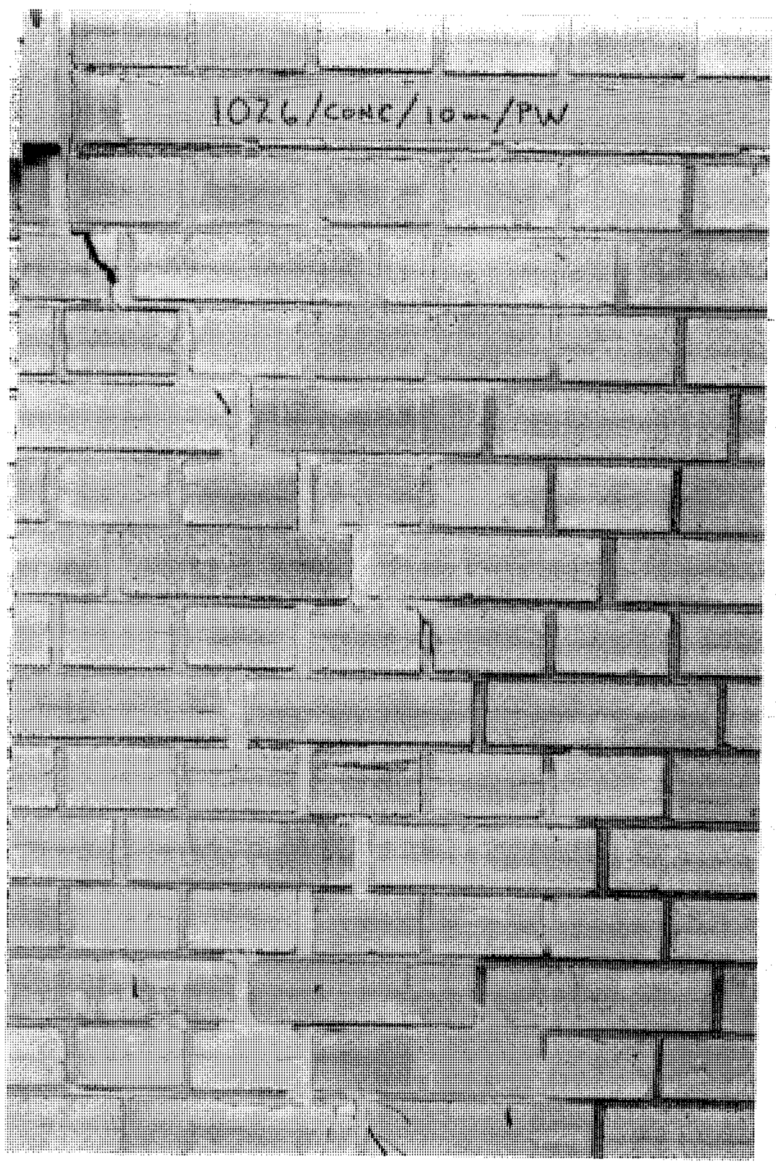


Figure 8-14

A cleaning test was executed with PROSOCO'S 1026 detergent on the brick of the south elevation of Building 3. No cleaning was achieved by this method (the left side of Figure 12 shows this area before cleaning).

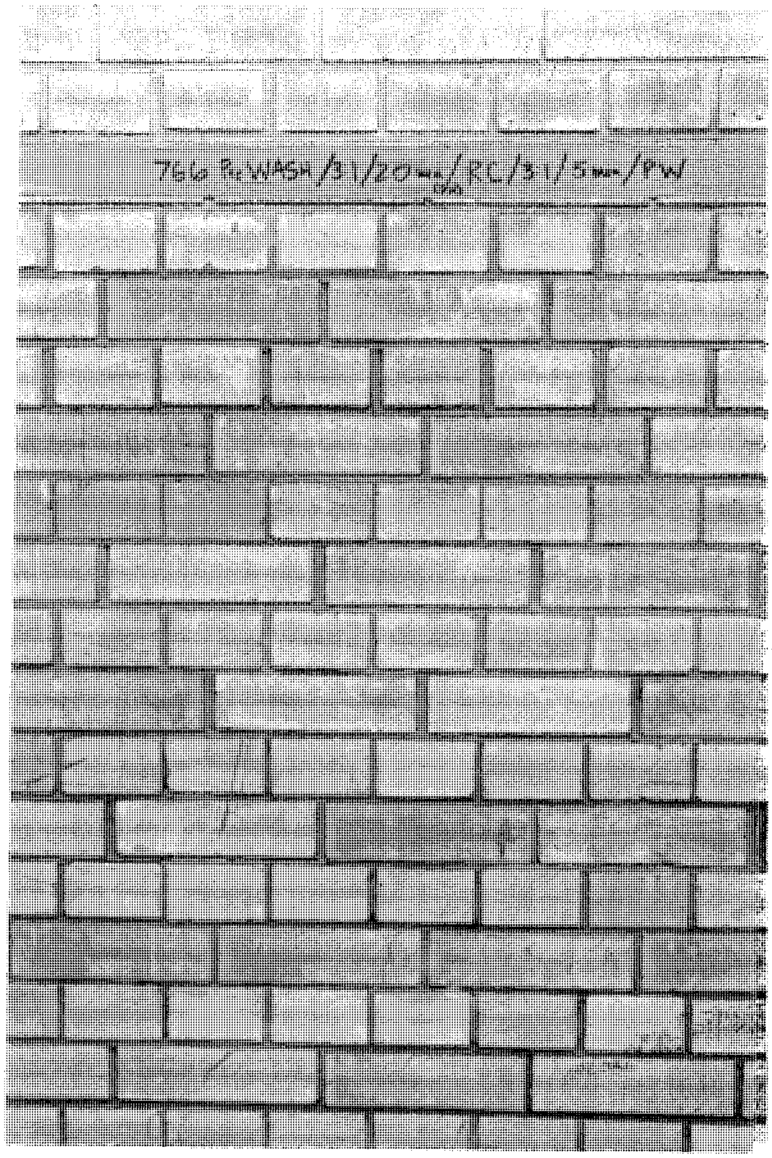


Figure 8-15

Cleaning tests on the brick of Building 3 were also executed with an alkaline pre-wash/acid after-wash system. The results shown here on the south elevation of Building 3 indicate that no cleaning was achieved by this method.

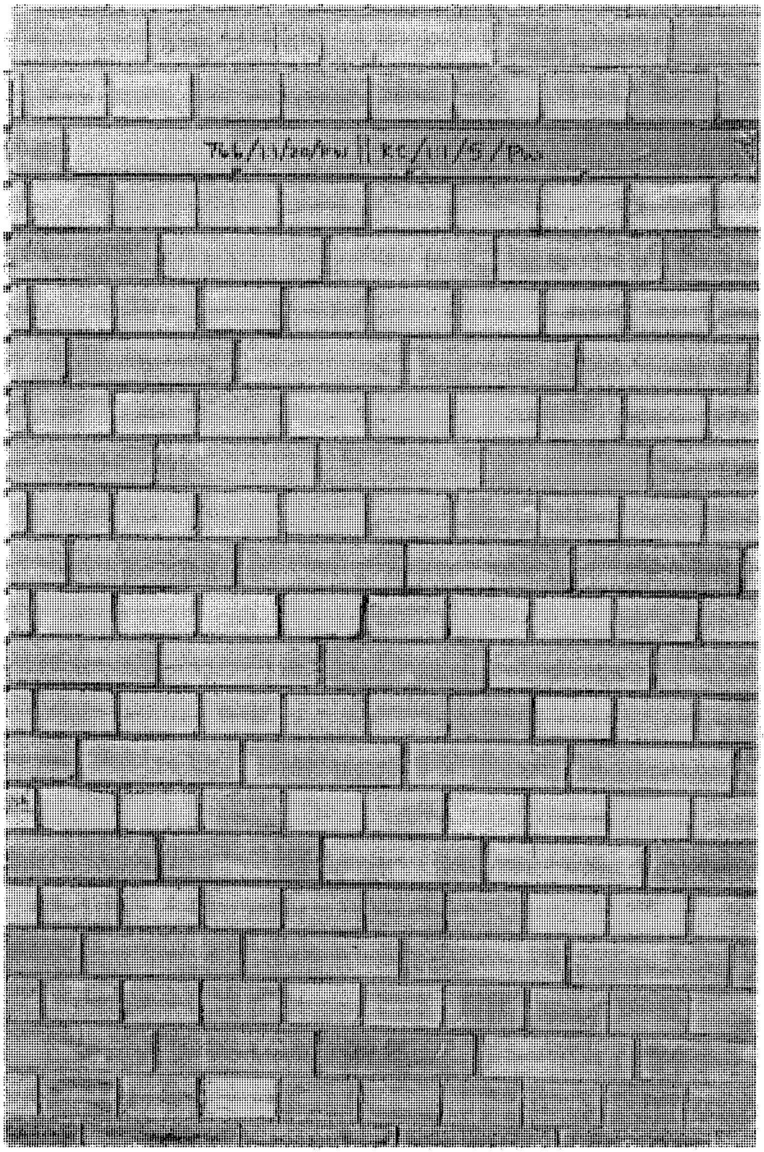


Figure 8-16

Cleaning tests were executed on the brick of Building 3 using increased concentrations in the alkaline pre-wash/acid after-wash system. Again, no cleaning was achieved as shown here on the south elevation of Building 3.

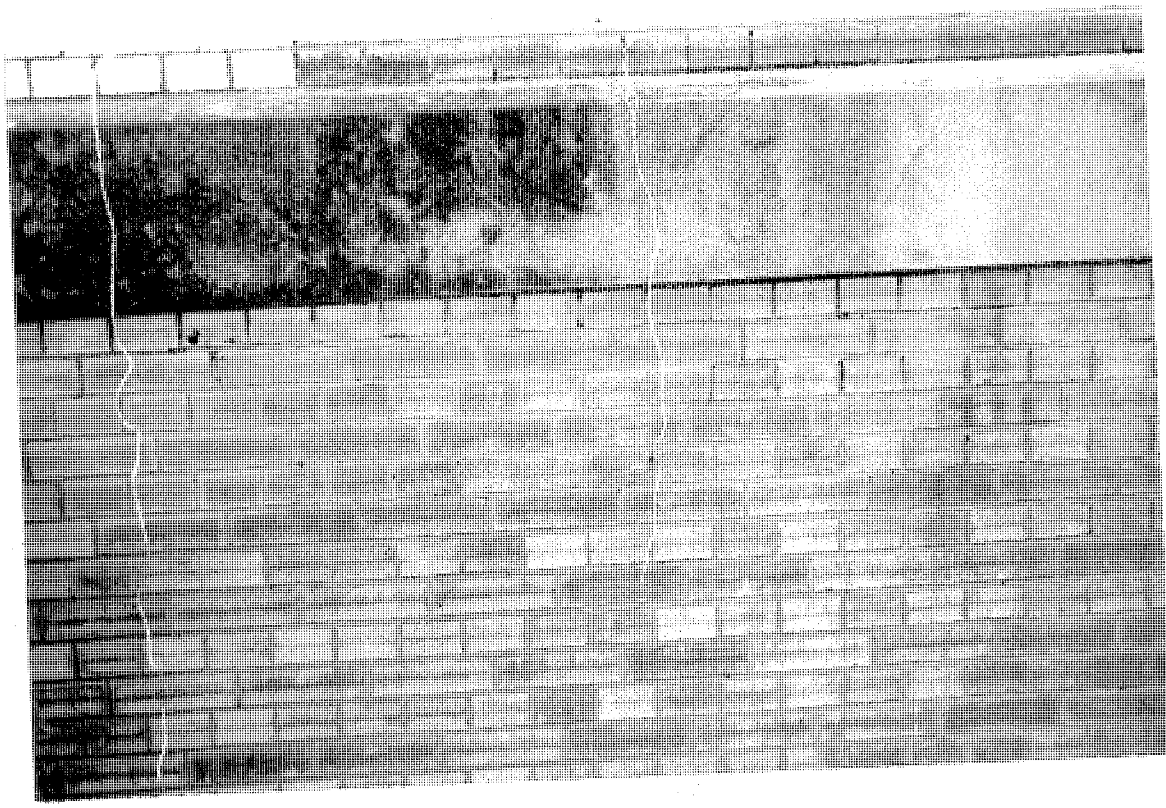


Figure 8-17

A section of the brickwork on the east elevation of Building 4 was cleaned with the water misting method. On the lower left the brick (and the limestone water table) can be seen before cleaning.

Figure 8-18

After 24 hours of water mist here on the east elevation of Building 4 the appearance of neither brick nor the limestone water table has altered significantly.

Figure 19

Application of ammonium thioglycolate poultice to brick to remove soiling from Buildings 3 & 4. Note the typical soiling conditions immediately adjacent to the poultices at Building 3.

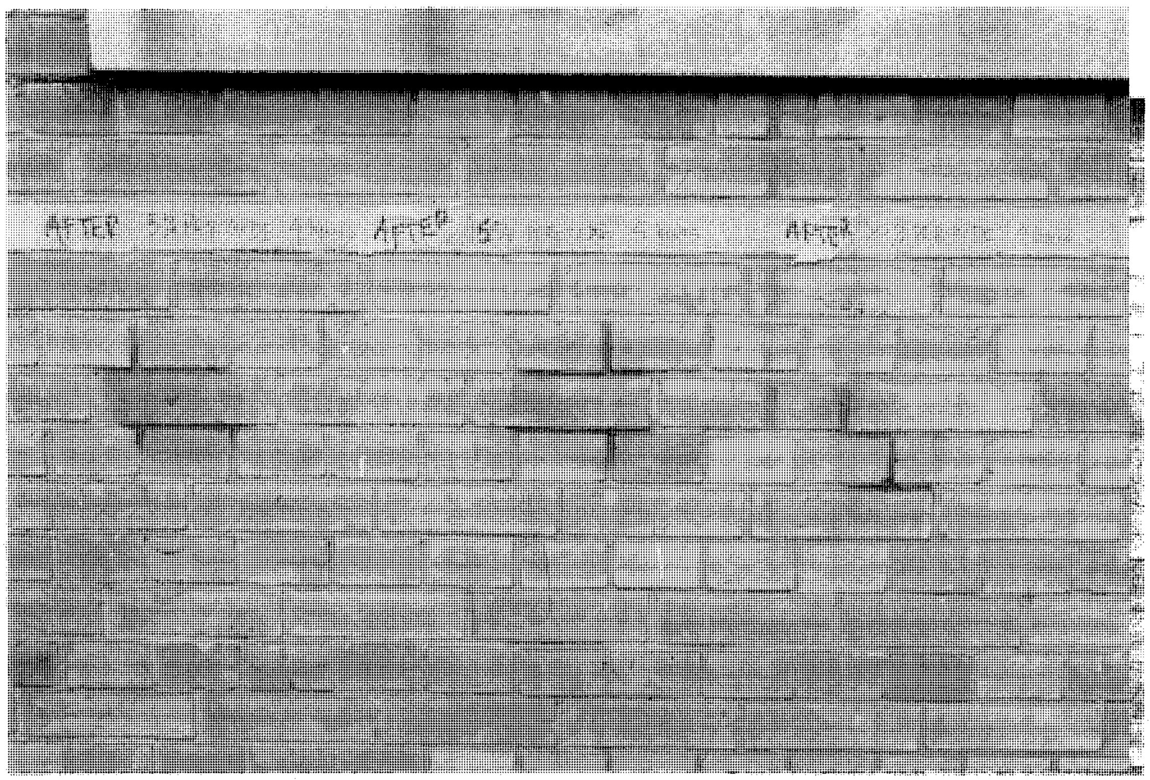


Figure 20

Unsuccessful results of the hydrogen peroxide cleaning tests; there was little or no change from "before" and "after" on Building 3.

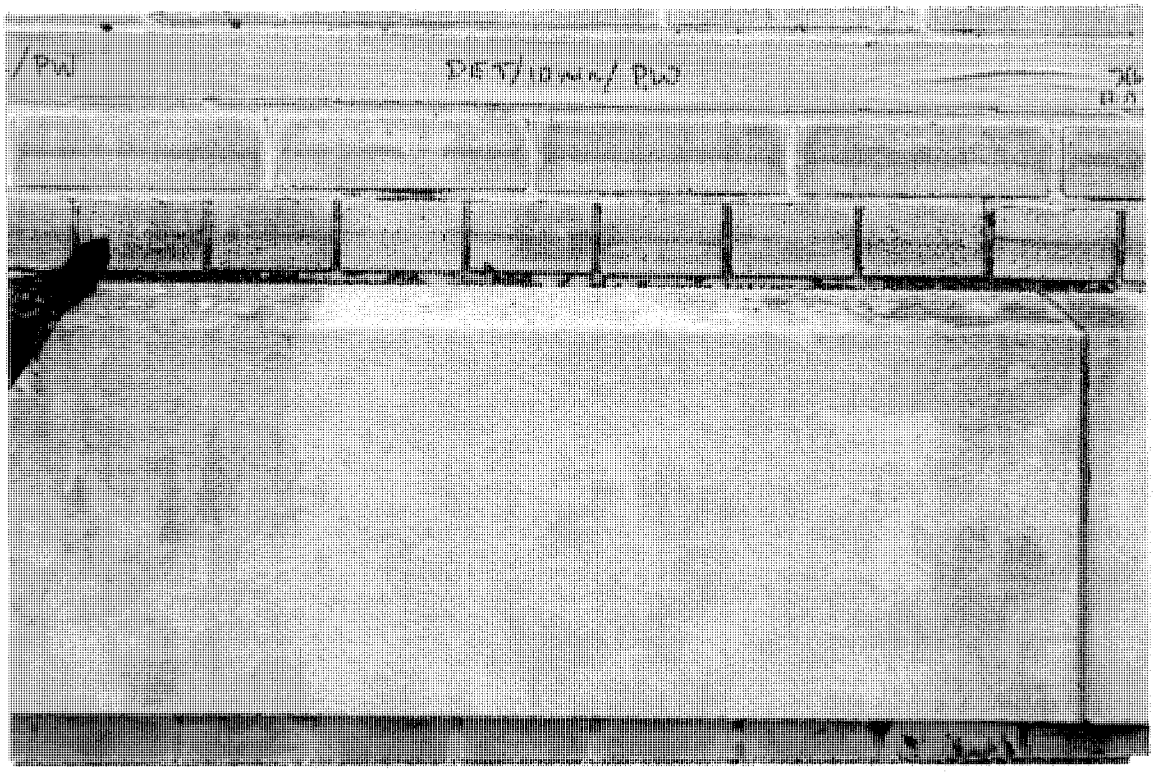


Figure 8-21

A section of the limestone water table on the north elevation of Building 4 was cleaned by several methods. Here can be seen the result when cleaning with a detergent followed by power washing. Good cleaning is achieved with little harm to the substrate. The before cleaning condition can be seen to the left and the to the right of the cleaned area.

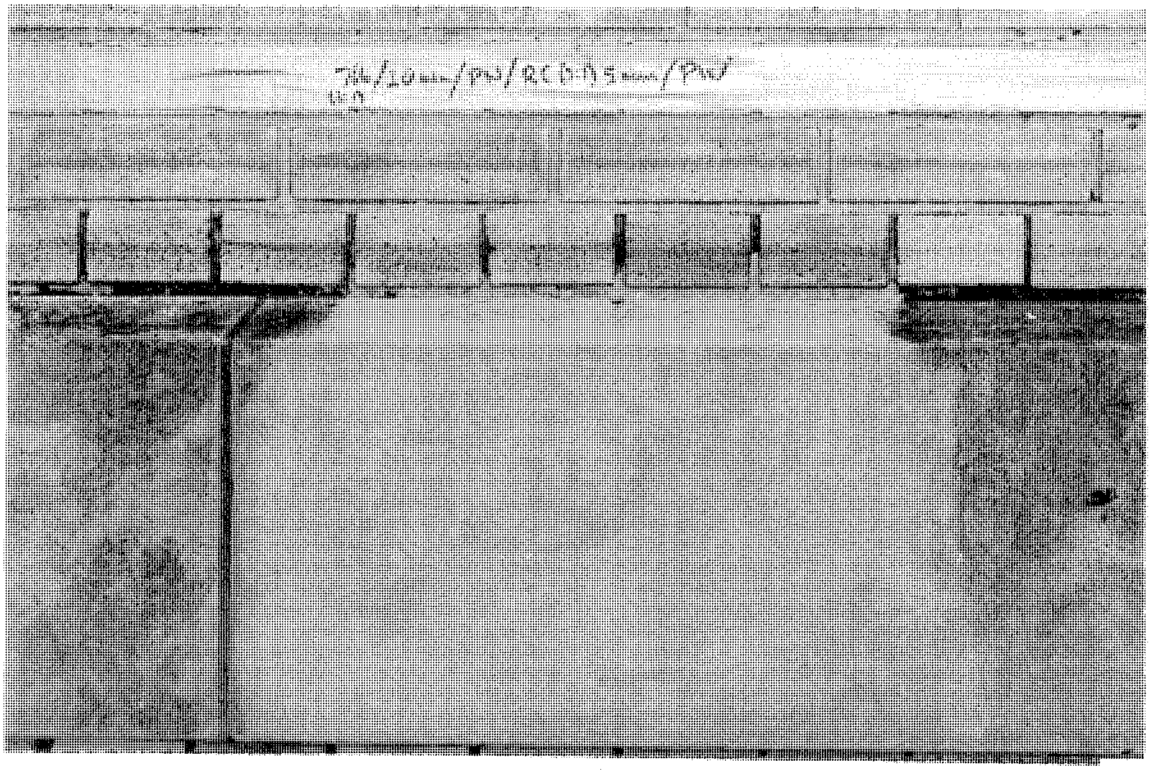


Figure 8-22

A section of the limestone water table on the north elevation of Building 4 was also cleaned by the alkaline pre-wash/acid after-wash method. Good cleaning is also achieved but the method is more aggressive on the substrate. The before cleaning condition can be seen to the left and the to the right of the cleaned area.

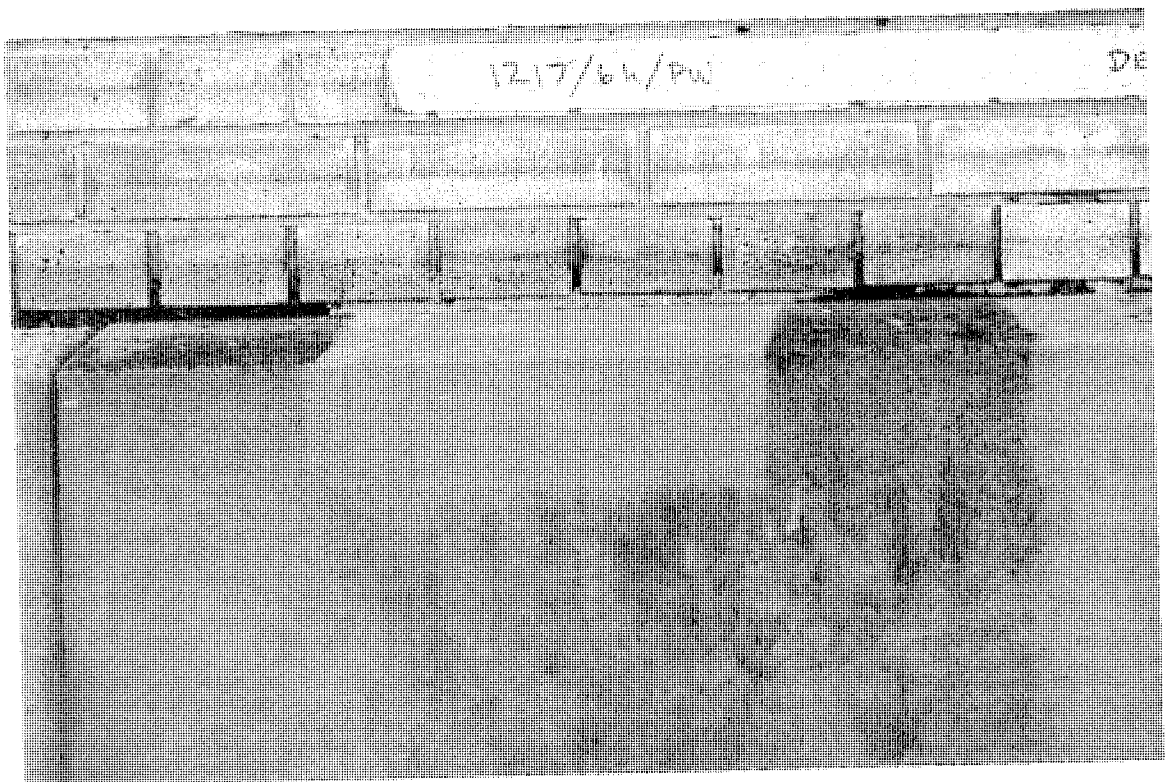
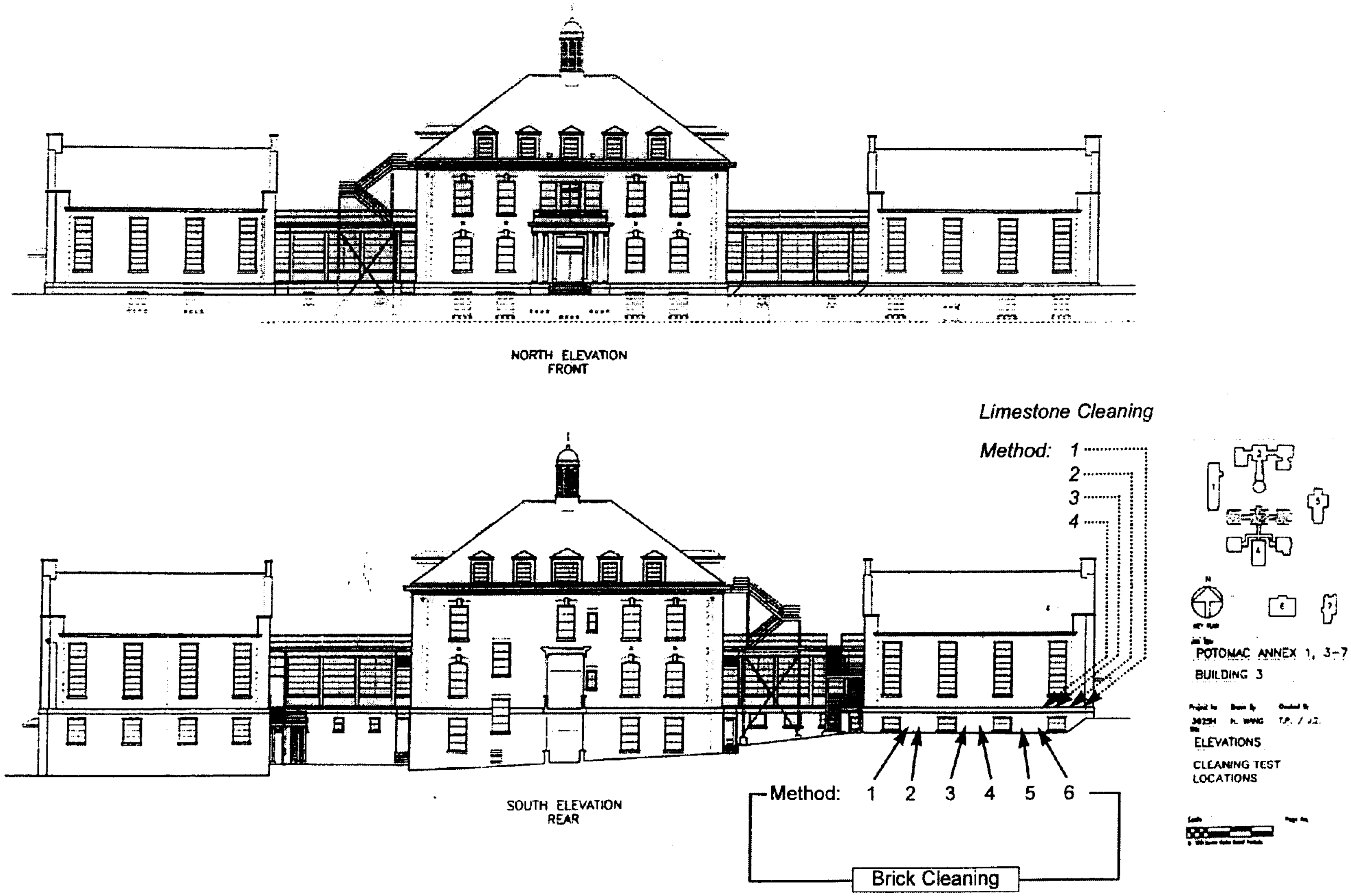
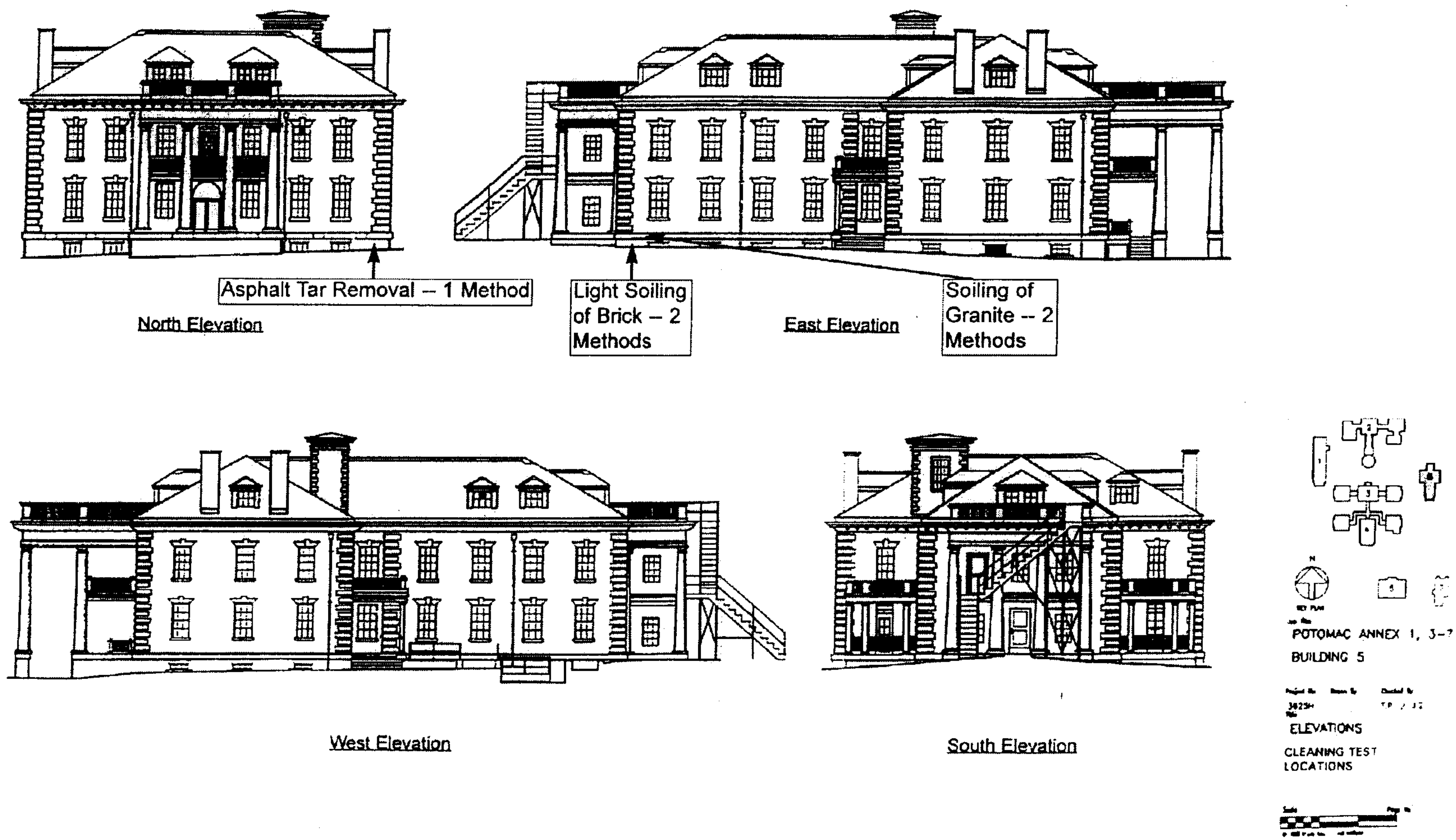


Figure 8- 23

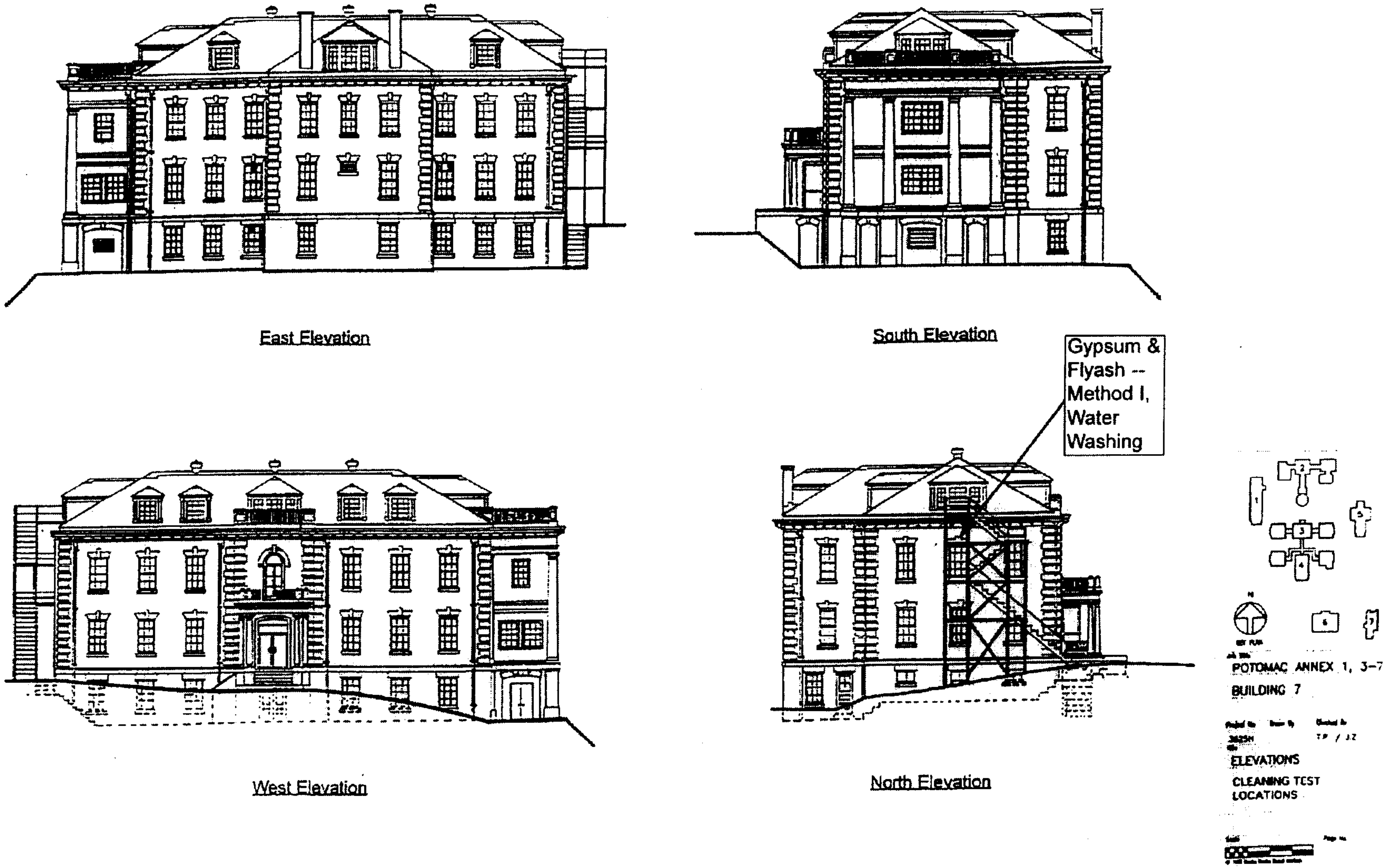
A section of the limestone water table on the north elevation of Building 4 was also cleaned using PROSOCO'S 1217 poultice for 6 hours followed by power washing. Good cleaning is also achieved by this method which is intermediate in aggressiveness to the detergent and alkaline pre-wash/acid after-wash methods. The before cleaning condition can be seen to the left and the to the right of the cleaned area.

CLEANING TEST LOCATIONS

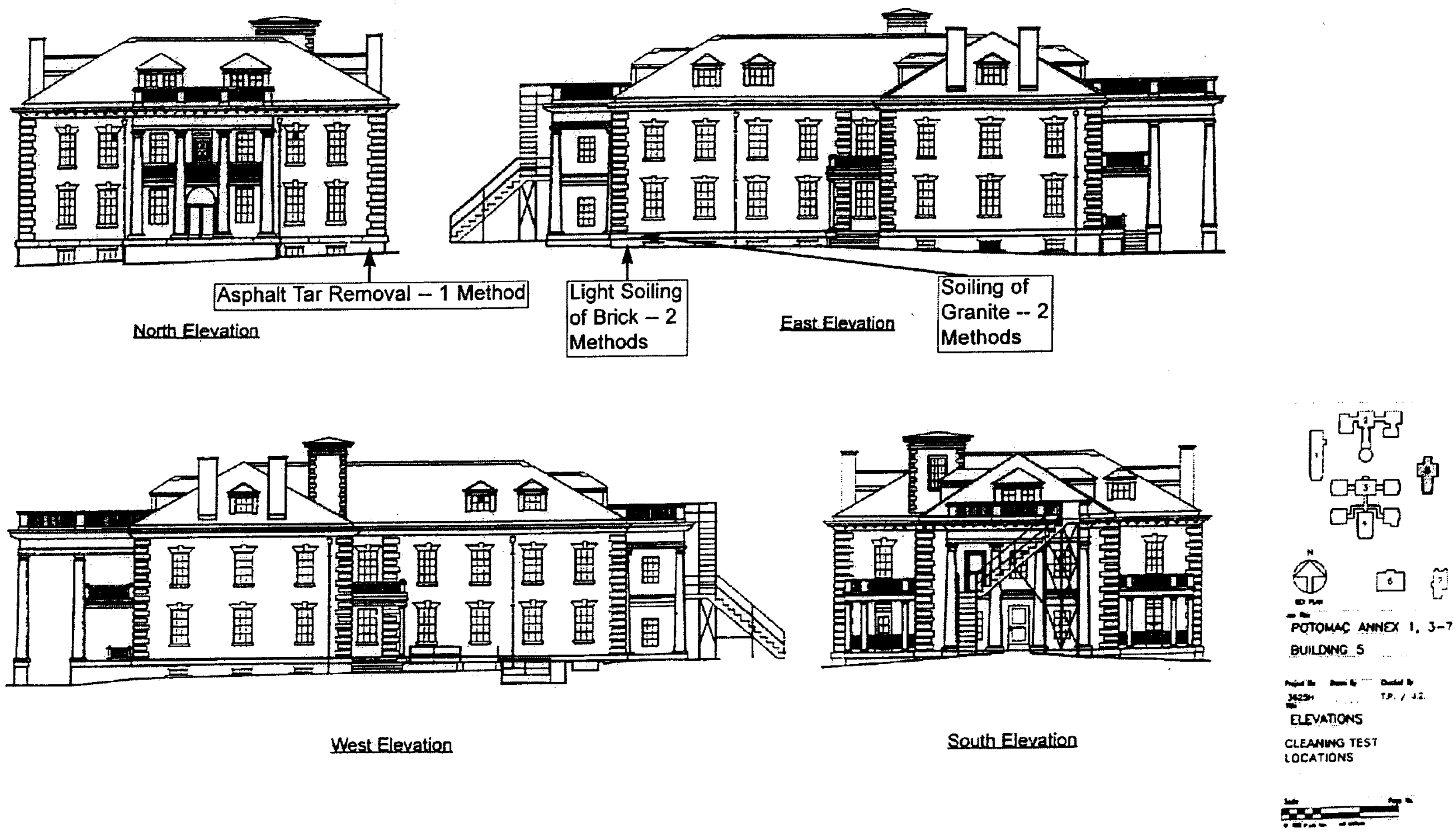



Asphalt Tar Removal -- 1 Method
North Elevation
Light Soiling of Brick -- 2 Methods
East Elevation
Soiling of Granite -- 2 Methods
West Elevation
South Elevation
POTOMAC ANNEX 1, 3-7
BUILDING 5
ELEVATIONS
CLEANING TEST LOCATIONS

CLEANING TEST LOCATIONS



CLEANING TEST LOCATIONS


Asphalt Tar Removal -- 1 Method
Light Soiling of Brick -- 2 Methods
Soiling of Granite -- 2 Methods
North Elevation
East Elevation
West Elevation
South Elevation
POTOMAC ANNEX 1, 3-7
BUILDING 5
ELEVATIONS
CLEANING TEST LOCATIONS

CLEANING TEST LOCATIONS