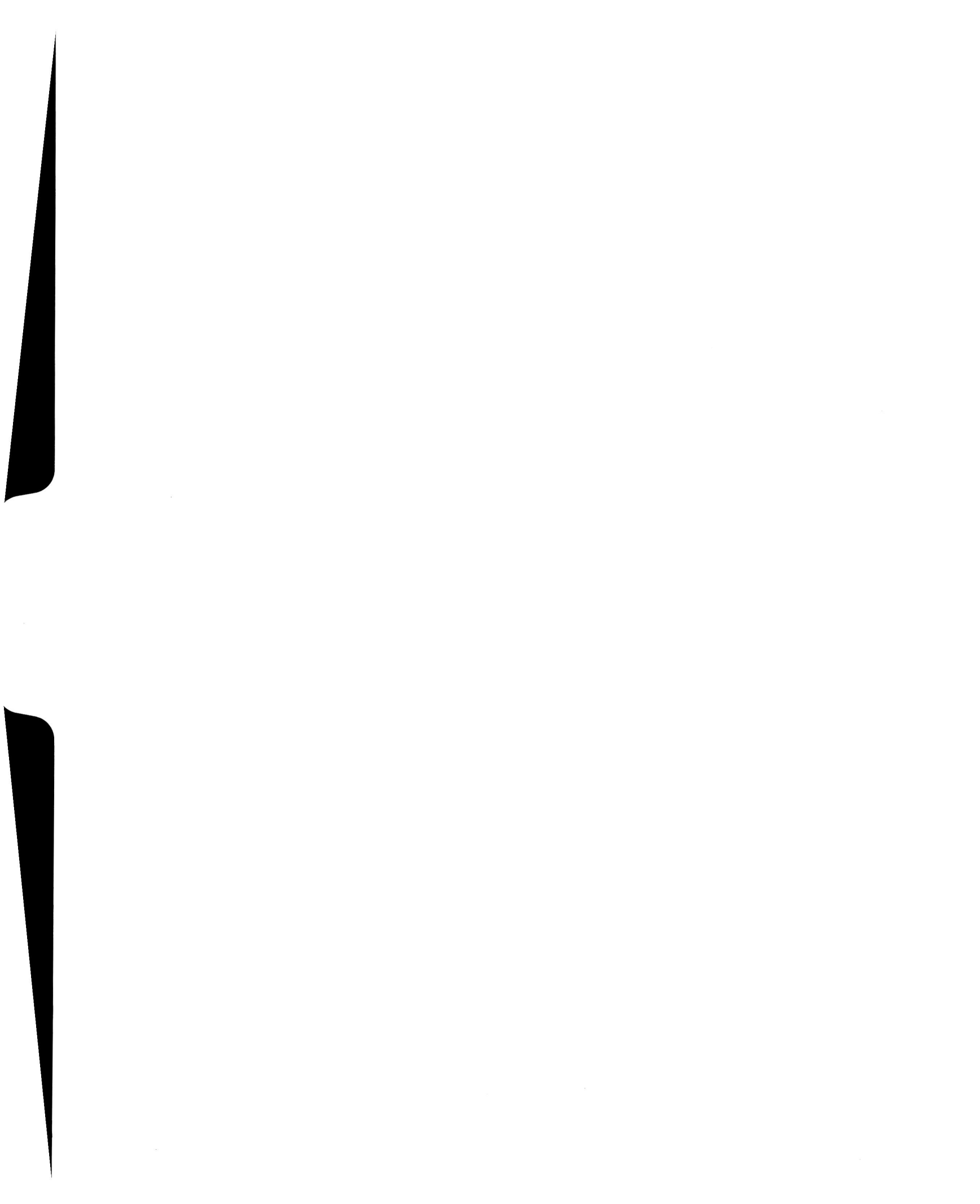


CHAPTER VIII



**CHAPTER VIII****MATERIALS CLEANING ANALYSIS****ON-SITE COLLECTION OF PHYSICAL DATA****DESCRIPTION OF STAINS AND SOILING**

The masonry and metal surfaces of the Department of Housing and Urban Development (HUD) Building were visually examined and materials and their finishes determined. The locations of the materials were noted along with their condition and causes of general staining and deterioration affecting the masonry.

Exterior surfaces of the building are lightly soiled with staining on only a few areas. The majority of soiling on the building exterior is generated by the heavy vehicular traffic and parking adjacent to and beneath the building colonnade. This soil has collected most severely on the triangular block screen walls which were constructed to screen the automobile parking areas. Stains have several different sources. On the white cement plaster ceiling of the colonnade, stains have been caused by moisture. Metal grill covers over lights and access panels are corroding, due to age and moisture. Metal window frames of the window wall of the west side of the cafeteria are heavily soiled. On the first floor granite walls, stains have been caused by glue remaining where signs have been placed and then removed, marker graffiti, and vehicles bumper scuff marks. To date, the soiling and staining has caused no deleterious side effects, although the cause of the staining such as corroding steel does have potential to damage the concrete. The potential for permanent staining as the soiling increases does exist. The most significant staining is due to the corrosion of the exposed ends of the steel chairs and bolsters that supported the reinforcement prior to placement of the concrete. This corrosion appears as a pattern of small dots of rust on the surface of the concrete. Corrosion of exposed reinforcing steel is also causing staining on the surface of the precast and cast-in-place concrete.

Interior masonry surfaces in the first floor north and south entrance lobbies, north and south elevator lobbies and building core areas on floors 1-10, and exterior entrance surrounds and columns in the first floor cafeteria are finished in bushhammered concrete. The walls are lightly soiled in most areas, with heavier areas of soiling found in the elevator lobbies on all floors around the elevator call buttons. The 4 inch high reveal at the bottom of the concrete walls is soiled and stained with the floor cleaning and finishing coatings. Areas of staining are primarily glue stains between the elevator doors where signs have been removed. Other areas include rust stains on the concrete beneath the drinking fountains in the northeast quadrant of the building caused by a leaking pipe. The concrete soffit above the elevator doors on floors two through ten have been painted. In the cafeteria, the columns and exposed concrete were painted in 1993; although the paint was removed on the main exterior entrance surround, the columns remain painted white. Wooden capitals, also painted white, have also been installed on the top of these columns.

The bluestone flooring of the first floor has been concealed under a thick layer ( $\pm 1/16$  inch thick) consisting of numerous coats of wax. Metal surfaces on the interior of the building are generally in good condition.

The scope of the Materials Cleaning Analysis includes both exterior and interior masonry and metals cleaning tests.

The following chart (Exhibit 8-A) lists and describes the materials, location, condition and causes of deterioration.

### JUSTIFICATION FOR CLEANING

The HUD Building's original clean appearance is slightly impaired by the overall areas of light soiling and localized dark staining. Cleaning the facades of the building will improve its appearance and may significantly assist in the prevention of future deterioration of the stained and soiled areas. Soiling and stains not only detract from the aesthetic quality of the building but also contribute to the progressive decay of the concrete and mortar. The benefit of cleaning includes the removal of soil and contaminants that can cause the further breakdown or deterioration of materials and finishes as well as attracting more pollutants. Dirt typically collects on horizontal surfaces such as metal louvers and window sills. Periodically rain washes the dirt off of the horizontal surfaces and onto the face of the masonry. Removal of soil from all surfaces, masonry and metals, is necessary. Dirt greatly increases the effective surface area of the masonry, multiplying the damaging effects of atmospheric pollutants while it slows the evaporation of moisture contained within the masonry. This increased dampness in the stone and concrete raises the chances of damage due to freeze-thaw cycles and facilitates the introduction of damaging soluble salts into the masonry. Cleaning is an essential part of preventive maintenance not only cosmetically but to discourage the deterioration of the concrete and granite, making cleaning an essential part of the preservation of the building.

### EXPECTED APPEARANCE AFTER CLEANING

Removing soiling and staining that is potentially hazardous to the concrete, bluestone and granite, thus assisting in the masonry's preservation and restoring the building's original appearance, is the purpose of cleaning. Removal of soil from metal surfaces is necessary to prevent these surfaces from soiling adjacent surfaces. There are numerous approaches to cleaning, however the goal is not to over clean - and by doing so remove a layer of the original material, but to improve the appearance and expected life span of the material. Removal of all dirt and stain particles is not necessary and would be impossible to achieve without removing part of the masonry itself, so some slight discoloration is to be expected. Because a majority of the facades are only slightly soiled, the possibility exists that the entire surface may not need to be cleaned; only the stained and heavily soiled areas require attention to produce a uniform clean color in the concrete and granite.

There should be no visible damage to the concrete or stone, either due to the cleaning or future adverse side effects related to the cleaning materials or methods. Cleaning materials should not alter or obscure the original wood texture or joint pattern of the exposed concrete. Smooth surfaces of the margins of the interior concrete should also be pitted or dulled. Metal surfaces should retain their original surface finishes, texture and color. The final, cleaned building should be evenly clean, with no streaking or staining. It should be expected that heavily stained areas will not be as clean as the less soiled areas of the walls. Precautions are to be taken to prevent future problems caused by such things as salts and moisture penetrating to metal anchors or interior surface materials. The cleaning method therefore should anticipate any potential problems with the building surfaces.

#### PREVIOUS SURFACE TREATMENTS FOUND ON BUILDING

Cleaning and repointing of the granite end walls was performed in 1972. The building was cleaned in 1986 using Sure Klean "Restoration Cleaner" for the granite surfaces and Sure Klean "Limestone Cleaner" for the concrete surfaces. The surface of the granite on the exterior of the first floor is streaked and not evenly cleaned and may be the result of this cleaning.

Exterior cleaning tests on the concrete portions of the building was to be done in 1991 as part of GSA Contract #PCN: RDC08112. Application of a water repellent to the concrete was also part of this contract. After cleaning tests were performed it was impossible to determine which areas had been cleaned and which hadn't, so the concrete on the building was not cleaned and the water repellent was not applied.

#### ENVIRONMENTAL CONSIDERATIONS

The site and surroundings of the HUD Building exhibit several conditions that will have an effect on the selection of cleaning techniques and materials, especially those methods employing chemicals. Both Seventh and D Streets and the sidewalks are heavily trafficked at all times of the day. The Seventh Street Plaza and the Ninth Street courtyard areas and connection to L'Enfant Plaza have heavy pedestrian traffic during the day. The north and south elevation parking areas have automobile parking and traffic. Trees and plants are located on all four elevations of the building. There is also a playground on the northwest corner of the building.

The sidewalks, Seventh Street Plaza, Ninth Street courtyard, and north and south parking areas should be closed to pedestrians and automobiles, with street parking prohibited on streets adjacent to the facades being cleaned. Provisions for waste water disposal must be made to keep water from draining into areaways and from being tracked into the building by pedestrians. Trees and bushes around the building should be protected from spraying by shielding on the scaffolding or other supports and excessive runoff. Waterproof enclosures should be erected around the three main entrances of the building to provide safe access for the occupants and visitors during the cleaning operations. Building

materials, other than those intended for cleaning such as plaster, anodized aluminum, painted steel and glass must also be protected from direct, repeated or prolonged exposure to water and chemicals. Bluestone paving must be protected from cleaning and chemical runoff and the polished granite datestone protected from acidic cleaning compounds. Work on the north half of the west elevation should be scheduled when the playground is not in use. Although working at night will reduce danger to pedestrians and disruption of the building, experience has shown that it is difficult to evaluate cleanliness of the masonry surface under artificial light.

Temperature of the air and material being cleaned is very important for the proper performance of the cleaning chemicals being used and to prevent damage to the masonry. Wetting the masonry surface when the air or surface temperature is at or near freezing creates the potential of the moisture freezing in the surface of the masonry, resulting in freeze thaw damage to the material. Cleaning chemicals also have manufacturer's recommended temperature ranges within which the chemicals perform at their optimum. No cleaning should be executed when the air or masonry surface temperature is below 45 degrees F, unless adequate approved means are provided for maintaining a 45 degree F temperature of the air and materials during and 48 hours subsequent to cleaning. Manufacturer's recommendations regarding acceptable temperature ranges for the cleaning materials and methods being used should also be adhered to.

Cleaning materials and methods employed on the interior of the building should include protection of surfaces not being cleaned as described above. Interior cleaning materials should also be selected to be suitable for interior use. Cleaning materials should have a minimum odor and no harmful or dangerously combustible fumes. Water used in washing and rinsing should be applied only to the surface to be cleaned and all rinse water, cleaning solution and soil should be collected and disposed of.

## STONE AND CONCRETE ANCHORAGE SYSTEMS

### **CONCRETE**

There is no anchoring system for the cast-in-place concrete, however, the presence of exposed reinforcing steel and steel chairs on the surface of the concrete are to be considered in the selection of cleaning materials and methods. Cleaning chemicals should not react with the steel to accelerate the oxidation of the steel or increase the rust staining.

The precast concrete exterior wall panels on the second through tenth floors are anchored by steel clip angles embedded in the backs of the panels and welded to the building's structure. These attachment points are far from the face of the units and well protected from cleaning chemicals.

## GRANITE

The granite on the stair tower walls is 3 inches thick while at the first floor it is 2 inches thick. The exterior granite wall panels are anchored with stainless steel disk anchors to the concrete wall behind. Stainless steel relieving angles are used at each floor of the stair tower to support the granite. Exposed stainless steel cap nuts are used to anchor the stainless granite soffit stones at the second floor level of the stair towers.

Stone anchors appear to be properly detailed to protect anchors, structural members and interior surfaces from damage due to chemicals or high pressure water. The stone anchors do not corrode on exposure to water and most chemicals. Care must be exercised when using these products to prevent them from migrating through the stone joints to the anchors.

## EXTERIOR AND INTERIOR MASONRY CLEANING METHODS

Many concrete and stone cleaning techniques are available and considered suitable for use on the HUD Building. Prior to selecting one technique, the advantages and disadvantages of each should be deliberated and each appropriate method tested carefully. It may become apparent that in order to adequately clean the masonry, several methods will be required. Presented below are potential cleaning techniques and their suitability for use on the building.

## WATER TREATMENTS

All cleaning methods involving water or water vapor can be used only when there is no danger of frost during application and drying time which can range from a week to a month or more. Therefore, testing and use of water treatment on the building should be conducted between late April and early September. Water treatments often pose little hazard to the masonry surface as long as excessive water pressure is not applied. Water pressure for proper cleaning should be determined during cleaning tests which are performed before the actual cleaning has begun. The minimum distance between the surface being cleaned and the spray nozzle is 12 inches. Pressure washing equipment should have intact, accurately calibrated, operating gauges with which to measure the water pressure. Water pressure should cause no damage to the sound masonry surface.

### Prolonged Spraying

In preparation for this treatment, staging is erected in front of a wall area measuring approximately 40 feet square and is encased in polyethylene sheeting to create an enclosure along the top of the cleaning areas. Perforated hoses are set up along the top of the wall and a continuous fine mist of water sprayed onto the masonry. The wall is soaked in this manner for as long as a week or until the dirt deposits soften sufficiently to be easily removed. This treatment may be followed by a low to moderate pressure (200-600 psi)

washdown to remove the dirt. The enclosure would then be dismantled and re-erected in another area and the process repeated. Cleaning would begin at the top of the building so that the water would run down and soften the dirt below. This process requires minimal expenditures for materials and equipment, however, it uses large quantities of water. This method is typically used in cleaning heavily soiled masonry and is considered inappropriate for use since it is inefficient and awkward to erect and re-erect an enclosure of limited size around a building of this size. Prolonged soaking also poses a number of potential hazards and chances of indirect damage. It may cause additional staining by dissolving minerals and other soluble substances within the masonry and drawing them to the surface with the evaporating water. In addition, saturation of the wall may damage anchors, framing, and other concealed metalwork, as well as mortar joints and interior plasterwork. Finally, it is difficult to ensure proper drainage and disposal of large quantities of waste water. This method was not tested.

#### Water Wash

A medium (400-800 psi) to high (800-1200 psi) pressure warm water (80-120 degrees F) wash is sprayed over the masonry surface which at the same time may be scrubbed with a natural bristle brush to loosen and remove the dirt. Occasionally, detergents are used in combination with a water wash. Water wash is good for final rinsing after other cleaning operations and allows retention of the patina. It has effective cleaning capabilities as a sole cleaning method on lightly to moderately soiled masonry.

Heavily soiled areas which have dirt embedded in the pores of the stone and localized stained areas may not be sufficiently cleaned in one washing operation. While superficial dirt is removed by water washing, the deeper soil deposits will be pulled to the surface as the stone dries, producing a brown stain. This staining may be avoided or removed by repeating the cleaning process.

Water wash was tested on-site for use on lightly to moderately soiled concrete and stone exterior areas of the building. Because the large quantities of water are difficult to contain and control, these methods were not tested on the interior masonry.

#### Steam Cleaning

Steam generated in a flash boiler is directed against the masonry surface with a low pressure (10-80 psi) nozzle. Steam cleans more readily than a plain wash, by swelling dirt deposits and is considered the only effective method for removing dirt from irregular surfaces without damage to the masonry. Generally, however, much of the steam condenses before hitting the masonry surface, and thus becomes no more effective than a warm water wash. Steam cleaning, however, uses only approximately 10% of the amount of water used for a water wash and thus alleviates some of the problems of staining and indirect damage. Steam cleaning is slower and therefore more costly than other methods and is not recommended for large scale cleaning. It was not tested on the HUD Building.



## CHEMICAL TREATMENTS

Chemical treatments include the application of acidic and/or alkaline chemicals to assist in the cleaning process. These chemicals are applied following the cleaning chemical manufacturer's recommendations. Field testing, to determine how the chemicals will perform is also required before full scale cleaning. Periodic testing of the surface to determine the pH is also performed during cleaning to determine when all of the cleaning chemical has been removed and the surface has been properly rinsed and/or neutralized.

### Acid Cleaners

Hydrofluoric acid (HF) is the only cleaner known to leave no soluble salts in masonry. It is the most commonly used acid cleaner and is applied in a (2-5%) dilute water solution, usually with a surfactant or wetting agent and traces of phosphoric acid to prevent staining. It cleans by dissolving part of the masonry surface and thereby loosening attached dirt. The dissolved material is then washed off.

This method is suitable for flamed finish granite and concrete, although this technique is not generally recommended for use on polished granite. Unlike other methods, cleaning should proceed from the bottom of the building to the top to prevent streaking. Any process utilizing acids carries the risk of damage to surrounding glass, aluminum, vegetation and humans. Spray from cleaning may damage paint and glass on passing automobile traffic. Disposal of the run-off has to be carefully controlled to prevent damage to nearby vegetation. Some cities do not allow drainage of toxic chemicals into the sewer system. Masking of aluminum entrances and storefronts is necessary during this type of cleaning operation.

This treatment was tested on-site for cleaning of the exterior and interior concrete and granite.

### Alkaline Cleaners

The most commonly used alkali solutions are sodium hydroxide (NaOH), potassium hydroxide (KOH) and ammonium hydroxide or ammonia (NH<sub>4</sub>OH). These chemically react with the dirt to liberate it from the stone surface. A dilute (5%) solution is applied with bristle brushes or power spray and then rinsed off with a medium pressure (600-800 psi) or high pressure (800-1200 psi) water wash.

Alkaline cleaners will not react with limestone, marble, brick or mortar as the acidic solutions do. They do, however, tend to form soluble salts which crystallize as efflorescence; this occurs more readily with sodium hydroxide than ammonia. If the surface is rinsed and if no water repellent coating (which might cause spalling as the salts crystallize in the stone) is applied afterwards, the danger can be greatly reduced. However, heavily soiled areas requiring more than two or three applications of the cleaner should be cleaned by another method to avoid damaging the masonry and causing efflorescence to occur. Adding an acidic rinse after the alkaline wash will improve the

performance of the cleaning system and neutralize the surface of the masonry to prevent staining. Alkaline cleaners are mainly used for lightly or moderately soiled masonry. Because of their potential of leaving salts in the masonry, alkaline cleaners alone were not tested on the building. Note that ammonia corrodes bronze and copper.

#### Alkaline Wash and Acid Rinse

A highly effective masonry cleaning method is the combined use of an alkaline wash to loosen the soil and an acid rinse to wash away the dirt and neutralize the alkaline wash. This alkaline solution is stronger than that normally used when using the alkaline wash alone. After the application of a high pressure (800-1200 psi) water rinse, the alkaline wash is applied with a soft bristled nylon brush and allowed to remain on the surface for an hour or more. A high pressure water rinse is again applied so that all soluble staining elements are driven from the pores of the masonry. The acidic rinse is then applied with a brush to neutralize the alkaline surface and then washed off the surface of the building.

This process holds an advantage over using an alkaline cleaner alone because it reduces the chance of soluble salts remaining in the masonry surface after cleaning. Precautions for this procedure are the same as those for the alkaline cleaning. Wood, metal, painted surfaces and polished granite should be protected from the acid rinse. Vegetation, humans and automobile traffic should also be protected from the acid rinse and water overspray. This cleaning method is suitable for testing on the moderately to heavily soiled exterior concrete surfaces of the HUD Building facades.

#### **DETERGENTS**

Detergents may be added to a low pressure water wash to assist the cleaning. The detergents are typically synthetic, water soluble compounds that are mixed with water. The detergents allow the water to surround the soil particles so that the soil may be washed from the surface of the masonry. Scrubbing the surface with a soft brush will often improve the performance of the detergent. Complete rinsing of the masonry surface to remove all of the detergent and soil is necessary to evenly clean the masonry.

Detergents were tested on cleaning the interior masonry surfaces and exterior plaster arcade ceiling.

#### **ABRASIVE TREATMENTS**

In abrasive cleaning, the masonry surface is bombarded with a fine aggregate, which removes the dirt layers mechanically by removing the surface of the masonry. The aggregate may be sand, shells or other particles; they may be applied wet or dry and under a range of pressures. In removing the dirt surface, all conventional abrasive techniques remove part of the masonry as well. This method is not recommended for use on historic buildings and was not tested at the HUD Building.

### **SPECIAL CLEANING PROBLEMS AND TREATMENTS**

**Graffiti and Glue Stains:** The granite on the first floor colonnade has areas where glue remains after the removal of signage. Alkaline chemicals such as lye or caustic soda are effective for dissolving glue from stone but should be used sparingly and should be followed by a neutralizing water wash to avoid build-up of harmful salts. Most paints and similar adhesives can be removed using a methylene chloride stripper. This solvent is highly toxic and slow working but is safe for use on most masonry surfaces.

**Wax Build-up and Staining:** Repeated waxing of the floors has stained the recessed base at the bottom of the concrete walls with wax build-up and covered the bluestone flooring with a thick black layer of wax. Typically floor wax coatings are stripped prior to the next application of wax and can be removed using a standard wax remover. Because the wax coatings are so thick and because they are applied to rough concrete and stone, rather than smooth, less porous tile surfaces, removal may require special solvent or methylene chloride strippers and application procedures.

### **INTERIOR AND EXTERIOR METALS CLEANING METHODS**

Exterior metals of the HUD Building are primarily black anodized aluminum. Metal railings and miscellaneous metals are painted steel which is in poor condition. The metals cleaning only addresses the anodized aluminum because the painted metals are recommended to be repainted. The anodized aluminum window frames of the window wall of the west side of the cafeteria and at the entrance doors are heavily soiled. The soiling detracts from the appearance of the metal work but does not cause the deterioration of the metal. Metal surfaces on the interior of the building are generally painted and in good condition.

Anodized coatings, which are extra-thick oxide coatings produced on the surface of aluminum by electrochemical treatment, are exceptionally resistant to corrosion, discoloration and wear. These coatings will be damaged however, by harsh chemicals, rough conditions, abrasives and neglect. Cleaning the anodized aluminum should employ the gentlest means possible to remove the soiling. Materials and methods not suitable for cleaning anodized aluminum are: harsh abrasives, alkaline cleaners, acidic cleaners, cleaners containing trisodium phosphate, phosphoric acid, hydrochloric acid, hydrofluoric acid or fluorides.

### **ANODIZED ALUMINUM CLEANING TREATMENTS**

#### **Low Pressure Water Wash**

A low (50-100 psi) pressure warm water (80-120 degrees F) wash is sprayed over the aluminum surface which at the same time may be scrubbed with a natural bristle brush to loosen and remove the dirt. This method will be tested on the aluminum frames.

### Detergents

Mild detergents will improve the ability of the warm water wash to remove the soil by "loosening" the dirt so that it may be washed away. The surface should be scrubbed with a soft bristle brush and then thoroughly rinsed to remove all soiling and detergent. This method was tested on the aluminum frames.

### Solvents

Solvents, such as MEK, are effective for removing oils, wax, polishes and coatings. Solvents may also damage the sealants and gaskets in the window frame system. Because of this, solvent cleaning will not be tested on the aluminum window frames.

### Fine Abrasive Pads

Fine abrasive pads are suitable for removing heavy soil from the anodized aluminum frames. The surface of the metal is thoroughly wetted with clean water and then the surface of the metal rubbed with the abrasive pad in the direction of the grain of the finish of the metal. This method will be tested on the aluminum frames.

## **ON-SITE TESTING PROGRAM**

### **PROCEDURES FOR TESTING ALTERNATIVE CLEANING METHODS**

As outlined above, there are a variety of masonry and metals cleaning techniques which can be used on the HUD Building, each with a range of potential effects. It has generally proven very difficult to determine in advance the exact reaction of building materials and soils to cleaning techniques, particularly since some of the most serious problems, such as staining or salt deposits released from inside the masonry, may not become apparent until one or more annual weathering cycles have passed. Therefore, it is recommended that a number of cleaning techniques be tested on-site, with their effectiveness analyzed both immediately after application and at the completion of one annual weathering cycle.

### **EXTERIOR MASONRY CLEANING TEST METHODS**

- (A) Medium pressure warm water wash (500 psi; 4 gpm) with minimum 25 degree fan spray tip for concrete, bluestone, plaster ceiling and granite.
- (B) High pressure warm water wash (1200 psi, 4 gpm) with minimum 25 degree fan spray tip for concrete, bluestone and granite.
- (C) Acid cleaner, Restoration Cleaner (by ProSoCo), to clean bluestone concrete and granite. Prewet area of masonry surface to be tested. Apply Restoration Cleaner (hydrofluoric acid, pH 3.0) undiluted to maintain 4% maximum solution and let

stand 3-5 minutes. Reapply cleaner and rinse treated area from bottom to top with high pressure (1200 psi, 4 gpm) water until sudsing ceases.

- (D) Alkaline cleaner with an acidic rinse, 766 Masonry Prewash with Limestone Restorer Rinse (by ProSoCo) to clean concrete. Prewet area of stone surface to be tested. Apply Prewash undiluted solution with a soft brush and let stand 30 minutes to 1 hour. Rinse treated area from bottom to top with high pressure (1200 psi, 4 gpm) water until sudsing ceases. Immediately apply Limestone Restorer diluted with 2 parts water. Allow restorer to dwell 3-5 minutes and rinse masonry surface with high pressure water wash.
- (E) Graffiti Remover (940 Paint Remover by ProSoCo) to remove glue stains and graffiti from granite. Apply Graffiti Remover solvent liberally with a brush. Let stand several minutes. Reapply and scrub surface with stiff brush. Remove with high pressure water wash. Cold weather may require a longer stand time, up to 30 minutes.
- (F) Ferrous Stain Remover (by ProSoCo) to remove rust stains from concrete. Apply remover in concentrate to the rust stains and allow to dwell fore 3-5 minutes. Reapply concentrate and rinse stain from the concrete surface with medium pressure water.
- (G) Asphalt and Tar Remover (by ProSoCo) to remove stains from granite. Apply the remover to the dry tar stains and allow to dwell 3-5 minutes. Reapply remover and agitate the surface of the tar with a stiff brush. Rinse the surface with a medium pressure water wash to remove all remover and tar.

#### **INTERIOR MASONRY CLEANING TEST METHODS**

The following procedures are recommended for testing on interior concrete for overall cleaning and stain removal. Paint removal from concrete in the cafeteria has been tested and performed (see Chapter X, Architectural Concrete - Paint Removal)

- (H) Detergent cleaning using Trisodium Phosphate to clean interior concrete and plaster ceiling under arcade. Dilute 1/2 cup of detergent in 1 gallon of warm water. Prewet surface of concrete to be cleaned. Apply detergent with a soft brush, scrubbing vigorously. Allow the surface to soak for 3-5 minutes and scrub surface again. Rinse surface with clean water and sponges.
- (I) Acid cleaner, Interior Stone Cleaner (by ProSoCo), to clean concrete and remove wax coating at the recessed base of the wall. Prewet area of masonry surface to be tested. Apply Interior Stone Cleaner (a blend of organic and inorganic acids and wetting agents) undiluted and let stand 3-5 minutes. Reapply cleaner and rinse treated area with water until sudsing ceases.

- (J) Warm Water Wash (90-110 degrees F). Wash the concrete surface with clean warm water and a soft synthetic fiber bristle brush.

#### **ANODIZED ALUMINUM CLEANING TEST METHODS**

- (K) Low Pressure Water Wash (50-100 psi) pressure, (80-120 degrees F). Spray aluminum surface and simultaneously scrub with a natural bristle brush to loosen and remove the dirt.
- (L) Detergents. Following procedures above for low pressure water wash, add a mild dish detergent such as Joy or Ivory Liquid to the surface of the aluminum while scrubbing. Rinse surface to remove all soil and detergent.
- (M) Fine Abrasive Pads for removing heavy soil from the anodized aluminum frames. The surface of the metal is thoroughly wetted with clean water and then the surface of the metal rubbed with the abrasive pad in the direction of the grain of the finish of the metal. Care shall be exercised to remove only the soil build-up and not damage the anodized aluminum finish.

#### **INTERIOR WAX COATING REMOVAL METHODS**

The following procedures are recommended for testing on interior concrete wall base and bluestone flooring to remove the thick wax coating from the flooring and the wax soiling and staining from the recessed concrete base.

- (N) Wax remover, commercially available wax remover to remove wax build-up and staining from bluestone flooring at first floor and recessed concrete base. Apply wax remover and clean following manufacturer's instructions.
- (O) Stripper, 509 Paint Stripper by (by ProSoCo), a strong, solvent based paint stripper to remove wax build-up and staining from bluestone flooring at first floor and recessed concrete base. Apply stripper to dry stone flooring and concrete base and allow to dwell 30 minutes. Do not allow stripper to dry on the surface of the masonry. Agitate the surface with a brush and remove stripper and wax with a water rinse and scrub brush. Reapply stripper as necessary to remove remaining wax and stains and rinse as described above.

### ON-SITE CLEANING LOCATIONS AND TEST METHODOLOGY

On May 4, 1995, masonry and metals cleaning analysis were performed on the exterior surfaces of the HUD Building.

Each cleaning method was tested on accessible areas of the building with the heaviest soiling. The test panels included sections of soiled concrete, soiled plaster ceilings, soiled and stained bluestone paving, soiled and stained granite and soiled anodized aluminum entrance walls. Each test area and the techniques used are noted on elevation sketches and the cleaning process documented photographically. Photographs of the test panels before and after cleaning are included at the end of this chapter and are keyed to the text.

The area for exterior cleaning testing was at the southwest corner of the building (Illus. No. 8-6).

The weather was clear, dry and cool with a steady breeze out of the northeast. Temperatures ranged from 40 to 50 degrees over the 24 hour period immediately before and after the tests. The cleaning chemicals and equipment were supplied and cleaning tests performed by Dave Etchison of Brisk Waterproofing under the supervision of Reed A. Black, AIA of Oehrlein and Associates Architects.

Interior Cleaning Tests were performed on July 19, 1995 by Reed A. Black, AIA of Oehrlein and Associates Architects. Interior concrete cleaning was performed on the walls of the basement level north elevator lobby and in the southwest lobby adjacent to the doors to the Cafeteria.

### CLEANING TEST RESULTS

The Cleaning Test Panels were examined during and immediately after performing the cleaning tests. The exterior panels were examined again on July 19, after they had weathered for several months. This was done to allow time for any adverse side effects of the cleaning to appear. The interior cleaning tests were observed after they had dried on the same day that the interior cleaning had been performed. The letters key the cleaning methods to the photos at the end of the text.

### **EXTERIOR MASONRY CLEANING TEST RESULTS**

- (A) Medium pressure warm water wash (500 psi; 4 gpm) with minimum 25 degree fan spray tip. This cleaning method was not effective in removing the soiling or staining from the concrete (Illus. Nos. 8-8, 8-9), bluestone (Illus. Nos. 8-21, 8-22) or plaster ceiling (Illus. Nos. 8-23, 8-24).
- (B) High pressure warm water wash (1200 psi, 4 gpm) with minimum 25 degree fan spray tip. This cleaning method did not remove the staining and soiling from the concrete (Illus. Nos. 8-4, 8-5, 8-8, 8-9, 8-10 and 8-11). The High Pressure Water

wash was also not effective in cleaning the bluestone paving (Illus. Nos. 8-21, 8-22) and only slightly effective in removing the soil from the granite wall panels (Illus. Nos. 8-17, 8-18).

- (C) Acid cleaner, Restoration Cleaner (by ProSoCo) was applied to the masonry walls in three different dilutions: 1:1, 1:2 and 1:3 water to acidic cleaner. None of the acidic cleaners were very effective in cleaning the concrete (Illus. Nos. 8-2, 8-3, 8-8 and 8-9). The acidic cleaner was very effective in removing the oil and soiling from the exterior bluestone paving (Illus. Nos. 8-21 and 8-22). The 1:3 acidic cleaner was very effective in removing the typical soiling and generally cleaning the granite wall panels (Illus. Nos. 8-17, 8-18). The acidic cleaner did not remove the black scuff marks, tape stains or graffiti from the granite. It did remove the mortar stains from the wall after the thick mortar droppings had been scraped off. The acidic wash was also effective in cleaning the exterior plaster ceiling (Illus. Nos. 8-23, 8-24).
- (D) Alkaline cleaner with an acidic rinse, 766 Masonry Prewash with Limestone Restorer Rinse (by ProSoCo), to clean concrete. This cleaning method was very effective in removing the very heavy soiling, staining and general soiling from the concrete. (Illus. Nos. 8-4, 8-5, 8-8, 8-9, 8-11 and 8-12). The cold temperatures probably reduced the effectiveness of the alkaline cleaner and the wind caused the cleaner to quickly dry on the surface of the concrete. This resulted in the formation of a white film residue on the surface of the concrete due to the salts from the alkaline cleaner being absorbed into the concrete. This film took several months to weather away. Warmer temperatures and working out of the sun and wind will allow the cleaner to work more quickly and prevent it from drying into the surface of the concrete. The cleaned concrete surface is noticeably cleaner and whiter than the adjacent soiled concrete.
- (E) Graffiti Remover (940 Paint Remover by ProSoCo) was effective in removing the glue stains and marker graffiti from the granite. The remover worked in one application with a dwell time of 20 minutes. The remover did not stain or discolor the surface of the stone but it did leave the shadow of the tape marks (Illus. Nos. 8-17, 8-19, 8-20). An additional application of the Remover may be necessary to remove all of the tape, but, because the surface was wet and would have prevented the Remover from working, the Remover was not reapplied.
- (F) Ferrous Stain Remover (by ProSoCo) was not effective in removing the rust stains (Illus. Nos. 8-14, 8-15). While the concrete surface was wet it appeared that the stain remover had removed some of the rust stains caused by the corroding steel reinforcing supports. The use of the stain remover in combination with a poultice may be necessary to remove the rust stains.
- (G) Asphalt and Tar Remover (by ProSoCo) was not effective in removing the tape stains or graffiti (Illus. Nos. 8-17, 8-19, 8-20).



**INTERIOR MASONRY CLEANING TEST METHODS**

The following procedures were tested on interior concrete and exterior plaster ceiling of the arcade for overall cleaning and stain removal. Paint removal from concrete in the cafeteria was previously tested and performed (see Chapter X, Architectural Concrete - Paint Removal).

- (H) Detergent cleaning using Trisodium Phosphate (TSP) cleaner on the interior concrete left the surface uniformly clean. The surface of the concrete was rinsed several times to remove the white residue of the TSP cleaner (Illus. Nos. 8-29, 8-30). The plaster ceiling of the arcade was also cleaned removing most of the soiling and leaving the plaster surface a slightly grey (Illus. Nos. 8-23, 8-24).
- (I) Acid cleaner, Interior Stone Cleaner (by ProSoCo), was as effective as the (H) Detergent in cleaning the interior concrete. It removed the staining at the outside corner of the concrete but had no effect on the wax build-up at the recessed concrete base (Illus. Nos. 8-29, 8-30).
- (J) Warm Water Wash had almost no effect on the cleaning of the interior concrete walls (Illus. Nos. 8-29, 8-30).

**ANODIZED ALUMINUM CLEANING TEST METHODS**

- (K) Low Pressure Water Wash (50-100 psi) pressure, (80-120 degrees F.) removed the surface dust but did not remove heavy soiling or staining (Illus. Nos. 8-25, 8-26).
- (L) Ivory Liquid Detergent, in combination with a low pressure water wash and scrubbing with a soft brush, removed all of the soiling and staining without damage to the aluminum frame or glass (Illus. Nos. 8-25, 8-26).
- (M) Fine Abrasive Pads were not tested on the aluminum because the detergents removed the heavy soiling and staining. Abrasives can damage or alter the surface of the anodized aluminum and were not tested to prevent damage to the finish.

**INTERIOR WAX COATING REMOVAL METHODS**

The following procedures were testing on interior concrete wall base and bluestone flooring to remove the thick wax coating from the flooring and the wax soiling and staining from the recessed concrete base.

- (N) Wax Remover was applied to the concrete base and allowed to dwell for 5 minutes and then the surface scraped to remove the loose wax. It took 5 applications of the Wax Remover following this procedure to remove the wax from the concrete base and the base was still slightly stained (Illus. Nos. 8-29, 8-30). The Wax

Remover was applied to the bluestone flooring and allowed to dwell for 30 minutes. The surface was scraped and the Remover reapplied. Only a few coats of wax were removed with each of the two applications (Illus. Nos. 8-27, 8-28).

- (O) Stripper, 509 Paint Stripper (by ProSoCo), was very effective in removing the thick wax build-up from the bluestone flooring (Illus. Nos. 8-27, 8-28) and wax staining from the recessed concrete base (Illus. Nos. 8-29, 8-30). Removal of the wax staining at the recessed concrete base took two applications of the Stripper. The bluestone flooring took three applications of the stripper with a dwell time of 30 minutes each. The first two applications of the stripper removed the majority of the wax. The surface of the stone was scraped and rinsed between each Stripper application to remove the thick gooey wax and stripper. The third application of the stripper was applied to the joints and recesses in the surface of the stone where the wax had collected and was the thickest. The cleaned bluestone was restored to its original natural color and surface texture without staining or bleaching.

### **RECOMMENDATIONS**

The following recommendations are based on the results of the cleaning tests, possible adverse effects of the cleaning methods to the building materials or its occupants, and whether the amount of soiling or staining justifies the expense of cleaning. The cleaning tests only serve to evaluate suitability of a particular chemical or product in removing a specific soiling or staining from a particular building material. Therefore, this is not a wholesale endorsement of the specific materials used. Testing cleaning materials and methodology is always required prior to building cleaning as what performs well in one area of the building may not perform well on a different type of soiling in another location of the building.

- ◆ **Precast Concrete Wall Panels:** The precast concrete wall panels on the exterior of the building on the second through tenth floors are generally lightly soiled with streaks of heavy soiling in isolated areas of the building. The overall appearance of the panels is good. Therefore, the expense of cleaning the entire exterior of the building at this time is not justified. Spot cleaning to remove the heavy streaking would result in brightly cleaned areas that will be much cleaner than the overall building, resulting in an uneven appearance.
- ◆ **Precast Concrete Screen Walls, Streaking at the Concrete Pilotis and the Heavy Soiling at the Concrete Penthouse Walls:** The precast concrete screen walls under the building are heavily soiled. This heavy soiling, along with the streaking at the concrete pilotis and the heavy soiling at the concrete penthouse walls, gives the building its dirty appearance. The heavily soiled concrete walls at the first floor and penthouse should be cleaned with alkaline cleaner and an acidic rinse (see Chapter X, Outline Specification for Exterior Masonry Cleaning).

- ◆ Exterior Bluestone Paving: The bluestone paving is stained with oil and grease which may be tracked into the building to soil the floors and which if not removed may permanently stain the stone. The exterior bluestone paving should be cleaned with acidic wash to remove all staining and soiling (see Chapter X, Outline Specification for Exterior Masonry Cleaning).
- ◆ Granite Walls: The granite walls at the corners of the building are generally clean. The granite walls on the exterior first floor of the building are soiled and stained. Exterior granite walls at the first floor should be cleaned with acidic wash, mortar stains remaining from the repaving of the bluestone paving scraped off, graffiti removed, and black scuff marks and tape stains removed with graffiti removers and paint strippers (see Chapter X, Outline Specification for Exterior Masonry Cleaning).
- ◆ Plaster Ceiling: The plaster ceiling of the arcade on the exterior of the building is heavily soiled. If it is cleaned it will improve the appearance at the ground level of the building and will increase the amount of light reflected into the interior of the first floor making the lobbies and cafeteria brighter. The exterior arcade plaster ceiling should be cleaned with a detergent, scrub brush and medium pressure water wash (see Chapter X, Outline Specification for Exterior Masonry Cleaning).
- ◆ Bluestone Flooring: The thick coating of dark wax applied to the lobby floors alters the original appearance of the lobbies, makes the lobbies darker, makes the floors slick, requires additional maintenance with the constant application of wax, and requires the installation of carpet runners to prevent slipping and protect the wax finish. The wax build-up should be removed from the bluestone flooring using a chemical stripper (see Chapter X, Outline Specification for Bluestone Paving: Cleaning and Finishing).
- ◆ Interior Concrete: The interior concrete walls are typically lightly soiled with staining where building occupants touch the walls and heavy wax build-up in the recessed base at the bottom of the walls. This soiling darkens the walls and gives the interior of the building a dirty appearance. The soiled walls will look noticeably dirtier when the doors and trim are painted their original off-white color. The interior concrete walls should be cleaned using low pressure water and TSP Detergent. The wax build-up and staining at the recessed base should be removed using a chemical stripper (see Chapter X, Outline Specification for Exterior Masonry Cleaning).

**EXHIBIT 8-A: TYPICAL CONDITIONS AND CAUSES OF DETERIORATION OF MASONRY AND METAL ELEMENTS**

<u>MATERIAL/SURFACE TREATMENT</u>	<u>LOCATION ON BUILDING</u>	<u>ATTACHMENT SYSTEMS</u>	<u>GENERAL CONDITION AND APPEARANCE</u>	<u>TYPES/LOCATIONS OF DIRT/SOILING</u>	<u>CAUSES OF SOILING AND STAINING</u>	<u>RECOMMENDATIONS</u>
BLUESTONE: New York State with natural cleft surfaces and sawn edges.	Exterior: Paving at the plaza on the north side of the building and paving under the arcade under the north, elevations	1" thick pavers laid on a mortar bed and pointed with grey mortar.	Poor: pavers are cracked, broken, loose and missing. Pavers have been replaed with red and purple pavers not matching the originals.	Tar on pavers  Oil and exhaust stains	Asphalt waterproofing oozing out from under paving at banner.  Stains caused by cars parking on paving.	Remove tar stains from paving  Remove oil stains from paving
	Interior: Flooring at first floor north and south entrance lobbies	1" thick pavers laid on a mortar bed and pointed with grey mortar	Interior flooring is in very good condition.	All of the flooring has a thick coat of wax	Failure to remove previous coatings and soil before rewaxing floor	Remove thick wax and apply clear penetrating matte finished sealer and waxed finish
572 GRANITE: Cherry Hill with a thermal finish (date stone on east elevation has a polished finish)	Exterior: Walls of first floor and stair towers at corners of the building	3" thick panels at stair towers, 2" thick panels at first floor, stainless steel disk anchors secured in dovetail slots, joints are pointed with grey mortar. Soffit pieces at stairs are secured with exposed cap nuts.	Good, minor joint deterioration. Several panels at tops of the stair towers are dislocated.	First floor walls are streaked and lightly soiled.	Walls appear to be unevenly cleaned.	Clean granite walls evenly and remove stains and soiling
				Adhesive and glue stains at first floor walls	Signage removal	Clean granite walls
				Marker stains  Exhaust stains and scuff marks	Graffiti  Stains from automobile parking adjacent to wall.	Clean granite walls  Install wheel blocks which are compatible with existing materials and building design

<u>MATERIAL/SURFACE TREATMENT</u>	<u>LOCATION ON BUILDING</u>	<u>ATTACHMENT SYSTEMS</u>	<u>GENERAL CONDITION AND APPEARANCE</u>	<u>TYPES/LOCATIONS OF DIRT/SOILING</u>	<u>CAUSES OF SOILING &amp; STAINING</u>	<u>RECOMMENDATIONS</u>
<p>CONCRETE: Cast-in-place with board form, smooth form and bush hammered finish.</p> <p>Precast with smooth finish.</p>	<p>Exterior: Precast concrete wall panels at floors 2-10, light standards, stanchions, screen walls; cast-in-place at first floor pilotis, sign banner, retaining walls, miscellaneous walls at plaza, penthouse walls.</p>	<p>Precast wall panels are attached to the building structure via steel anchors embedded into the back sides of the panels. Cast-in-place units are reinforced with steel supported on metal chairs.</p>	<p>Good, although the surfaces are deteriorating due to corrosion of embedded metal and spalling of concrete surface. Surfaces are typically lightly soiled with localized areas of heavy soiling and staining.</p>	<p>Rust stains at light standards and retaining walls</p>	<p>Corroding steel sign attachments and standards, corroding railings and retaining walls</p>	<p>Remove steel bands and rust stains from light standards and concrete</p>
				<p>Rust stains at pilotis and walls</p>	<p>Corroding steel reinforcing</p>	<p>Remove rust stains and patch spalled concrete</p>
				<p>Moderate soiling at recessed surfaces of concrete</p>	<p>Atmospheric pollutants that collect on concrete surfaces and are not washed off by rain</p>	<p>Clean concrete to restore appearance and reduce potential for permanent staining</p>
				<p>Heavy soiling of concrete wall at first floor</p>	<p>Soil from car exhaust</p>	<p>Clean concrete to restore appearance and reduce potential for staining</p>
	<p>Interior: Cast-in-place walls at first floor lobbies and elevator lobbies, floors 2-10 elevator lobbies, stairwells, concrete columns at cafeteria.</p>	<p>N/A</p>	<p>Interior exposed concrete is in good condition.</p>	<p>Light soiling typical on all interior concrete surfaces</p>	<p>Accumulation of airborne dirt on concrete</p>	<p>Clean interior concrete walls evenly and remove stains and soiling</p>
<p>Heavy soiling at elevator call buttons</p>				<p>Soiling from people touching stone when pushing buttons</p>	<p>Clean interior concrete walls evenly to remove soiling</p>	
<p>Glue stains at elevators</p>				<p>Removed signage</p>	<p>Clean interior concrete walls evenly to remove stains</p>	
<p>Rust stains at drinking fountain</p>				<p>Leaking plumbing</p>	<p>Clean interior concrete walls evenly to remove stains</p>	
<p>Painted concrete columns in cafeteria and soffits above elevator doors</p>				<p>Interior redecoration</p>	<p>Remove paint from painted concrete</p>	

<u>MATERIAL/SURFACE SURFACE</u>	<u>LOCATION ON BUILDING</u>	<u>ATTACHMENT SYSTEMS</u>	<u>GENERAL CONDITION AND APPEARANCE</u>	<u>TYPES/LOCATIONS OF DIRT/SOILING</u>	<u>CAUSES OF SOILING &amp; STAINING</u>	<u>RECOMMENDATIONS</u>
METAL: Painted wrought iron railing, galvanized steel grates	Exterior: Guard rail at west side of building, grates at vents and light pits, enclosures at stairs, fences at bicycle storage.	Metal work is typically attached to adjacent masonry with screws and expansion anchors	Guard rails are corroding and are in poor condition	Paint finishes are failing on railings and grates	Paint finishes are failing due to age of the coating	Clean, prime and paint metal to match original color
	Interior: Stair handrails, door frames, toilet partitions, fan coil cabinet louvers	Varies	Good	Enclosures and fences are typically soiled	Soiling is due to the collection of airborne dust and dirt on the metals.	Remove and discard non-original fences and enclosures
ALUMINUM: Mill finish	Penthouse louvers, cast aluminum "Great Seals" at entrance lobby	Screws	Good	Heavy soiling on louvers	Collection of airborne dirt and dust on louvers	Clean louvers to remove dirt and dust
ALUMINUM: Black anodized	Window frames and storefronts at first floor lobbies and cafeteria, lobby display case frames	Screws	Good	Heavy soiling on frames in cafeteria	Collection of airborne dirt and dust on louvers	Clean aluminum to remove dirt and dust
BRONZE	Bumper guards at bottom of banner	Screws	Good			
STAINLESS STEEL	Banner letters and stair railing	Varies	Good	Railing is soiled	Lack of maintenance	Clean stainless steel railing

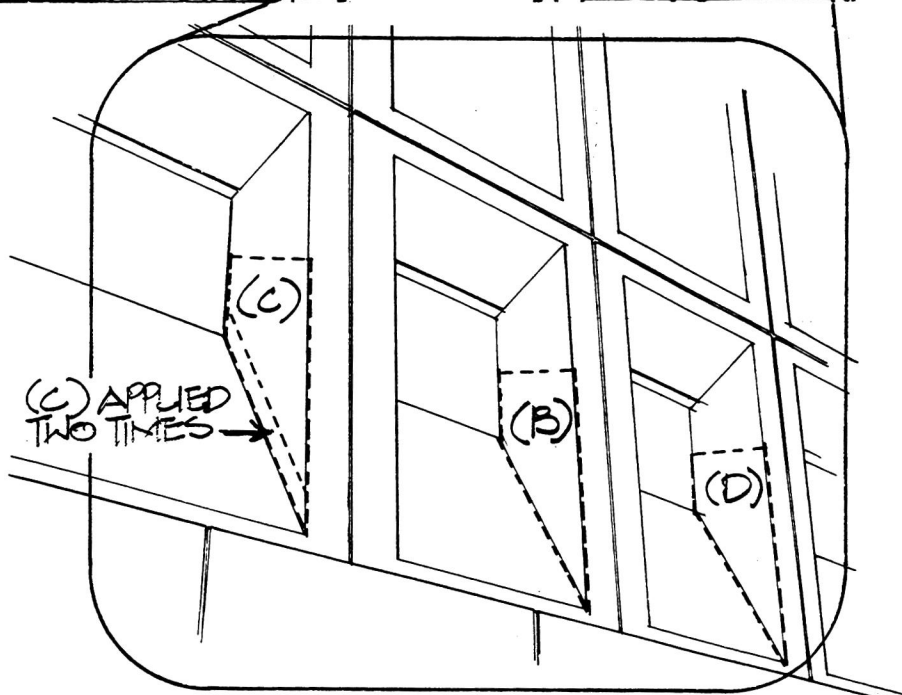
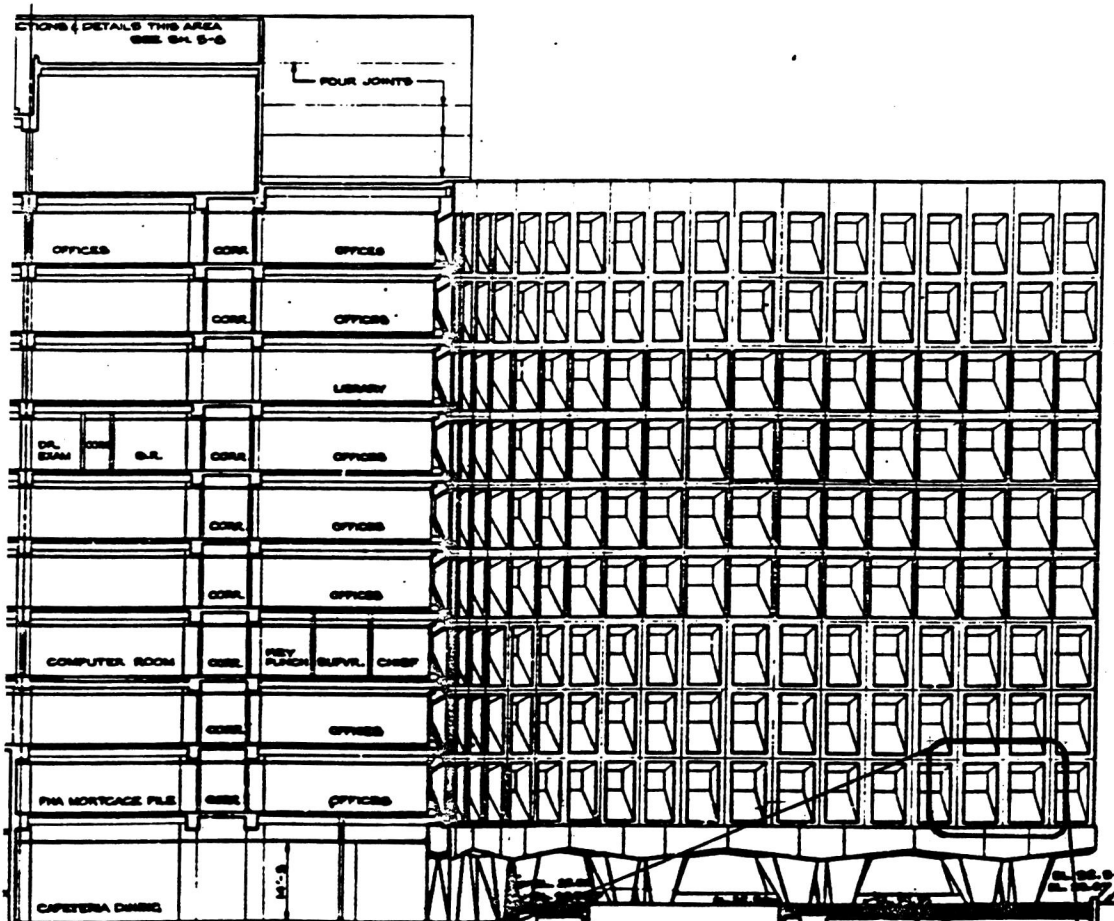


Illustration No. 8-1

Housing and Urban Development Building, south end of west elevation (section through building looking south). Exterior precast concrete wall panel cleaning test location sketch showing: (B) High Pressure Water wash (C) Acidic Wash diluted 3:1 with water and (D) Alkaline Cleaner with an Acidic Rinse. Acidic wash was applied two times on bottom portion of panel.

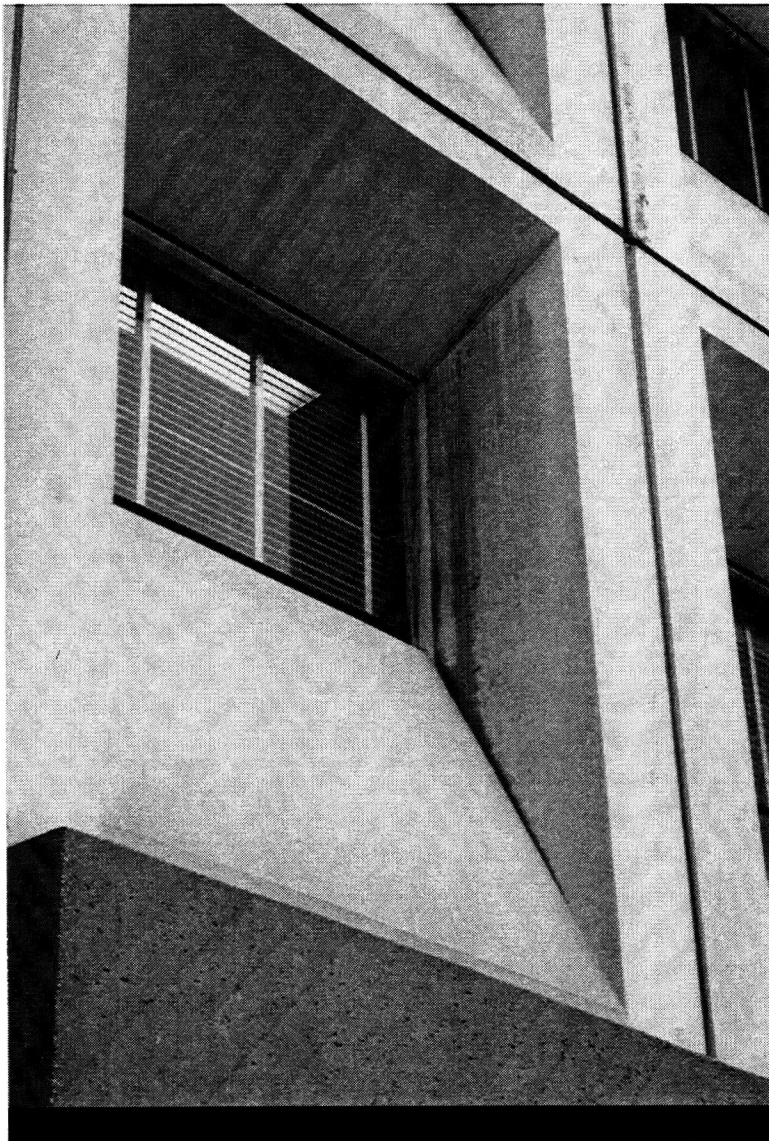


Illustration No. 8-2

Subject: Housing and Urban Development Building, south end of west elevation at second floor

Date: May 4, 1995

Description: "Before" photograph of (C) Acidic Wash cleaning test. Testing was performed on bottom half of right side of the splayed concrete panel. See Illus. No. 8-1.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



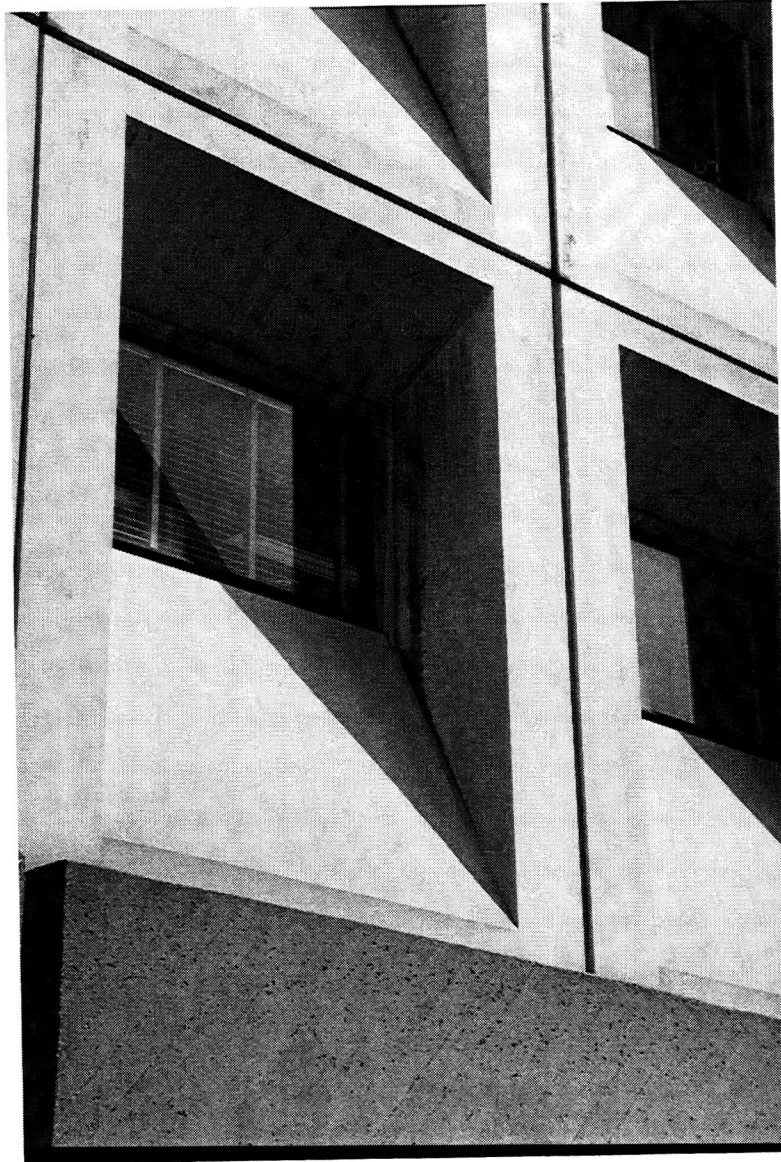


Illustration No. 8-3

Subject: Housing and Urban Development Building, south end of west elevation at second floor

Date: July 19, 1995

Description: "After" photograph of (C) Acidic wash cleaning test. Testing was performed on bottom half of right side of the splayed concrete panel. The acidic cleaner did not clean the concrete any better than the high pressure water. The acidic cleaner was applied two times to the heavy soiling at the bottom 8 inches of the panel and still did not lighten or remove this soil.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

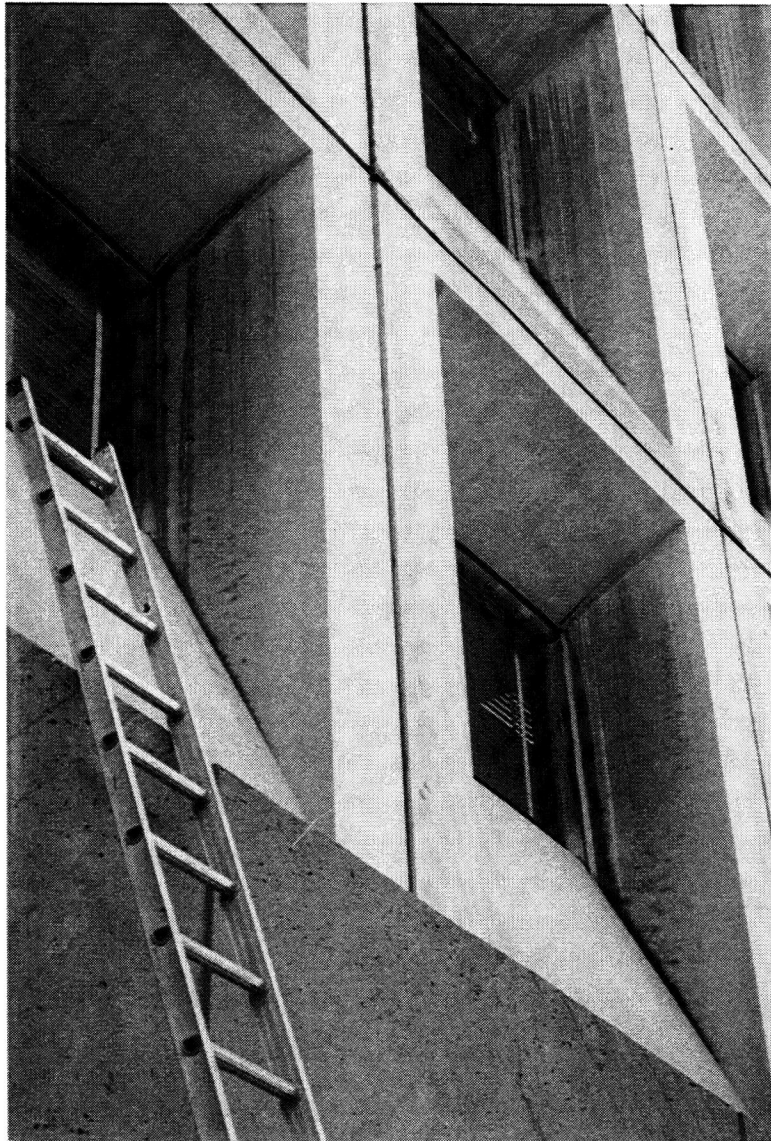


Illustration No. 8-4

Subject: Housing and Urban Development Building, south end of west elevation at second floor

Date: May 4, 1995

Description: "Before" photograph of (B) High Pressure Water Wash and (D) Alkaline Cleaner with an Acidic Rinse cleaning test. High pressure water wash was performed on bottom half of right side of the splayed concrete panel on left side of photograph. Alkaline cleaner with an acidic rinse was performed on bottom half of right side of splayed concrete panel on right side of photograph. See Illus. No. 8-1.

Photographer: Reed A. Black AIA

Source: Oehrlein & Associates Architects

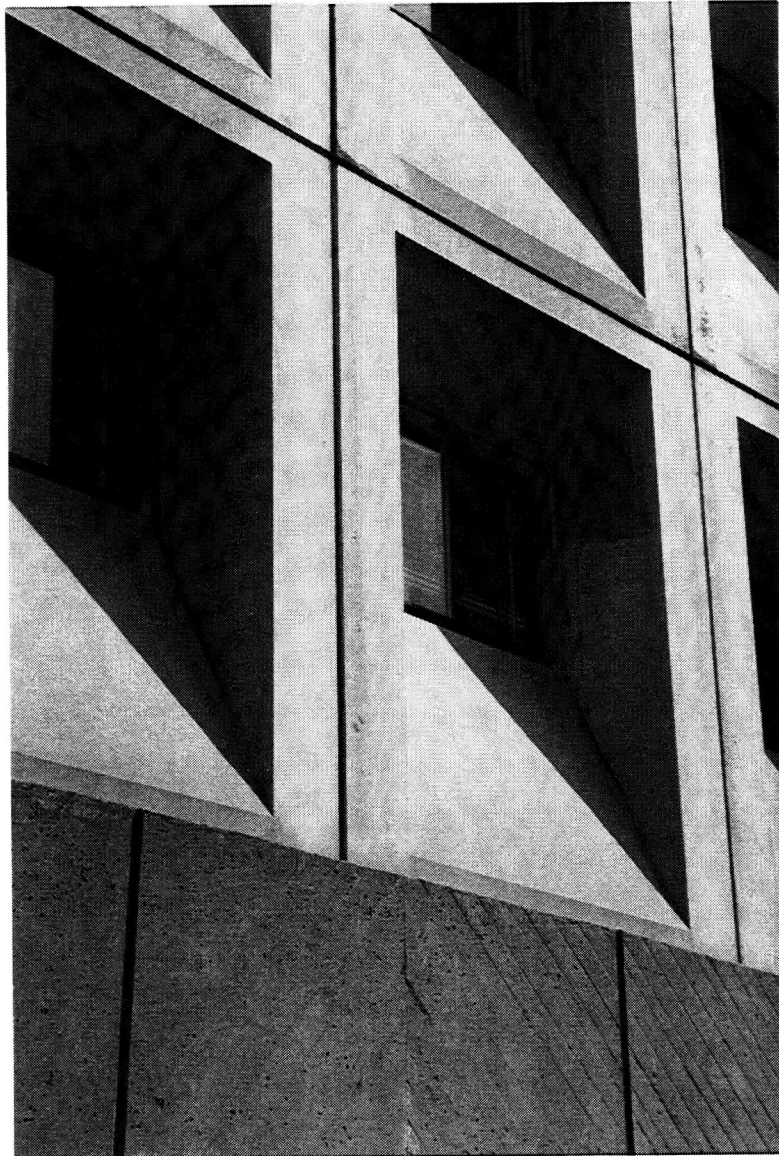


Illustration No. 8-5

Subject: Housing and Urban Development Building, south end of west elevation at second floor

Date: July 19, 1995

Description: "After" photograph of (B) High Pressure Water wash and (D) Alkaline Cleaner with an Acidic Rinse cleaning test. High pressure water wash, performed on bottom half of right side of the splayed concrete panel on left side of photograph, remove the surface soiling but did not remove staining and did not clean the surface evenly. Alkaline cleaner, performed on bottom half of right side of splayed concrete panel on right side of photograph, removed the soiling and most of the staining from the concrete

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

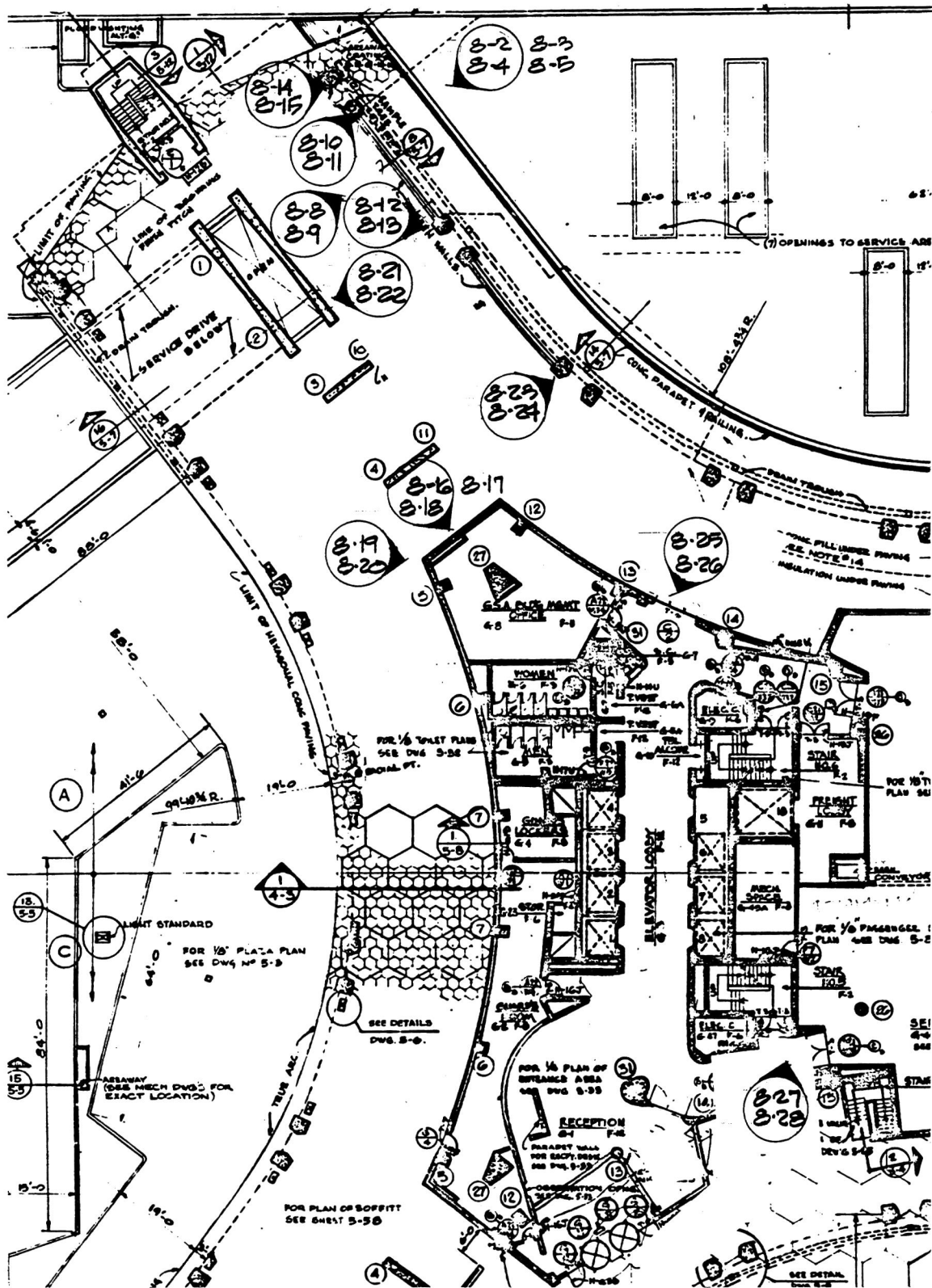


Illustration No. 8-6

Subject: Housing and Urban Development Building, First floor plan at southwest corner of building showing first floor interior and exterior cleaning test photograph locations. Numbers indicate photograph number and arrows indicate direction in which photograph was taken.

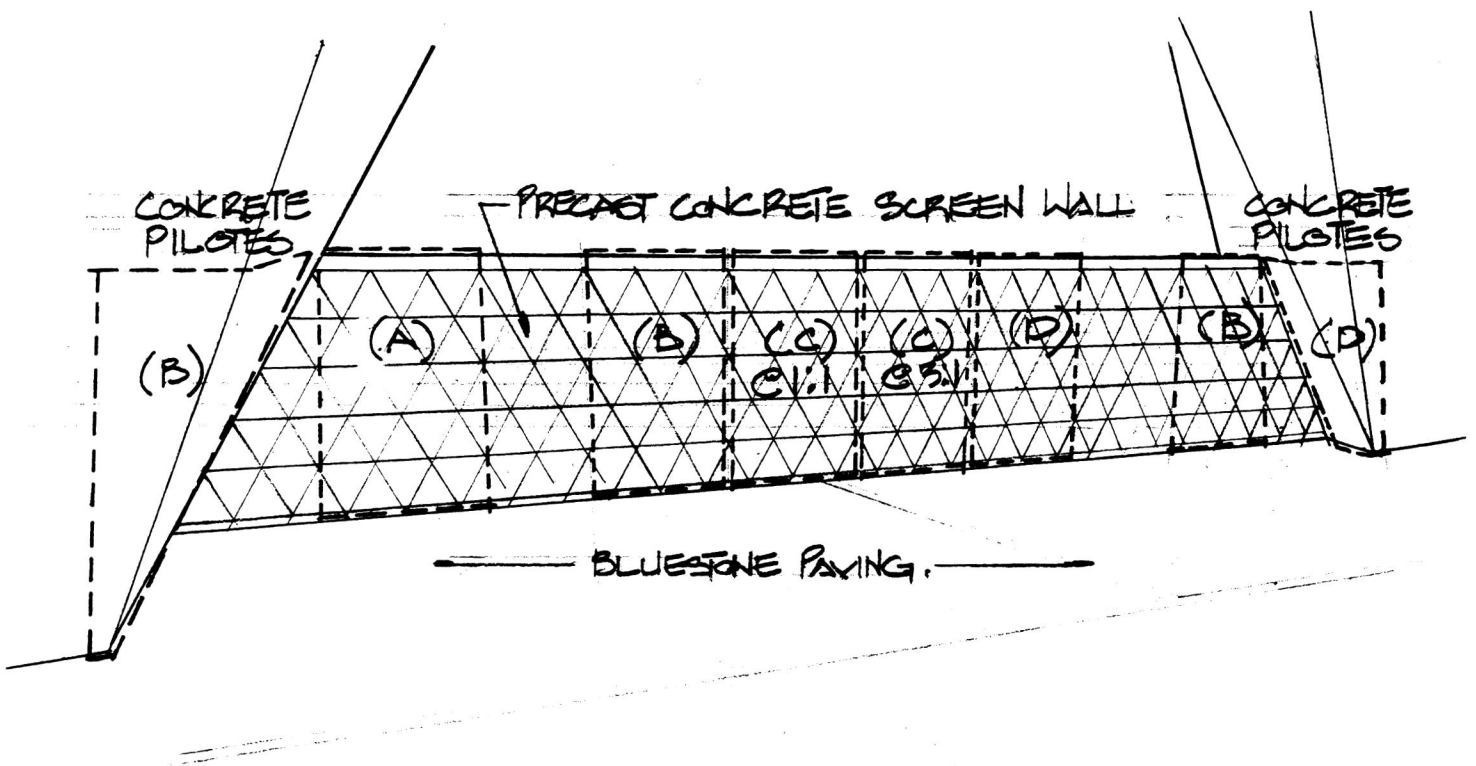


Illustration No. 8-7

Subject: Housing and Urban Development Building. Sketch of precast concrete screen wall and cast in place concrete pilotes showing cleaning test locations for (A) Medium Pressure Water, (B) High Pressure Water, (C) Acidic Wash diluted 1:1 & 3:1 with water and (D) Alkaline Wash. See Illus. No. 8-6 for wall location.

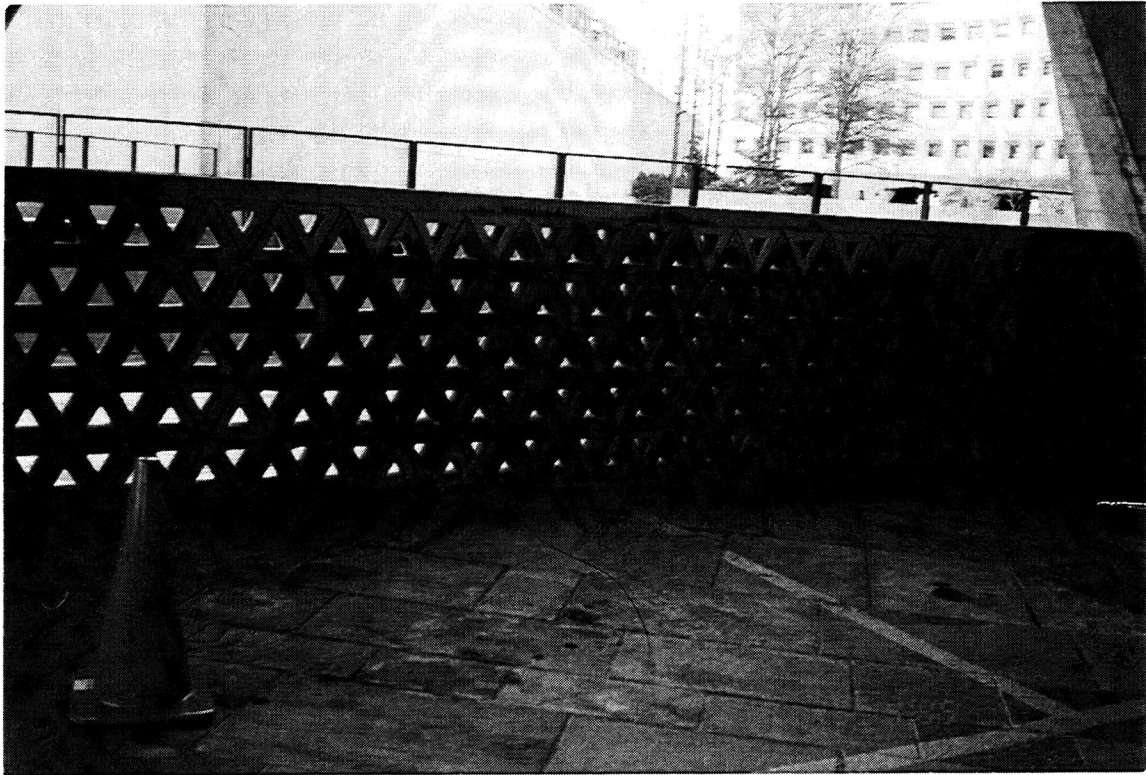


Illustration No. 8-8

Subject: Housing and Urban Development Building, precast concrete screen wall at first floor, southwest corner of building.

Date: May 4, 1995

Description: "Before" photograph of precast concrete screen walls before test cleaning (A) Medium Pressure Water, (B) High Pressure Water, (C) Acidic Wash and (D) Alkaline Wash. See Illus. No. 8-6 for location of wall and Illus. No. 8-7 for test cleaning sketch.

Photographer: Reed A. Black AIA

Source: Oehrlein & Associates Architects

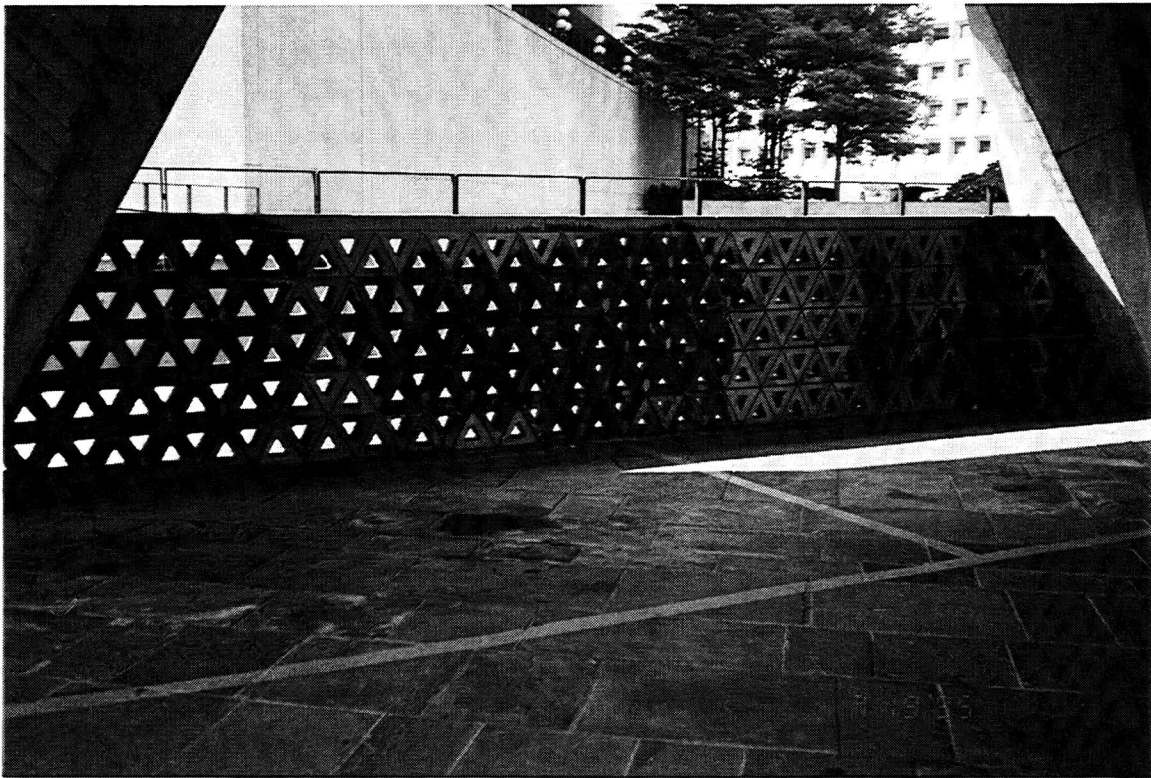


Illustration No. 8-9

Subject: Housing and Urban Development Building, precast concrete screen wall at first floor, southwest corner of building

Date: May 4, 1995

Description: "After" photograph of test cleaning precast concrete screen walls. (A) Medium Pressure Water and (B) High Pressure Water washes had no noticeable effect on the soiling. The (C) Acidic Wash also did not remove the heavy soiling. The (D) Alkaline Wash removed all of the heavy soiling leaving only slight traces of soil stains, greatly improving the appearance of the wall. See Illus. No. 8-6 for location of wall and Illus. No. 8-7 for test cleaning sketch.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

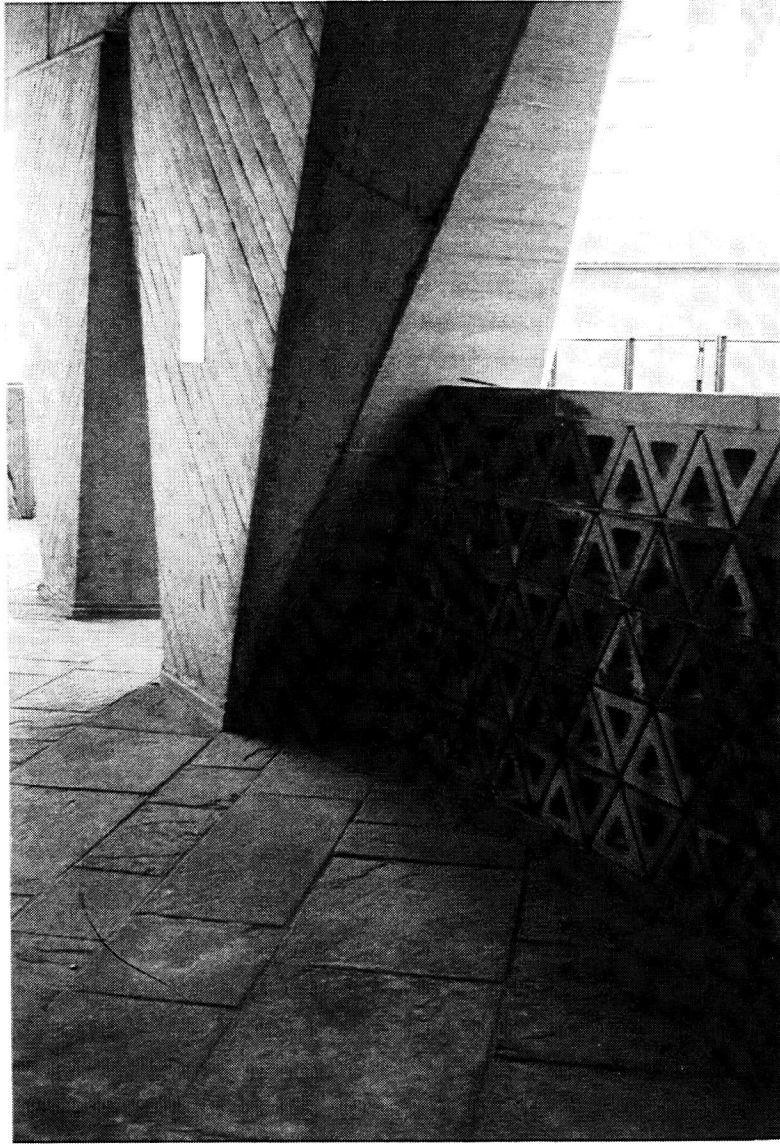


Illustration No. 8-10

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building

Date: May 4, 1995

Description: "Before" photograph of cast-in-place concrete pilotis before test cleaning (B) High Pressure Water Wash. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



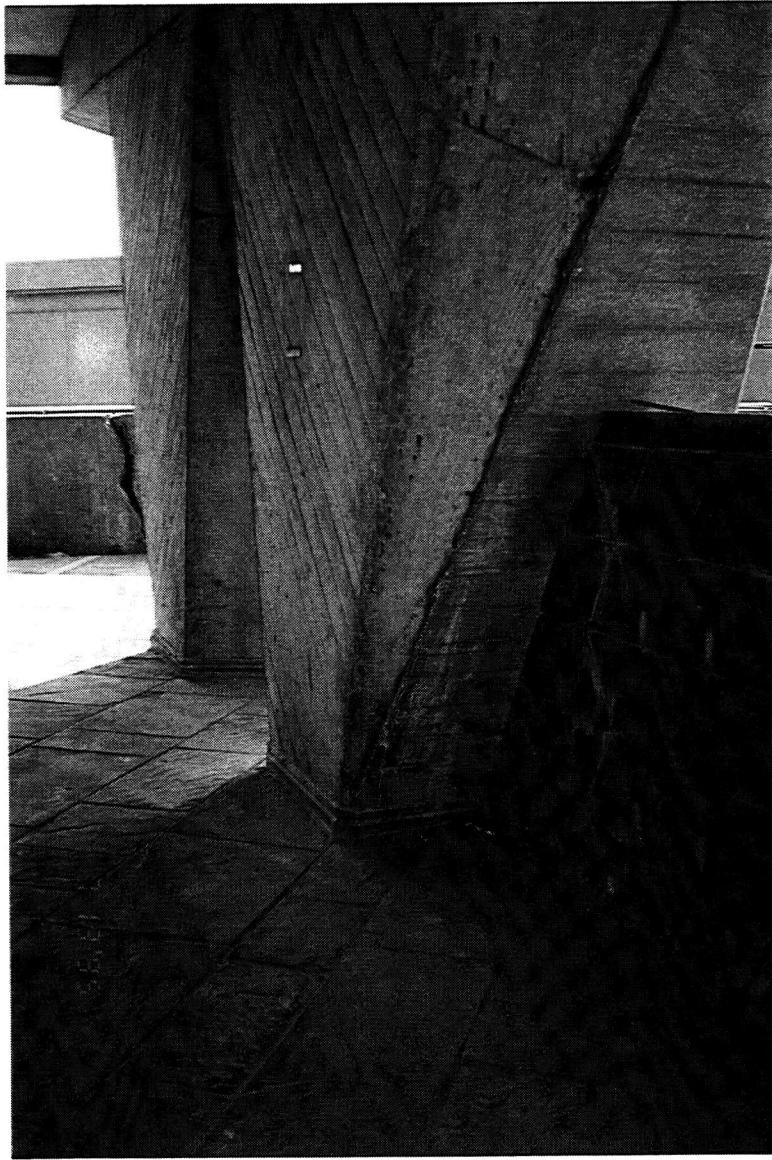


Illustration No. 8-11

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building

Date: July 19, 1995

Description: "After" photograph of cast-in-place concrete pilotis (B) High Pressure Water Wash test cleaning. High Pressure water did not remove any of the soiling or staining. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

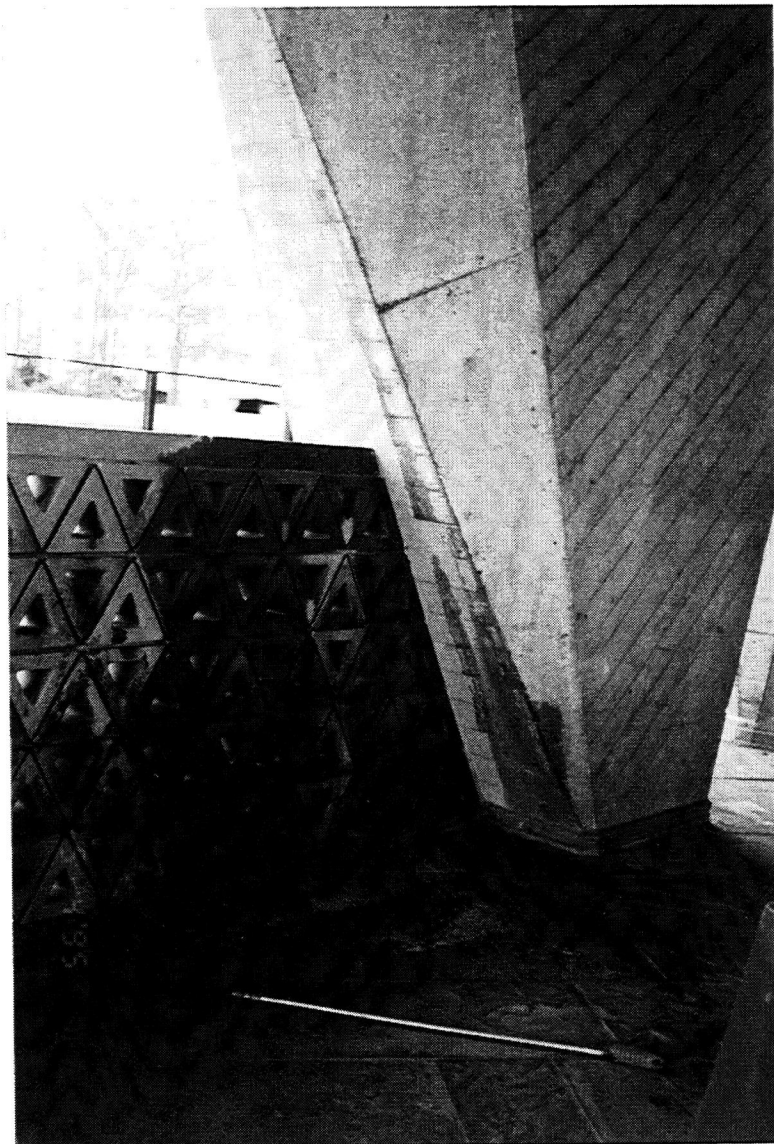


Illustration No. 8-12

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building

Date: May 4, 1995

Description: "Before" photograph of cast-in-place concrete pilotis before test cleaning with (D) Alkaline Wash and Acidic Rinse. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-13

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building

Date: July 19, 1995

Description: "After" photograph of cast-in-place concrete pilotis at test cleaning with (D) Alkaline Wash and Acidic Rinse. This method removed all of the heavy soil streaking and light soiling on the surface from the face of the concrete, leaving the surface clean. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-14

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building

Date: May 4, 1995

Description: "Before" photograph of cast-in-place concrete pilotis prior to test cleaning with (F) Ferrous Stain Remover. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-15

Subject: Housing and Urban Development Building, cast-in-place concrete pilotis at first floor, southwest corner of building.

Date: July 19, 1995

Description: "After" photograph of cast-in-place concrete pilotis at location of test cleaning with (F) Ferrous Stain Remover. While the surface was wet it appeared that the stain remover had removed some of the rust stains caused by the corroding steel reinforcing supports. After the surface dried the stains reappeared. The Ferrous Stain Remover had no effect on the stains. See Illus. No. 8-6 for location of pilotis.

Photographer: Reed A. Black AIA

Source: Oehrlein & Associates Architects

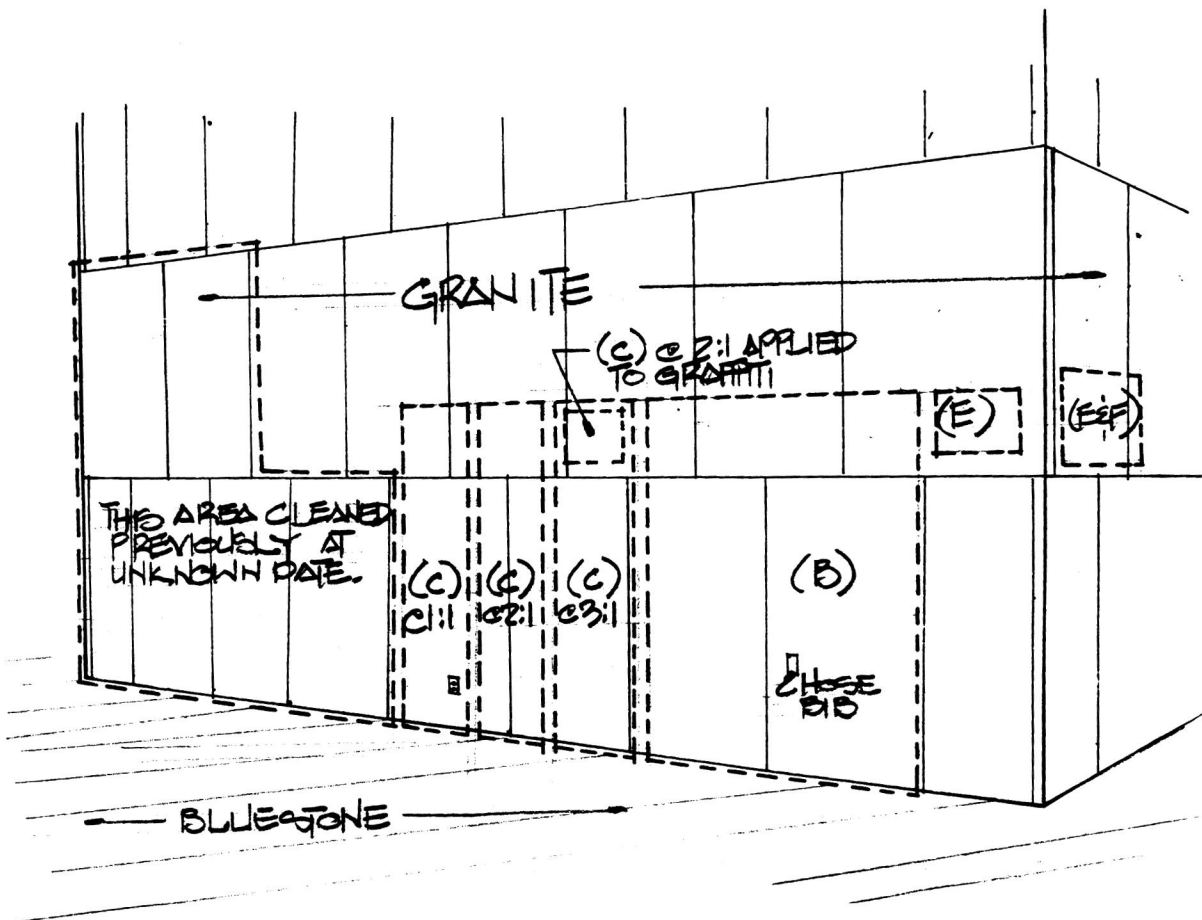


Illustration No. 8-16

Subject: Housing and Urban Development Building. Sketch of granite wall at southwest corner of first floor showing cleaning test locations for (B) High Pressure Water Wash, (C) Acidic Cleaners diluted 1:1, 2:1 & 3:1 with water, (E) Graffiti Remover, and (F) Asphalt and Tar Remover. See Illus. No. 8-6 for wall location. See Illus. Nos. 8-17, 8-18, 8-19 and 8-20 for "before" and "after" photographs of cleaning tests.

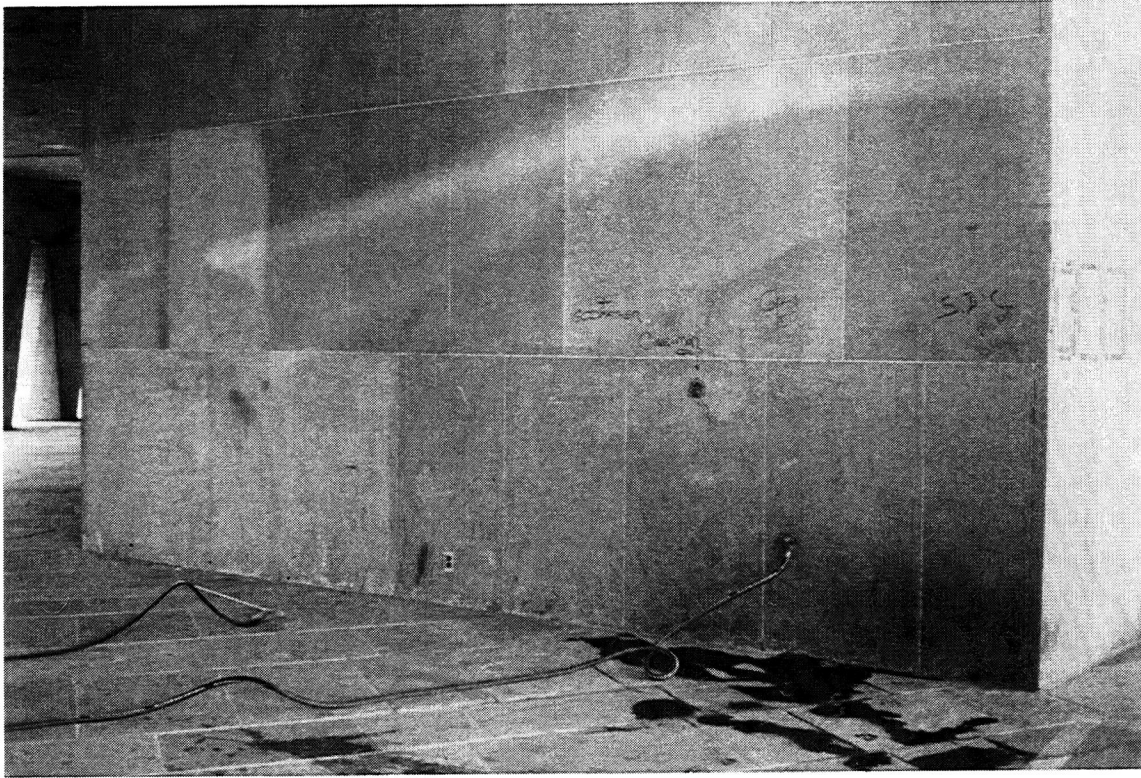


Illustration No. 8-17

Subject: Housing and Urban Development Building, granite wall at southwest corner of first floor.

Date: May 4, 1995

Description: "Before" photograph of granite wall prior to test cleaning with (B) High Pressure Water Wash, (C) Acidic Cleaners and (E) Graffiti Remover and (F) Asphalt and Tar Remover. See Illus. No. 8-6 for location of granite wall and Illus. No. 8-16 for detail sketch of cleaning test locations.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

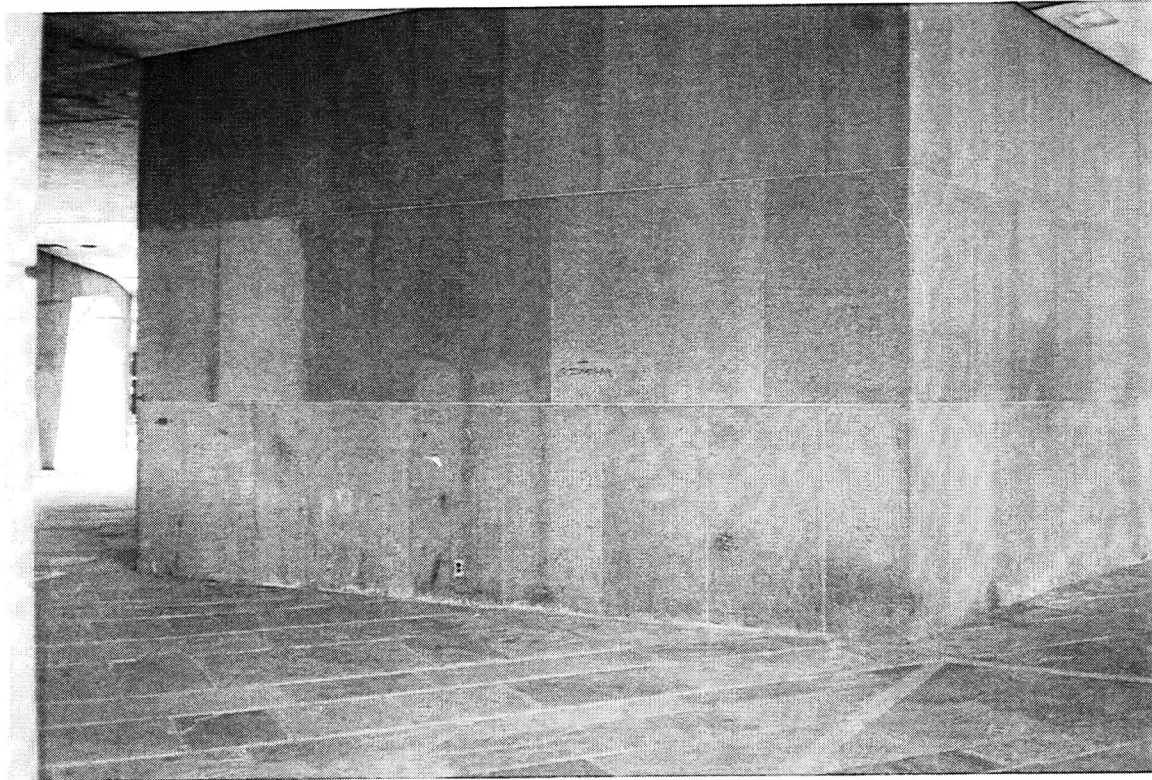


Illustration No. 8-18

Subject: Housing and Urban Development Building, granite wall at southwest corner of first floor

Date: July 19, 1995

Description: "After" photograph of granite wall test cleaning. (B) High Pressure Water Wash cleaned the granite surface to about the same level as the acidic cleaner diluted with three parts water. The (C) Acidic Cleaner diluted with only one part water was most effective in removing the general soiling, however, the graffiti and black scuff marks at the bottom of the wall were not removed. See Illus. No. 8-6 for location of granite wall and Illus. No. 8-16 for detail sketch of cleaning test locations.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



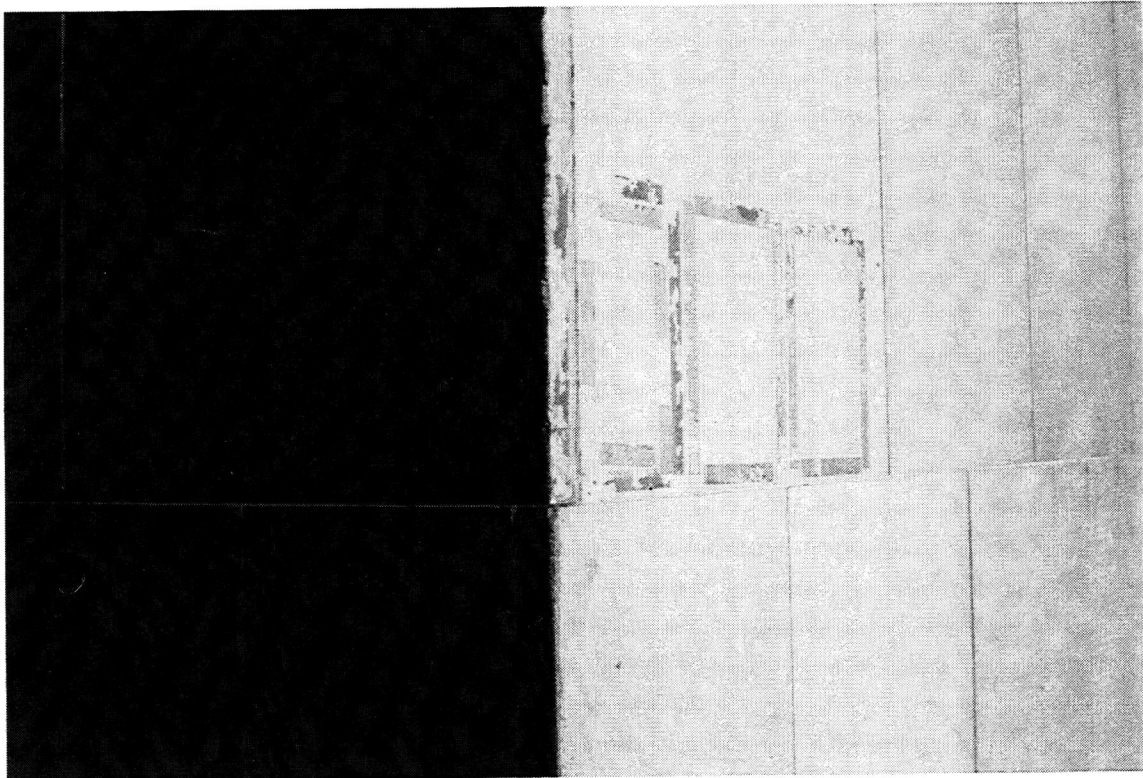


Illustration No. 8-19

Subject: Housing and Urban Development Building, graffiti and stains on granite wall at southwest corner of first floor

Date: May 4, 1995

Description: "Before" photograph of corner of granite wall showing tape stains from removed signage and black "magic marker" prior to test (E) Graffiti Remover and (F) Asphalt and Tar Remover stain removal. See Illus. No. 8-6 for location of Granite wall and Illus. No. 8-16 for detail sketch of test stain removal locations.

Photographer: Reed A. Black AIA

Source: Oehrlein & Associates Architects

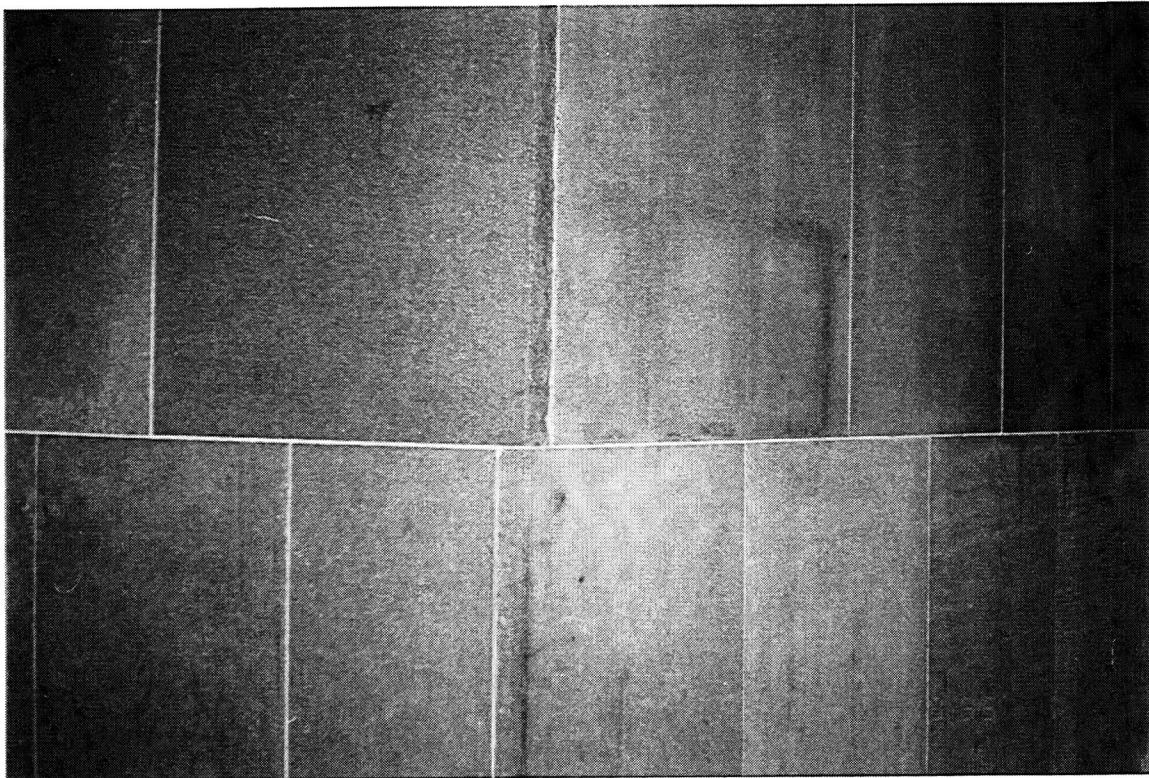


Illustration No. 8-20

Subject: Housing and Urban Development Building, graffiti and stains on granite wall at southwest corner of first floor

Date: July 19, 1995

Description: "After" photograph of corner of granite wall at stain removal locations, showing tape stains from removed signage and black "magic marker" prior to test stain removal. (G) Asphalt and Tar Remover did not remove the tape or the graffiti stains. The (E) Graffiti Remover did remove the marker and tape stains. See Illus. No. 8-6 for location of granite wall and Illus. No. 8-16 for detail sketch of test stain removal locations.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-21

Subject: Housing and Urban Development Building, bluestone paving with oil and grease stains at southwest corner of first floor.

Date: May 4, 1995

Description: "Before" photograph of bluestone paving at parking space showing oil and grease stains prior to test cleaning with (A) Medium and (B) High Pressure Water Wash and (C) Acidic Wash. See Illus. No. 8-6 for location of bluestone paving.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-22

Subject: Housing and Urban Development Building, bluestone paving with oil and grease stains at southwest corner of first floor

Date: July 19, 1995

Description: "After" photograph of bluestone paving at parking space. (C) Acidic Wash was tested on the center third of the parking space and removed almost all of the soil and oil stains. (A) Medium and (B) High Pressure Water Wash was used on the outside thirds of the parking space and were not effective in cleaning. Additional oil stains have been deposited since the cleaning tests were performed. See Illus. No. 8-6 for location of bluestone paving.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-23

Subject: Housing and Urban Development Building, soiled plaster ceiling at southwest corner of first floor

Date: May 4, 1995

Description: "Before" photograph of sand finished plaster ceiling prior to cleaning tests with (H) Detergent, (C) Acidic Wash. and (A) Medium Pressure Water wash. See Illus. No. 8-6 for location of plaster ceiling.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-24

Subject: Housing and Urban Development Building, soiled plaster ceiling at southwest corner of first floor.

Date: July 19, 1995

Description: "After" photograph of sand finished plaster ceiling. Test cleaned area in center of photograph was cleaned with (H) Detergent. The clean area to the left of the photograph was test cleaned with an (C) Acidic Wash. Both cleaners performed well. The (A) Medium Pressure Water wash tested on the right side of the photograph did not remove any soiling. See Illus. No. 8-6 for location of plaster ceiling.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-25

Subject: Housing and Urban Development Building, soiled anodized aluminum entrance doors and frames at south end of west elevation

Date: May 4, 1995

Description: "Before" photograph of black anodized aluminum entrance doors and frames prior to test cleaning with (K) Low Pressure Water and (L) Detergents. See Illus. No. 8-6 for location of entrance doors.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-26

Subject: Housing and Urban Development Building, soiled anodized aluminum entrance doors and frames at south end of west elevation

Date: July 19, 1995

Description: "After" photograph of black anodized aluminum entrance doors and frames. (K) Low Pressure Water used on the center door and frame removed little soiling and no staining. (L) Detergents worked well and removed all soiling and almost all staining. (M) Abrasive pads were not tested to prevent damage to the metal finish. See Illus. No. 8-6 for location of entrance doors.

Photographer: Reed A. Black, AIA

Source: Ohrlein & Associates Architects





Illustration No. 8-27

Subject: Housing and Urban Development Building, first floor bluestone flooring in South Lobby adjacent to Cafeteria doors

Date: July 19, 1995

Description: "Before" photograph of bluestone flooring prior to testing (N) Wax Remover and (O) Stripper to remove multiple wax coating from floor and concrete base. See Illus. No. 8-6 for location of bluestone flooring test cleaning.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

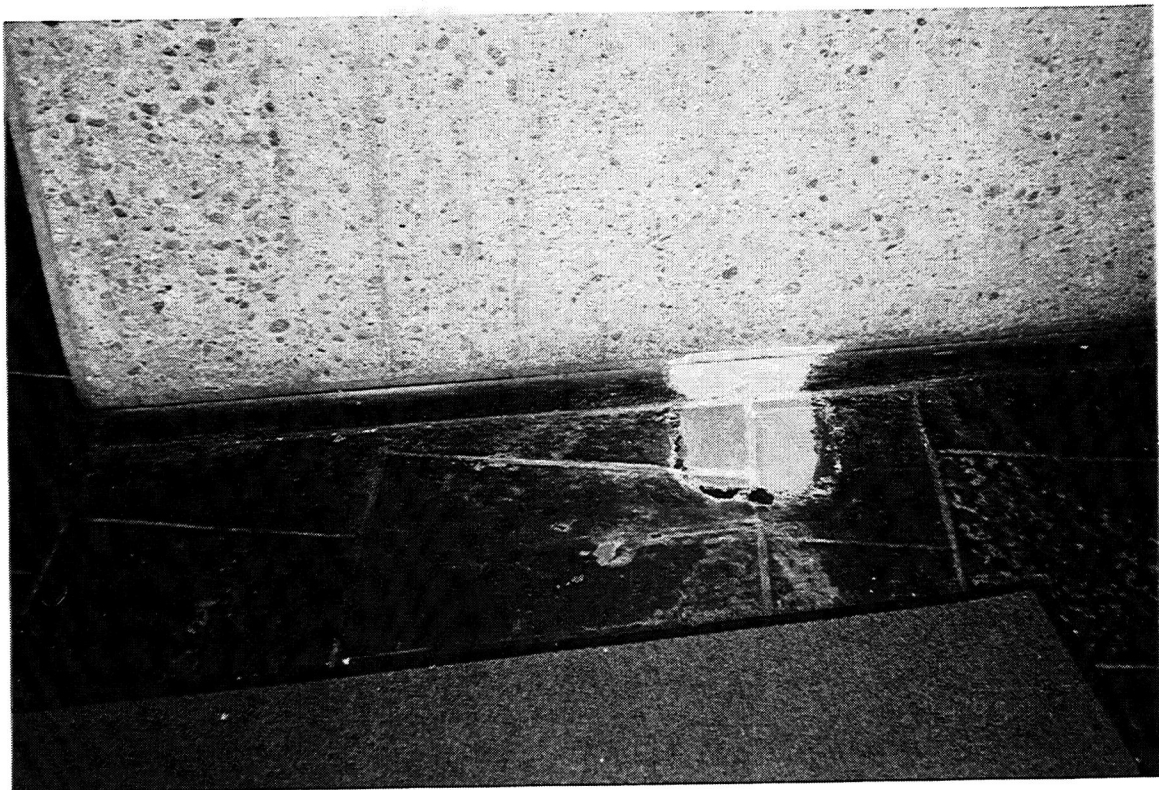


Illustration No. 8-28

Subject: Housing and Urban Development Building, first floor bluestone flooring in South Lobby adjacent to Cafeteria doors

Date: July 19, 1995

Description: "After" photograph of bluestone flooring and concrete base. (N) Wax Remover was applied two times to floor and base in left side of photograph and only removed several thin layers of wax. (O) Stripper was applied three times to the bluestone flooring and concrete base and removed all of the wax build-up (note cleaned area). See Illus. No. 8-6 for location of bluestone flooring test cleaning.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-29

Subject: Housing and Urban Development Building, basement floor, north core adjacent to service elevator door showing soiled concrete

Date: July 19, 1995

Description: "Before" photograph of recessed concrete base soiled with multiple layers of floor wax and concrete wall with general soiling prior to testing. (I) Interior Stone Cleaner, (J) Warm Water and (H) Detergent was tested on the soiled concrete and (N) Wax Remover and (O) Stripper was tested to remove floor wax build-up from the concrete base. See Illus. No. 8-31 for sketch of location of each cleaning tests.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects



Illustration No. 8-30

Subject: Housing and Urban Development Building, basement floor, north core adjacent to service elevator door showing soiled concrete at bottom of wall.

Date: July 19, 1995

Description: "After" photograph of interior concrete cleaning tests. The (I) Interior Stone Cleaner and (H) Detergent performed equally well in removing the general soiling from the concrete. The (N) Wax Remover was very slow and required numerous applications while the (O) Stripper removed the wax build-up from the concrete base in only two applications. See Illus. No. 8-31 for sketch of location of cleaning tests.

Photographer: Reed A. Black, AIA

Source: Oehrlein & Associates Architects

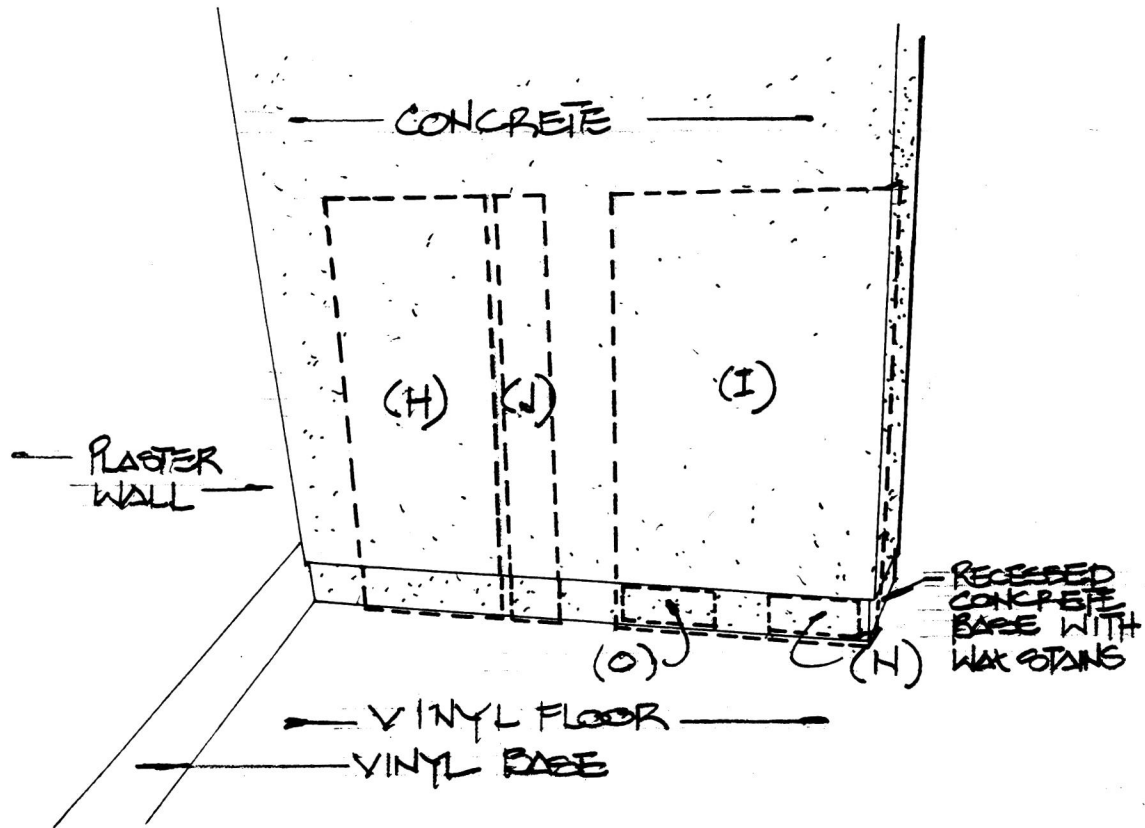


Illustration No. 8-31

Housing and Urban Development Building, sketch showing the location of each cleaning test application on the concrete wall and base at the basement floor, north core adjacent to service elevator door. Cleaning tests included: (I) Interior Stone Cleaner, (J) Warm Water and (H) Detergent, (N) Wax Remover and (O) Stripper. See Illus. Nos. 8-29 and 8-30 for "before" and "after" photographs.