Washington State University

COMPREHENSIVE TRANSPORTATION PLAN

Appendix E

Parking Facility Maintainence Manual

Prepared for

WASHINGTON STATE UNIVERSITY

Prepared by

Kimley»Horn

Appendix E: Recommended Maintenance Procedures

1. RECOMMENDED MAINTENANCE PROCEDURES

The recommended maintenance procedures listed in this appendix are based on direct Kimley-Horn and Associates, Inc. experience and the recommendations presented in the National Parking Association (NPA) Parking Garage Maintenance Manual. For ease of reference, the procedures have been divided into categories and are presented in the same order as used in the NPA Parking Garage Maintenance Manual.

1.1. Cleaning

Maintaining a clean facility is important because it affects the overall appearance of the structure, promotes a good reputation and increases the user's perception of safety. Likewise, poor housekeeping invites disregard for proper waste disposal and may indicate an increased tolerance for vandalism or abuse of the facility. It is our experience that the increased user satisfaction and facility reputation often offset the costs of keeping the facility clean. Generally, the membrane waterproofing, sealant, and expansion joint warranties require that the structure be maintained in a clean, safe and serviceable condition. As a result, we recommend that the maintenance program should include the following housekeeping and preventative maintenance items

1.1.1. Housekeeping Items

1.1.1.1 Sweep weekly all parking floor areas

One of the most frequently overlooked aspects of parking garage maintenance is proper floor cleaning. If not removed, debris will eventually end up in the floor drains and drain lines and cause slow or blocked drainage.

Sweeping can be done either with hand brooms or sweeping machines designed for parking garage floor slabs. All sweeping equipment must first be reviewed "in action" to identify any sharp or rigid components which might contact the traffic bearing membrane or expansion joints and cause damage. Sweeping machines should also be reviewed for weight to be sure that it is less than the design live loads. Sweeping machines should be checked regularly to confirm that they are not causing damage.

1.1.1.2 Sweep or mop elevator lobbies, attendant booths, entrance and exit lanes, and elevators daily. Stairs should be cleaned daily and more frequently if they are heavily used.

Stair and elevator lobbies are highly visible areas and will experience high volumes of patron foot traffic. These areas should be maintained in a clean and safe condition at all times.

1.1.1.3 Periodically sweep or wash out expansion joints and joint sealants.

Debris and dirt accumulation within expansion joint and/or joint sealant recesses can hasten deterioration of the joint systems.

Stones, glass, and miscellaneous debris trapped against the expansion joint or joint sealant may puncture the gland/sealant during repeated pounding from tires and the continued expansion and contraction of the gland with seasonal structural movement.

1.1.1.4 Windows in attendant booths should be washed daily. Other windows in the stairways, elevator cabs, and elevator shafts should be cleaned once a month to once a quarter, depending on their conditions and accessibility.

1.1.1.5 Stair enclosures, doors, and frames should be cleaned monthly. The elevator floors and walls should be cleaned monthly.

1.1.1.6 Trash receptacles should be emptied daily.

Clearly marked trash receptacles should be placed at areas of pedestrian traffic flow such as the stair and elevator lobbies, etc. The absence of trash receptacles, or poor maintenance and collection of trash will tend to encourage littering.

1.1.1.7 Floor drains should be cleaned out weekly.

Debris can buildup in floor drains and drainpipes causing slow or blocked drainage. Ponding water, which will occur with blocked drains, creates a slip hazard and can affect the durability of the concrete.

1.1.1.8 Grease and oil spots that build up in parking stalls, drive lanes and entry/exit locations should be cleaned at least twice a year. Large spots should be cleaned immediately and other spots should be cleaned as soon as significant “build up” occurs.

1.1.1.9 Signs should be cleaned with a mild detergent semi-annually to maintain appearance and visibility of the signs.

1.1.1.10 Parking control equipment should be cleaned weekly.

1.1.2. Preventative Maintenance Items

1.1.2.1 Semi-annual wash down of the floor slabs and lower vertical surfaces of walls and columns with high volume low-pressure water source such as a fire hose.

Preceded by sweeping, a wash down of the garage will help clean the deck of debris.

Before and after washing floors, all drains should be checked to see that they are functioning properly. Sand washed off floors can clog drains. Temporary burlap filters may be used to prevent sand from entering drains, but must be removed immediately after washing.

A high-pressure, low volume water source (maximum 2,500 psi) may be used to remove spots the fire hose was unable to clean. This high-pressure method should first be reviewed to confirm that the high-pressure water would not cause damage to the traffic bearing membrane, stripes, sealants, expansion joints, or concrete, etc.

After several months of vehicular traffic, the traffic striping will become less visible due to an accumulation of dirt and debris. Cleaning during the wash down should help to "brighten" the striping.

- More frequent (monthly) washing should be considered at high traffic areas and at any areas where slower drainage is observed.
- During winter months washing can be performed whenever moderate temperatures occur.
- The underside of each level should be reviewed during each wash down to identify any leaking through the slab system.
- Leak locations should be identified on plans and sealants repaired as necessary as soon as possible.

1.1.3. Doors and Hardware

1.1.3.1 Lubricate all doors. Lubrication of doors and related hardware should be performed according to manufacturer's recommendations or at least semi-annually.

- **Frequency:** 6 months
- **Procedure:** According to Manufacturer's recommendations
- **Supplies:** Lubricant and rags

1.1.3.2 Check operation of all doors. All door hardware should be reviewed to assure proper operation. When a malfunction is noted, it should be corrected immediately to maintain the safety and security of the garage.

- **Frequency:** 6 months
- **Procedure:** According to Manufacturer's recommendations
- **Supplies:** Flashlight

1.1.3.3 Checks doors for signs of corrosion. Proper cleaning and painting of the doors is important to maintain an attractive entrance to the facility. Inspections should be scheduled to review all doors and hardware for signs of corrosion and damage.

1.1.3.4 Other preventative maintenance includes painting, which is addressed in Section 1.1.7.

- **Frequency:** 6 months
- **Procedure:** According to Manufacturer's recommendations

- **Supplies:** Flashlight, wire brushes, rags, and paint supplies

1.1.4. Electrical Systems

1.1.4.1 Inspect lights for proper operation. A properly illuminated facility promotes safer travel within the facility and provides a more secure feeling among its users. Daily inspection of luminaries (complete lighting unit), lamps, lenses, emergency lights, ballasts, electrical conduit, light fixture attachment to structure, distribution panels, time controls, etc. should be scheduled to ensure adequate illumination within the facility at all times. Defective luminaries should be repaired or replaced immediately. A properly illuminated facility promotes safer travel within the facility and tends to instill a more secure feeling among users.

- **Frequency:** Weekly
- **Procedure:** According to Manufacturer's recommendations
- **Supplies:** Ladder

1.1.4.2 Clean and replace lights. Uniformity of lighting is a very important safety concern in parking structures. Scheduled cleaning of lights including lenses and replacement of lamps should be set up to maximize the uniformity of the lighting systems. Lamps should be replaced in groups at the end of their average rated life (refer to lamp cut sheets and local lamp supplier for average rated life). Lamp manufacturer studies indicate that energy costs may be reduced if lamps are replaced in groups before they burnout.

Illumination reduction also occurs due to dirt and dust that accumulates both inside and outside of the light fixture. Annual cleaning of light fixtures is recommended in order to maintain adequate luminance. Replacement of the acrylic lenses may be necessary if "yellowing" of the plastic is reducing the light output.

- **Frequency:** Every 12 months
- **Procedure:** According to Manufacturer's recommendations for replacement of lamps
- **Supplies:** Tool kit, ladder, lamps, recommended lens cleaner, and rags

1.1.4.3 Inspect electrical conduits and panel boxes. Electrical conduits and distribution panels should be inspected monthly to determine if they are functioning properly. Any water leaking into the conduit or panel boxes must be noted and remedied promptly. Identify and repair the source of leaking water in such locations as cracks, joints, and floor openings. Weekly re-secure, as necessary, electrical conduit and electrical fixtures for proper mounting. Cleaning and repainting of metal items or replacement and repair to reduce leaking should be performed as needed.

- **Frequency:** Weekly

- **Procedure:** Visually inspect conduits and panel boxes
- **Supplies:** Tool kit, ladder, waterproof sealant, and rags

1.1.5. Elevators (for Parking Structure #3)

1.1.5.1 Check elevators for proper operation

- **Frequency:** Daily
- **Procedure:** Visually inspect conduits and panel boxes
- **Supplies:** Tool kit

1.1.5.2 Perform annual inspection of elevators. Preventative maintenance and good housekeeping is essential for proper operation of elevators and associated equipment. Additionally, most elevator codes and local building codes require periodic safety and maintenance inspections. Since requirements vary with the type of equipment, we recommend that the University verify local requirements and review the service contract provided with the equipment installation. Specific maintenance requirements for each piece of equipment are described in the operation and warranty manuals provided by the equipment supplier. Copies of these should be kept with this manual for ease of reference.

- **Frequency:** Every 12 months
- **Procedure:** Contact installer & have annual inspection performed
- **Supplies:** None

1.1.6. HVAC

HVAC systems in the cashier booth (PS-1) should be inspected monthly. Air conditioner filters should be changed monthly.

Specific maintenance requirements for each piece of equipment are described in the operation and warranty manuals provided by the equipment supplier. Copies of these should be kept with this manual for ease of reference.

1.1.7. Painting

1.1.7.1 Inspect painted surfaces for corrosion damage. Maintenance of painting systems is necessary to preserve the facility appearance as well as protect the underlying metal from corrosion. Painted elements that are operations or safety related should be inspected monthly. Painted steel requiring maintenance and inspection includes hollow metal doors, mechanical lines, bollards, and miscellaneous metal.

- **Frequency:** Monthly

- **Procedure:** These surfaces should be inspected noting paint chipping and corrosion of the underlying metal. Rusting areas should be properly prepared by removing all rust down to bare, near white metal followed by priming and painting. As a minimum, miscellaneous metals requiring painting or touch-up should be painted using a two-coat alkyd enamel system. Application preparation should include removing all dirt, oil, grease and other foreign matter followed by a prime coat and two coats of alkyd enamel paint (i.e. Glid-Guard Silicone-Alkyd Enamel, by Glidden).
- **Supplies:** Paint, brushes, rollers, paint thinner (cleaner), rags, ladder, and wire brushes.

1.1.7.2 Clean and restripe parking stalls. In order to avoid confusion for parking facility users, restriping of parking stalls should be initiated when the existing stripes begin to fade and are difficult to see. What appear to be faded stripes may only be stripes covered with an accumulated film of dirt, oil and grease.

- **Frequency:** Every 12 months
- **Procedure:** Therefore, the maintenance staff should first wash down the striped areas using a mild detergent if necessary, prior to considering the repainting of stripes. This may be adequate to sufficiently brighten the existing stripes. When restriping is required, ”non-chlorinated rubber” paint should be used.

  When painting over existing stripes, the existing paint should be thoroughly cleaned and prepared by removing all de-bonded paint prior to applying new paint. When changing the striping layout the existing stripes should be completely removed. Painting over the existing stripes with gray paint is not recommended because as the gray paint begins to fade the old strips will become visible and create confusion.
- **Supplies:** Paint (as listed below), brushes, rollers, paint thinner (cleaner), rags, ladder, and wire brushes,
  - “Latex Traffic Paint, ” Glidden, Cleveland, OH.
    - No. 22685 Yellow
    - No. 22683 White
    - No. 20090 Blue
  - “Setfast Acrylic Latex Traffic Paint,” Baltimore Paint and Chemical Co., Division of the Sherwin-Williams Company, Baltimore, MD.
    - No. TM225 Yellow
    - No. TM226 White
    - No.TM2133 Blue

1.1.8. Parking Control Equipment

To ensure proper function and minimize equipment down time, inspections and preventative maintenance should be performed on a regular basis. The parking control equipment consists of control software, loop detectors, card readers, mechanical gates, and revenue control equipment. The particulars of the parking control equipment are in the operations manual and maintenance manuals provided by the manufacturer. These operation manuals are provided and should be located near this manual for ease of reference. In addition to any specific recommendation provided by manufacturer, we recommend the following:

- **Procedure:** The control software should be tested every 90 days.
  - The loop detectors should be tested every 90 days to verify that they are functioning properly.
  - The card reader optics should be cleaned once a month with a standard bar code cleaning card.
  - Each gate should be observed on a monthly basis to watch the motion of the gate arms. Any unusual motion should be noted and limit switches adjusted.
  - Any unusual noises should be noted and the parts lubricated with SAE #10 oil. Belts should be checked for tension and tightened to proper tension. In addition, each gate should have preventive maintenance performed by an authorized equipment supplier every 6 months.
  - The system computer should be kept dust free and away from excessive heat and cold.
- **Supplies:** Tool kit, rags, oil

1.1.9. Plumbing Systems

1.1.9.1 Clean and flush drainage system. The plumbing system design consists of floor drains, drain risers, and a dry fire protection standpipe. Floor drains and piping should be inspected monthly to assure proper drainage and the rapid disposal of water. Remove sediment from the piping and flush the drain system thoroughly in conjunction with the semi-annual floor slab wash down. During the wash down procedures, it is recommended that temporary filters, such as burlap, be installed over the drains to minimize debris and sediment collection in the drainage system.

- **Frequency:** Floor drains and piping – monthly
  - Floor slab wash down – every 6 months
- **Procedure:** Floor drains and piping should be inspected monthly to assure proper drainage and the rapid disposal of water. Remove sediment from the piping and flush the drain system thoroughly in conjunction with the semi-annual floor slab wash down. During the wash down procedures, it is recommended that temporary filters, such as burlap, be installed over the drains to minimize debris and sediment collection in the drainage system.

- All piping and fittings should be checked for damage, leaks or corrosion. Damaged components should be immediately repaired or replaced upon discovery. Appropriate action should be initiated to correct or minimize any leaking observed. All corrosion damage should be promptly repaired to arrest the process before a larger scale problem develops.
- Floor drain grates should be replaced as required to minimize the risk of a pedestrian tripping hazard.

- **Supplies:** Hoses, flashlights, bristle push brooms, and burlap bags

1.1.9.2 Inspect and drain standpipe system. The dry fire protection standpipe system should be maintained in a condition to function properly at all times. Pipes, sleeves, and pipe hangers must be kept free of corrosion.

- **Frequency:** **Monthly**
- **Procedure:** Pipes, sleeves, and pipe hangers must be kept free of corrosion. These surfaces should be inspected noting paint chipping and peeling. Areas should be properly prepared by removing loose paint followed by priming and painting. Application preparation should include removing all dirt, oil, grease and other foreign matter.
- **Supplies:** Paint, brushes, rollers, paint thinner (cleaner), rags, ladder, and wire brushes

1.1.9.3 Waterproofing. As indicated in Section 1.1, to maximize the service life of this structure, it is very important to minimize water penetrations into the structure. As a result, the waterproofing components require rigorous monitoring and maintenance. The waterproofing system design consists of traffic bearing membrane (over occupied spaces), penetrating surface sealer, control joint and cove sealants, and expansion joints. These components have a limited life span and will require periodic repair, reapplication and total replacement at the end of their service life. Lack of periodic maintenance may lead to premature deterioration of the concrete and embedded reinforcing steel and will increase future repair and maintenance costs. Water leaking through damaged waterproofing components can also damage vehicle paint finishes, light fixtures and electrical distribution systems, and in general be a nuisance to facility users and maintenance staff.

1.1.9.4 Inspect traffic-bearing membrane (deck coating). The primary function of this membrane is to prevent water leakage through the concrete in these areas.

- **Frequency:** Monthly
- **Procedure:** Monthly inspection of the traffic bearing membrane should be performed, noting cracks, tears, blistering, debonding, and worn or deteriorated areas. Isolated failures may lead to localized water leaking, increased chloride contamination, and a potential increase in subsequent corrosion induced concrete deterioration. Membrane failures associated with or leading to concrete deterioration should be repaired only after any concrete deterioration or

corrosion damage is addressed and repaired. Membrane damage from wear, vandalism, or accidents will generally require only proper recoating. Recoating or reapplication must be performed only by a licensed applicator and the Manufacturer's recommendations for repairs or reapplication must be followed. The traffic bearing waterproofing membrane system is warranted for five years. Damage from vandalism or lack of maintenance will generally not be covered under the warranty. Therefore, it is important to maintain the scheduled cleaning and maintenance program noted in Section 1.1.

- » It is recommended that all repairs be fully documented and recorded in a maintenance log.

- **Supplies:** None required

1.1.9.5 Test penetrating sealer for effectiveness. The penetrating sealer has a limited effective life due to traffic wear, sun exposure, and internal concrete reactions. Generally, the sealer manufacturers recommend reapplication of the sealer every 3 to 7 years, however, we recommend sealer effectiveness testing prior to reapplication to minimize total long-term cost (may be possible to delay reapplication).

- **Frequency:** 3 to 7 years
- **Procedure:** To test for the effectiveness of the penetrating sealer the manufacturer of a testing laboratory should perform the test. If the sealer has lost its effectiveness, a waterproofing contractor should complete another application.
- **Supplies:** None required

1.1.9.6 Inspect and repair joint sealants. Sealants have been installed at concrete construction joints, and horizontal/vertical concrete interfaces (coves).

- **Frequency:** Monthly and every 6 months during wash downs
- **Procedure:** Monthly inspections of the sealants should be performed to visually determine where and if any sealants have failed. Failed/damaged sealants should be repaired and checked with the deck wash down for leaks. If failed sealants are not repaired, then potentially expensive restoration may be required to preserve structural safety. Thus, if leaking is observed, the source of leaking should be identified and resealed as soon as possible. The contractor must replace all failed joints for a period of five years.
- **Supplies:** None required

1.1.9.7 Inspect and repair expansion joints. All expansion joint glands should be inspected monthly for signs of leaking. Failed joint systems and subsequent leaking will cause contamination to the adjacent concrete and underlying cast-in-place members as well as a continuous nuisance to the facility users. Check individual product warranties for limitations. Damage from vandalism or neglect will not be warranted and therefore it is important to adhere to the cleaning and maintenance schedule as described in Section 1.1.

- **Frequency:** Monthly and every 6 months during wash downs
- **Procedure:** Monthly inspections of the expansion joints should be performed to visually determine where and if any expansion joints have failed. Failed/damaged expansion joints should be repaired and checked with the deck wash down for leaks. If failed expansion joints are not repaired, then potentially expensive restoration may be required to preserve structural safety. Thus, if leaking is observed, the source of leaking should be identified and resealed as soon as possible. The contractor must replace all failed joints for a period of five years.
- **Supplies:** None required

1.1.10. Safety Checks

Safety checks include assuring the proper operation of the lighting and illuminated pedestrian exit signs.

1.1.10.1 Inspect walkways, handrails, stairwells, and walking surfaces for hazards. Pedestrian walk paths must be maintained to avoid trip hazards such as loose stair nosings, damaged expansion joints, deteriorated concrete surfaces, or debris. Handrails should also be checked to verify rigidity and ability to withstand handrail loading. Refer to the NPA Maintenance Manual for a discussion on safety checks.

- **Frequency:** Daily
- **Procedure:** Pedestrian walk paths must be maintained to avoid trip hazards such as loose stair nosings, damaged expansion joints, deteriorated concrete surfaces, or debris. Handrails should also be checked to verify rigidity and ability to withstand handrail loading. The loose fittings should be tightened or repaired as necessary. Damaged expansion joints or deteriorated concrete surfaces should be repaired according to the procedures recommended in this section.
- **Supplies:** Tool kit

1.1.11. Security System

Security adds to the overall user perception of security in a structure and represents an additional liability for the owner if they are not functioning properly. Thus, it is critical that these systems are maintained and monitored during all hours of operation. If this cannot be done, it is our opinion that these systems should be removed from the structure. The security systems in this structure include:

- Push for assistance intercoms (all structures).
- Security cameras (PS-6)
- Monitors and VCR’s located in the security office (PS-6).

By having these systems the user assumes that the systems are operational and that there is someone monitoring their actions 24 hours a day. As a result we recommend that the systems be checked daily as part of a walk-through inspection, but no less often than weekly, to determine if the systems are

functioning properly. Equipment should be maintained as described in the literature provided with the equipment.

- **Frequency:** Daily
- **Procedure:** The camera-housing lens should be cleaned off at least once a month to ensure a clear view.
  - The monitors and other camera control equipment should be kept as dust free as possible.
  - Each VCR should be sent in once a year for a complete reconditioning.
  - The tapes used in the VCR's should be rotated daily. New tapes should be purchased quarterly and the old tapes thrown away.
- **Supplies:** Tool kit

1.1.12. Signs (Graphics)

The signs should be reviewed weekly for damage from corrosion or vandalism. Replacement, if necessary, should be performed immediately to avoid possible traffic flow problems. Also, signs placed on the top levels of the facilities (or in other areas facing the sun) should be inspected for sun damage annually.

- **Frequency:** Weekly
- **Procedure:** Signs should be washed periodically with a mild detergent to maintain appearance and visibility of the signs
- **Supplies:** Tool kit, mild detergent, water, rags, ladder, and hoses

1.1.13. Structural Systems

Maintenance of the structural system is one of the most important goals of this maintenance manual. Monthly inspections of the slab system and annual inspection of the beams, columns, walls, etc., are important in order to locate, monitor and record cracking and water leakage observed and allow for immediate repairs that will reduce further deterioration. Maintaining the waterproofing system, including sealants, coatings, expansion joints, etc. (see Section 1.1.9.3) is crucial for reducing deterioration of the structural system.

1.1.13.1 Perform inspections of slabs, beams, columns, and walls and make necessary repairs.

- **Frequency:**
  - Monthly – slabs
  - Every 12 months – beams, columns, and walls
- **Procedure:** Inspect slabs, beams, columns, and walls for cracks, spalls and water leakage. Repair deterioration after review and recommendation by qualified concrete restoration engineer.

- » If, for any reason, concrete repairs are to be made, PRESTRESSING TENDONS ARE UNDER HIGH TENSILE STRESSES AND MAY RELEASE WITH EXPLOSIVE FORCE DURING CONCRETE REMOVAL.

- **Supplies:** Tool kit, flashlights, and ladder

NO drilling or installation of powder driven fasteners in beams or tees should be allowed prior to confirming that this operation will not damage the prestressing tendons or components.

1.1.14. Stair and Elevator Enclosures

The stair enclosures include steel framed stairs and glass curtain wall systems. Semi-annual cleaning of exterior frames and glazing should be performed as needed.

1.1.14.1 Clean outside of stair and elevator enclosures and inspect for leakage.

- **Frequency:** Every 6 months
- **Procedure:** Most dirt may be removed with a moderate pressure water rinse and a brush or sponge. A mild detergent may be added to aid in cleaning the frames. Thoroughly rinse after using any detergent. The handrails are painted steel. Refer to Section 1.1.7 for recommended maintenance of painted surfaces.

  Leakage observed at caulked or gasketed glazing joints or at flashing joints should be repaired immediately. Broken panels should be replaced as soon as possible to maintain a safe passageway and minimize potential water damage to the structure or equipment.
- **Supplies:** Tool kit, ladders, mild detergent, sponges, rags, buckets, and hoses

1.1.15. Masonry

Masonry is a durable construction material that, if properly designed and installed, requires little maintenance. Maintenance that may be required includes cleaning, tuckpointing or preventive measures such as sealing the masonry and/or joints.

1.1.15.1 Clean masonry and inspect masonry for signs of distress and clean.

Masonry should be inspected every six months for signs of distress such as bowing masonry, corrosion stains through mortar joints, failure of sealants, spalled or cracked masonry or excessive efflorescence. If these conditions are observed, the consultation of a masonry design professional is recommended.

- **Frequency:** **Every 6 months**
- **Procedures:**

  <u>Cleaning</u>

  Cleaning of stains on masonry is only necessary to maintain its original color and beauty. Stains may be due to paint, efflorescence, dirt, smoke, mildew, graffiti, etc. The most common cleaning solutions for masonry are the following :

- Proprietary Cleaning solutions - such as “SureKlean” by Prosoco, Inc., Kansas City, KS (913)281-2700 or masonry cleaning products by Diedrich Technologies, Inc., Milwaukee, WI (414)764-0058.
- Detergent Solutions - suggested solution of ½ cup trisodium phosphate and ½ cup laundry detergent in one gallon of clean water.
- Acid Solutions - suggested solution of 10% muriatic acid (9 parts clean water to 1 part acid).

Most masonry stains should be removed with either proprietary cleaning solutions or detergent solutions. These cleaners should be used in strict compliance with manufacturer’s instructions. Acid solutions are not recommended and should only be used for extremely tough stains and on old stained masonry. Acid washing should only be used with a maximum 10% of acid, as overuse of acid will weaken the mortar and discolor masonry units. Acid should never be used on limestone, marble, calcareous sandstone, glazed brick, architectural terra-cotta, polished granite, light colored brick or dark brown or black brick. Caution must be used with acid and proprietary cleaners to prevent damage to adjacent elements, plantings, and injury to personnel.

Methods used for cleaning masonry include bucket and brush hand cleaning and pressurized water (maximum of 700 psi). Sandblasting is not recommended for cleaning any type of masonry as the risk of damaging mortar joints and scarring brick surfaces is too great. When cleaning masonry it is very important to saturate the masonry surface with clean water before and after cleaning. This prevents the cleaning agent from being absorbed into the masonry thus keeping it at the surface where the cleaning is necessary. With all cleaning methods a small trial should be completed to determine the affect on the masonry, i.e. effectiveness, color change etc.

Efflorescence

One of the most common stains on masonry in new construction is efflorescence. Efflorescence is typically white in color and is a deposit of water-soluble salts on the surface of masonry. Water-soluble salts are brought to the surface of masonry in solutions of water and deposited there by evaporation. The salts come from soluble salts in masonry units, in mortar or from penetration by rain or groundwater. Efflorescence is not at all detrimental to masonry, but only affects the aesthetics of the masonry. Moisture is the vehicle that brings the salts to the surface. In new masonry walls the moisture typically comes from water trapped in the brick materials and in the wall system from original construction. New buildings typically “bloom” with efflorescence for the first one or two years. If efflorescence continues beyond two years there is a source of moisture that needs to be identified and eliminated. This source of moisture may be through masonry joints, sealant joints, flashings etc.

Efflorescence is a relatively easily stain to remove. Over time rainwater will wash the efflorescence off the wall. Methods of removal include dry brushing or brushing with a stiff brush and clear water. Efflorescence stains that are more difficult can be removed with the use of a detergent solutions or proprietary cleaners as previously described.

Efflorescence removal using wet methods should only be completed in warm dry weather since the added moisture will tend to bring more salts out of the wall.

- **Supplies:** Tool kit, ladders, sponges, rags, buckets, cleaning, detergent, or acid solutions, and hoses

1.1.15.2 Inspect and repair deteriorated tuckpointing. The water penetration of masonry walls is most dependent on the condition of the mortar joints. Over time mortar will degrade due to atmospheric exposure. When mortar can be easily removed with a finger or with light pressure with a car key, tuckpointing of the mortar joints should be completed to maintain a water resistant wall. Excessive water penetration over time will lead to deterioration of the masonry units and corrosion of embedded metal materials.

- **Frequency:** Every 6 months
- **Procedure:** Inspect the mortar joints in the masonry and test the mortar for soundness with a small screwdriver. When soft areas are located, they should be visibly marked. The areas should be repaired by a masonry contractor.

  Tuckpointing involves removal of deteriorated mortar to a minimum depth of ½". Repair mortar should match the color and strength of the existing mortar. With soft masonry materials such as soft brick, limestone etc. using a soft tuckpointing mortar is essential. Type N mortar is most commonly used in tuckpointing of masonry walls.
- **Supplies:** Tool kit, keel or marking pens, and ladders

1.1.15.3 Preventive Maintenance. It is important to maintain joint sealants at construction joints and perimeters of masonry walls. Water penetration at these locations can lead to the deterioration of masonry materials, increased efflorescence, and the corrosion of steel support angles, masonry ties and supports.

Often it is recommended that masonry walls be sealed with a proprietary silicone, silane or siloxane type sealer to reduce water penetration. However, the sealing of masonry walls should not be completed without the consultation of a masonry professional as sealing masonry can at times cause more harm than good. For example, applying certain sealers to brick masonry that has efflorescence due to trapped moisture can result in the spalling of the face of the brick units. Crystallization of the salt deposited behind the sealer will result in spalling of the surface of the masonry. There is also a potential for moisture being trapped behind the sealer resulting in freeze/thaw damage to masonry units and mortar.

Numerous proprietary products are available for sealing masonry walls. Two suggested masonry sealers are “Hydrozo Clear Double 7" - water based by Degussa Corporation (Chemrex) (952) 496-6000 and “Aqua-Trete” by Huls America, Inc., (800) 828-0919. A trial

area should be complete to determine if the sealer changes the color and appearance of the masonry.

1.1.15.4 Remove graffiti from concrete and masonry surfaces. Graffiti results from the application of paint, felt tipped marker, crayons, lipstick or other materials. Graffiti should be removed as soon as possible after it is observed.

- **Frequency:** When needed
- **Procedure:** Inspect area where graffiti is observed. If it is on a painted surface, consider mechanical removal, such as sand blasting or grinding and repainting. If it is on a masonry surface the cleaning method may depend on the type of graffiti medium used. Sand blasting, water blasting, and chemical cleaning are available. Sand and water blasting may damage the masonry surface, while chemical cleaners pose environmental problems and may not be effective. Presently there are over 500 products listed that purportedly prevent, discourage, or remove graffiti.

  Blasting with baking soda and blasting with dry ice have been found to be effective and pose minimum damage to masonry and the environment.

  It may take several attempts with different materials before the graffiti is removed from masonry. Local firms specializing in graffiti removal should be retained for removal.
- **Supplies:** None required

2. RECOMMENDED MAINTENANCE SCHEDULE

This section provides a recommended schedule of cleaning, inspection, and other maintenance activities. In general, the need for repairs will be determined during the inspection or maintenance phase. The following symbols are used to designate scheduled activity:

2.1. Housekeeping

Housekeeping represents that work conducted by in-house staff consisting of basic cleaning, sweeping, wash downs, etc.

2.2. Inspection

Inspections may be performed by properly instructed in-house staff. Periodic inspections are necessary to confirm proper operation of systems or components.

2.3. Maintenance

Maintenance is usually performed by in-house staff, however, it may occasionally require an outside contractor. Maintenance represents tasks necessary to ensure proper operation of systems and components.

The recommended maintenance record form should be utilized by Parking Services maintenance staff or their designee to record periodic inspections, maintenance and repair.

All repairs should be performed on an "as needed" basis.