



## MULTIPLE HISTORIC CHINATOWN BUILDINGS Graffiti Cleaning and Prevention

Honolulu, Hawaii



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### **INTRODUCTION**

The Honolulu Authority for Rapid Transportation (HART) project, which is planned to be fully constructed and operational in 2019, includes an elevated light-rail public transportation option connecting East Kapolei to the Ala Moana Center, with twenty-one stations on the route including a station in Chinatown at the intersection of Numitz Highway and Kekaulike Street.

“In 2011 HART/FTA entered into a Programmatic Agreement (PA) with signatory and consulting parties, whose requirements included Stipulation IX.B which mandated that. “The City, in consultation with the consulting parties shall create, chair, and provide technical, administrative, and financial support for the operation of the Honolulu High-Capacity Transit Corridor Project Historic Preservation Committee (HPC). The City shall allocate two million dollars (\$2,000,000) within the Project’s budget to fund the program administered by the HPC... The HPC shall establish the goals, criteria, program guidelines, administrative procedures, and funding distribution for the disposition of these funds that will be provided by the City for exterior improvements to both Project related and other eligible or listed historic properties (including contributing resources within historic districts) within the Project’s APE consistent with the Secretary of the Interior’s Standards for the Treatment of historic Properties, 36 CFR pt. 68, accomplished through grants provided under this section...”

“In 2013 the HPC issued a request for applications from owners of historic properties located within the APE and 11 projects were ultimately selected by the HPC for funding. Six buildings located within the Chinatown Historic District were also chosen as the subjects of a Graffiti Cleaning and Prevention Study that was funded. The purpose of the study was to perform small scale treatment trials and review graffiti removal techniques and prevention methods and, based on conditions observed, develop a manual for the building owners to reference regarding the care and maintenance of their historic buildings with respect to graffiti removal and anti-graffiti coating. Jamie Morris of WJE was on-site to document the graffiti and perform limited graffiti removal, and protection trials from February 23 through February 26, 2015.

The following buildings are included in this study:

- 1 North Hotel Street
- 15–19 North Hotel Street
- 25 North Hotel Street
- 1024–1034 Nuuanu Avenue (Nuuanu Shops)
- 1111 Nuuanu Avenue (Perry Block)
- 175 North King Street (Armstrong Building)

### **BACKGROUND**

#### **Building Descriptions**

**1 North Hotel Street** is a single story brick and stucco building that is three and one half bays in width and four and one half bays in depth and is located on the northwest corner of Nuuanu Avenue and Hotel

Street (Figures 1 and 2). A metal canopy is anchored at the base of the parapet and extends over the adjacent sidewalk. The parapet above the canopy is corbelled brick with loose peeling remnants of a previously applied paint coating. The wall surface below the canopy is painted stucco (applied over the brick) with some isolated areas of exposed brick aligning with the canopy connection. The large punched openings include wood-framed fixed windows.

The graffiti present includes spray paint markings on the brick parapet. Locations where previously applied graffiti has been painted over are visible on the exterior plaster.

**15–19 North Hotel Street** is a single story brick building located on the west side of Hotel Street (Figures 3 and 4). The building is two bays in width and flanked by other buildings on the northwest and southeast. Although the building is divided into two storefronts, a single metal canopy originates at the base of the parapet and extends across both sections. The stepped, gabled parapet above the canopy is unpainted brick and includes a central vented opening. The storefronts beneath the canopy include painted brick, wood panels, and one painted cast iron element. Fenestration at 15 North Hotel Street includes a wood-framed storefront with fixed glazing and a large louver above the entrance. Fenestration at 19 North Hotel Street includes glass block, a corbelled cornice and parapet, and a corbelled arch over the large louvered vent above the entrance.

No graffiti was observed at the time of our site visit; however, previous graffiti on the painted brick has likely been overpainted.

**25 North Hotel Street** is a two-story brick building located on the west side of North Hotel Street (Figures 5 and 6). The building is six bays in width and flanked by other buildings on the northwest and southeast. A metal canopy originates at the top of the first floor and extends over the adjacent sidewalk. The second story is brick and capped with a simple corbelled parapet. The brick exhibits many previous attempts at mortar joint repointing. Six arched window openings including wood four-over-four light double hung light wood sash extend across the second floor. Each window has two operable shutters.

The first floor wall surface (below the canopy) is painted stucco (applied over the brick). The first floor openings include recessed entrances and large wood-framed storefronts with fixed windows.

The graffiti present includes markings from a black indelible marker. Markings are concentrated at the recessed entrances. Locations of previously applied graffiti have been overpainted with paint that is slightly lighter in color than the adjacent coating. At the second story there is an isolated area of white spray painted graffiti on the brick surface.

**1024–1034 Nuuanu Avenue** is located on the northwest side of Nuuanu Avenue between North Hotel Street and North King Street (Figures 7 and 8). The facade is ten bays wide and flanked by other building to the northeast and southwest. The address includes two distinct two-story brick facades. Each facade has arched openings on the second floor with wood-framed one-over-one light double-hung windows. The facade to the east includes stone arches and the brick appears to have been previously painted red; this coating has either worn away or been partially removed. The facade to the west includes brick arches above the opening and the brick facade does not appear to have been coated in the past. Metal storefronts are located between brick piers at the first floor of each facade. A metal canopy originates from the top of the first floor, extending over the sidewalk at each facade.

The graffiti observed includes isolated areas of black, blue, and white spray painted markings at the parapet.

**1111 Nuuanu Avenue**, known as the Perry Block, is a decoratively painted, two-story exterior plaster building located on the southeast corner of North Hotel Street and Nuuanu Avenue (Figures 9 through 11) that is four bays in width and seven bays in depth. Each bay includes an arched opening at each floor. The first floor openings include wood-framed fixed windows and paired wood doors with arched transoms and the second floor windows are one-over-one fixed sash in wood frames. On both the Nuuanu Avenue and North Hotel Street facades, there is a metal canopy at the top of the first floor and a decorative cornice at the parapet. The southeast facade of the Perry Block is brick. This facade was previously covered with extensive painted graffiti that has since been removed by chemical means using an unreported product. Although shadowing of the previous graffiti is still visible, the building owner is reportedly satisfied with the level of graffiti removal.

The graffiti currently present includes isolated locations of black indelible markings.

**175 North King Street** is located on the southwest corner of North King Street and River Street (Figures 12 and 13). The building is twenty bays in width and thirteen bays in depth. The River Street and North King Street facades include ashlar rock-faced basalt stone with one-over-one or two-over-two light wood double-hung windows at the second floor, and wood panels and storefront glazing in the openings between stone columns at the first floor. Large areas of the stone façade were previously painted with a silver colored metallic paint. This coating was reportedly applied prior to the tenure of the current owner. The west facade of the building includes a painted stucco surface at the first floor.

The graffiti observed includes isolated areas of white spray-painted markings at grade level on the stone facades and black spray-painted graffiti on the west facade.

Based on observations and conversations with building owners and tenants, previously implemented graffiti removal methods at 1 North Hotel Street, 15–19 North Hotel Street, 25 North Hotel Street, and 1111 Nuuanu Avenue (Perry Block) include overpainting (in areas of painted surfaces). Liquid chemical paint removers, paste chemical paint removals, and abrasive techniques including wire brushing have been previously implemented at 1024-1034 Nuuanu Avenue and 175 North King Street. Products previously used reportedly have included Dumond Chemical Smart Strip Pro and “Tagaway,” a liquid paint stripper; however the extent and methods of use are unknown.

The effects of the previous graffiti removal processes include visible overpainting, and slight reduction and spreading of spray paint treated with a liquid paint stripper. The previous attempts did not result in full removal of the spray paint.

## **GRAFFITI TREATMENT APPROACHES**

Although graffiti can occur in many forms, the most typical are applied coatings including but not limited to ink, indelible marker, wax markings, and paint. Graffiti can also occur in the form of abrasive markings such as glass scratching or carving into architectural surfaces. Although this document focuses on applied coatings, a brief discussion of treatments for glass scratching has been included at the request of Fung Associates.

Graffiti typically occurs at heights obtainable from grade level, or from higher and more visible vantage points that are considered a challenge to the vandals. This typically includes areas that are accessible from adjacent roofs.

In addition to being unsightly, graffiti is often considered to have a strong correlation with crime and undesirable activities. A high concentration of graffiti can negatively affect the perception of a neighborhood. In addition to removing graffiti to restore/maintain the original aesthetic of the surface, it has been shown that the rapid removal of graffiti acts as a deterrent to vandals and typically results in reducing the number of instances of application.

### **Available Graffiti Removal Methods**

Three general types of cleaning systems are available for removal of dirt and stains from building facades: microabrasive, chemical, and water methods. However, not all of these methods are appropriate for removal of graffiti. The selection of a cleaning method must take into consideration both the type of graffiti to be removed and the substrate to which the graffiti has been applied. For removal of painted graffiti, the sooner a cleaning product can be applied, the more likely it is to be successful.

In addition to this report, several sources exist to help guide the selection of appropriate cleaning materials. Examples include National Park Service *Preservation Brief 38: Removing Graffiti from Historic Masonry* (available online at <http://www.nps.gov/tps/how-to-preserve/briefs/38-remove-graffiti.htm>), and *Keeping it Clean: Removing Exterior Dirt, Paint, Stains, and Graffiti from Historic Masonry Buildings* (available online at <http://www.nps.gov/tps/how-to-preserve/preservedocs/Keeping-It-Clean.pdf>).

The cleaning method selected should be based on successful trials and should follow the Secretary of the Interior's Standards for the Treatment of Historic Properties, which states that the gentlest most effective cleaning methods should be selected. Methods and materials that result in damage to the substrate or that are harmful to humans, animals, and the environment should not be used. (The Secretary of the Interior's Standards can be reviewed online at <http://www.nps.gov/tps/standards.htm>.)

### **Microabrasive Methods**

Microabrasive methods consist of the physical removal of dirt and stains from a material's surface by the use of abrasive media delivered to the surface using different methods. Microabrasive methods commonly used in facade cleaning include a variety of abrasive media delivered to the surface in a stream of water (water is used to soften the dirt and buffer the impact of the media). Other microabrasive techniques use abrasive media embedded in sponges and delivered to the surface with pressurized air.

Due to the bond between the graffiti and the substrate, microabrasive methods are often unsuccessful in removing graffiti without affecting the underlying surface. Also, in the removal of isolated graffiti, even when used at very low pressures microabrasive cleaning may etch a shadow of the graffiti image into the substrate. Microabrasive methods may damage glazed masonry (such as terra cotta and brick), polished stone, or the outer surface of fire hardened brick. Thus in most cases, microabrasive methods are not appropriate for graffiti removal. However, isolated graffiti on certain substrates may be removed or reduced with carefully developed microabrasive protocols. Treating defined zones instead of only the graffiti area can result in the successful use of these methods without creating shadows of the graffiti. Prior to use, trials should be conducted to evaluate effectiveness and the aesthetic result. (Some microabrasive techniques, such as "soda blasting," have been found to be too aggressive for use on masonry. Other microabrasives, such as the proprietary Quintek Rotec system, have been used successfully for masonry cleaning, as further discussed below.)

## ***Chemical Methods***

Chemical cleaning methods consist of a wide range of chemicals available to address graffiti, as well as atmospheric soiling, biological growth, and coating removal. The chemicals selected must not result in damage to the substrate material. For example, highly acidic chemicals dissolve calcium carbonate based substrates such as limestone and marble. Additionally, chemicals may damage or etch adjacent surfaces not intended to be cleaned, so protection is frequently an important consideration. Lastly, some chemicals are hazardous and should be avoided. An example is methylene chloride, a common ingredient in certain paint removers, which is considered by the Occupational Safety and Health Administration (OSHA) to be a potential occupational carcinogen.

Poultices (an active chemical mixed with an inert vehicle such as clay or) diatomaceous earth (fine powder derived from naturally occurring siliceous sedimentary rock)) are generally most effective in removing graffiti from masonry and, like all chemical graffiti removal systems, are most effective if applied within 24 hours of the graffiti installation. Poultices have the advantage over liquid paint removers in that they can be applied to specific locations and remain active in place for a period of several hours, thus helping to dissolve and draw out the stain. Many liquid paint removers can soften the coating and result in spreading it over a surface or driving it into porous materials instead of removing it as the liquid is wiped away, making the coating even more difficult to remove.

Some poultice-type coating removal systems come with special paper that covers the poultice while it is active; upon completion of the dwell time, the graffiti remover and graffiti debris are removed with the paper, making clean-up easier. These systems are especially beneficial if special containment is required, as is the case with the removal of paint coatings that contain lead. For example, it is not known whether overall graffiti at 175 North Hotel Street and deteriorated (flaking and peeling) coatings at the 1 North Hotel Street parapet contain lead. Testing for hazardous materials should be performed prior to paint removal.

Chemical methods should be used to remove graffiti from unpainted substrates because chemical graffiti removal from painted surfaces can result in removal or damage to the underlying coating.

## ***Water Methods***

Water methods typically include pressure washing, steam cleaning, and hot water pressure washing. These methods alone are generally not found to be effective in removing most painted graffiti, as water lacks the ability to dissolve most common graffiti coatings. Low pressure rinsing is used in conjunction with chemical cleaning methods to rinse the chemicals from the substrate. Water pressures must be carefully monitored, as high-pressure water can damage many building substrates. Water methods should only be used on watertight facades. Open or deteriorated joints should be repointed or sealed (depending on location and substrate) prior to using water cleaning methods, as well as chemical cleaning methods, which typically require water application for pre-wetting and rinsing.

## ***Overpainting***

Overpainting is a graffiti removal method that covers the graffiti instead of removing it (Figure 14). Overpainting is appropriate for substrates, such as stucco and painted brick that were painted historically. The overpainting should match the base paint in color and sheen, and should be compatible with the base paint. Multiple applications may be required to cover dark colored graffiti. Where existing paint coatings are deteriorated or soiled, additional surface preparation such as scraping and/or cleaning may be required prior to overpainting. Overpainting is not an appropriate graffiti removal method if the substrate was not

historically painted. Consequently, overpainting is not an appropriate method to address graffiti at 175 North Hotel Street.

## **Available Protective Coatings**

### ***Clear Protective Coatings***

Various clear film-forming protective coatings (also known as sacrificial or barrier coatings) have been developed in an attempt to protect the underlying substrate from graffiti application, and facilitate the later removal of the graffiti. Clear protective coatings can be intended to be long-lasting (remaining on the surface after many uses) or sacrificial (removed from the surface after each graffiti incident) and may also incorporate other characteristics such as water repellency.

Although clear protective coatings may appear to provide a simple and desirable solution to the problem of graffiti, there are many considerations required prior to the selection of a clear protective coating, especially for historic buildings. Questions to be considered include the following:

- What is the longevity of the coating and how often is recoating recommended? This issue should be considered in terms of the anticipated rate of graffiti accumulation and the life cycle cost benefit of the clear protective coating.
- Does the coating result in a difference in gloss or sheen of the historic surface? This may result in an undesirable or patchy appearance.
- Does the coating discolor with UV exposure? This can be monitored on a limited basis through trial applications; however, the aesthetic impact of the coating in the future may be unknown.
- Does the coating accelerate dirt accumulation? This can be monitored on a limited basis through trial applications; however, the impact of the coating in the future may be unknown.
- Does the coating affect the water vapor permeability of the masonry? Changes in water vapor permeability may trap water and salts below the surface of the masonry and result in surface efflorescence or other distress.
- Are existing water repellent coatings present? Many clear coatings cannot be applied over existing water repellent coatings.
- Is the coating sensitive to abrasion? If so, surfaces subject to abrasion (such as those around entrances) may require more frequent maintenance of the coating.
- What substrate surface preparation is recommended? Many protective coatings require the surface to be cleaned prior to application. The initial cleaning of the substrate should be considered in the project budget.
- Is the coating suitable for all substrates present on the building facade?

In accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties, treatments applied to historic buildings should be reversible. Long-lasting film-forming clear protective

coatings are not reversible and their effect over multiple decades of weathering is not well documented or understood. Therefore, long-lasting clear protective coatings are not recommended.

Sacrificial clear protective coatings are water-based and are removed as part of the graffiti cleaning process. The coating is then reapplied after each graffiti removal event. The sacrificial coating removal process typically includes heated pressure washing. Additionally, since the coating is required to be reapplied after each graffiti removal, the presence of the coating does not necessarily result in labor savings relative to the prompt treatment of future graffiti applications with paint removal chemicals. Although product literature for some sacrificial clear protective coatings may claim that the product limits the accumulation of environmental soiling, it is difficult to validate such claims without comparative trials of treated and untreated locations.

### ***Window Films***

Graffiti in the form of glass scratching is also reported to be common in Chinatown (Figure 15). This type of graffiti typically includes scratching symbols or names into the glass surface with knives, keys, or other sharp objects. Depending on the depth of the markings, scratched surfaces are typically addressed by polishing the surface of the glass with cerium oxide. If the areas are deeply scratched, the area may need to be abraded with a high grit silicon carbide paper prior to polishing. The repair of deep scratches may alter the optical qualities of the glass. If scratching is severe, or covers a large area of the unit, replacement of the glass may be recommended. Replacement may also be recommended if repeated polishing efforts in the same location alter the optical qualities of the glass.

Optically clear protective window films are marketed as sacrificial coverings for use on glazing in graffiti prone areas. The films are applied to the exterior of the window and can be removed and replaced if glass graffiti occurs. These films may add additional protection against glass breakage. Shaded or solar protection options are also available.

Questions to be considered prior to the selection of a clear protective window film, especially for historic buildings, include the following:

- Is the width of the film sufficient to cover the glass, or will the film have to be installed with seams on the surface of large windows?
- Does the film change the appearance of the windows?
- Will the film affect the solar performance of the window?
- How does the cost of replacing the window film compare with the cost of glass polishing for typical markings?
- What is the longevity of the window film? Will it discolor or peel over time?
- How long has the product line been available? If the film needs to be replaced on one window in ten years will the same film be available, or will the film available in the future match the film installed?

If a protective window film is selected after careful review of the above considerations, a trial application is recommended to review the effect of the film on the appearance and performance of selected windows

prior to wide-scale implementation. A protective film should only be used if there is no adverse effect on the appearance and performance of the window.

### **Other Graffiti Prevention Methods**

In addition to protective coatings and films, the modification of site features may also deter future graffiti and protect building materials. Typical site modifications include spikes or barbs installed on horizontal surfaces typically used by vandals for access, increased site lighting (including motion-detector lights), and high resolution security cameras. These methods, in addition to prompt removal of future graffiti, may discourage vandals.

### **GRAFFITI REMOVAL TRIALS**

For purposes of this study, trials of multiple chemical cleaning methods were conducted in an attempt to identify the gentlest, most effective method for graffiti removal. Due to accessibility constraints, all trials were conducted at street level at the 175 North King Street building. Roof level access was not available for trials of graffiti removal on the parapets of other buildings, and graffiti was not present at other accessible areas.

Products included in the trials included Smart Strip, Smart Strip Pro, and Peel Away 7 by Dumond Chemicals; Safety Peel 1 by Prosoco; and site-mixed poultices of mineral spirits and acetone in clay-based poultice powder. Although some of the products included in the trials are acidic, based on the type and strength of the acids present, the use of these products is considered to have a negligible effect on the existing masonry or mortar joints. (Cleaning products containing strong acids, such as hydrofluoric or hydrochloric acid, should be avoided because these chemicals can damage building materials and also present a hazard to users and others in the work area.)

The products were applied to locations with a basalt stone substrate and white spray paint and silver painted coatings. The white spray painted area had reportedly been previously treated with a liquid paint stripper. However, the manufacturer or product name of the liquid paint stripper was not provided.

The products were applied according to manufacturer's printed instructions, covered with laminated paper and tape along the edges to increase adhesion (laminated paper is not typically supplied for Safety Peel 1; however it was used in this trial for consistency), and allowed to remain in place for approximately 17 hours or overnight. When the trial areas were reviewed the day after the application, the tape and paper coverings were no longer present; however, the chemical paste remained on the stone surface. (If the paper remains in place throughout the dwell period, improved effectiveness would be expected.)

Upon rinsing of the chemical residue, confirmation of pH neutrality, drying, and examination, it was apparent that the most effective product was Smart Strip Pro by Dumond Chemical. The application improved the appearance of the substrate, with very limited improvement at the spray painted area and significant improvement at the location of silver paint (Figures 16 through 22). Multiple applications will likely result in additional improvement at the location of silver paint. Repeated application can be tried at the area affected by white spray paint; however, a more significant improvement at this location may not be possible. As noted, removal of future applications of graffiti as soon as possible after the vandalism occurs (preferably within 24 hours of application) would be expected to greatly improve the effectiveness of the cleaner.

**Table 1: Summary of Coating Removal Trials**

<b>Product</b>	<b>Effectiveness on spray paint</b>	<b>Effectiveness on silver coating</b>
Dumond Smart Strip	Ineffective	Somewhat effective
Dumond Smart Strip Pro	Somewhat effective	Most effective
Dumond Peel Away 7	Ineffective	Somewhat effective
Prosoco Safety Peel 1	Ineffective	Ineffective
Mineral Spirits poultice	Ineffective	Ineffective
Acetone poultice	Ineffective	Ineffective

As mentioned above, if carefully used, select microabrasive products and procedures may be effective at removing the remaining spray paint in the area tested. One such method is the Rotec Vortex system by Quintek Corporation (<http://www.quintek.net/>). This method delivers the microabrasive medium to the substrate with water and is often used on building facades and stone sculpture. The abrasives selected must be softer than the substrate to avoid distress. The Rotec Vortex system may be considered to remove old spray paint from the basalt stone surface. The cleaning should include the graffiti area and adjacent stone units (incorporating an area bounded by mortar joints) to avoid etching (shadowing) of the graffiti pattern into the stone surface. This cleaning method must be performed by a contractor trained in the use of the Quintek Rotec system.

### **Clear Protective Coating Trials**

In response to a request by Fung Associates and the building owners, trials of a water-based clear protective coating, Sacrificial Coating SC-1 by Prosoco, were applied to three different surfaces including basalt stone on the 175 North King Street building, painted stucco on the 1111 Nuuanu Avenue building, and uncoated brick on the 1024–1034 Nuuanu Avenue building. The product was selected due to its availability and its characteristics as a reportedly non-water repellent sacrificial film-forming clear protective coating. The trials were installed for the purpose of reviewing the visual appearance of the product on the selected substrates; the effectiveness of the protective coating for addressing graffiti was not within the scope of the trial application.

Product literature states that the surface must be clean, dry, and absorbent prior to the installation of the coating. Prior to the trial applications, the surfaces were dry brushed to remove surface dirt and dust/debris was wiped away with a clean cloth. The coating was then brush applied in accordance with the manufacturer’s printed instructions. (Note that removal of the SC-1 product, as recommended by the manufacturer, requires the use of 180 degree Fahrenheit water at 500 to 1,500 psi using a nozzle with a 15 to 25 degree fan tip at a working distance of 3 to 6 inches from the wall surface. This process is not recommended. The temperature is hazardous to humans, and the recommended water pressure, nozzle size, and working distance can permanently etch many building substrates including brick, stone, wood, metal, and glass.)

Trials were allowed to completely dry and were visually examined approximately one week after installation (Figures 23 through 25). At the basalt stone trial location, the surface of the stone remained discolored with a white hazy appearance relative to the adjacent stone outside of the trial area. At the trial applied to painted stucco, there was no visibly discernable alteration of the surface appearance. At the trial applied to brick, the surface of the brick remained discolored with a white hazy appearance relative to the adjacent brick outside of the trial area. The surface color alteration observed at the brick and stone trial areas is not desirable; therefore, this product is not recommended for use on those materials. Due to the lack

of apparent modification of the surface appearance, the product may be appropriate for use on painted stucco; however, it should be evaluated for effectiveness in trials prior to overall application.

If further consideration is given to use of clear protective coatings on the brick and stone surfaces, additional water-based clear protective coatings should be evaluated in trials prior to overall application. Trials should be reviewed at least one to two weeks after application for their aesthetic effects on the substrate surfaces.

## **CONCLUSIONS AND RECOMMENDATIONS**

Several chemical paint removal products were evaluated in trials in an attempt to remove both spray paint and a silver coating from the surface of basalt stone. Smart Strip Pro was most effective in removing the silver coating from the stone and somewhat effective in removing the spray paint. If applied to freshly applied spray paint, the product is expected to be more effective. If promptly applied, this product is also expected to be generally successful in removing indelible marker from unpainted masonry surfaces.

Removal of the silver coating from 175 North King Street may be considered to restore the stone facades to their originally intended appearance. If this is desirable, we recommend using the Smart Strip Pro product following the procedure below.

The removal of the existing spray paint (which has been previously treated with a liquid paint stripper) is more challenging. The appearance may improve with repeated applications of Smart Strip Pro; however, previously applied liquid paint strippers may have drawn paint pigment into the stone's pores. A microabrasive cleaner, such as the Rotec Vortex system discussed above, may remove the aged spray paint if repeated applications of the chemical product is not successful.

Limited trials of a film-forming water-based clear protective coating were applied to various substrates to review the aesthetic effects of the application. The coating discolored the substrate on the brick and stone surfaces; however, no discernable difference was observed on the painted stucco surface. If further consideration is given to use of clear protective coatings after reviewing the concerns presented above regarding their use, additional products should be identified and tested on the intended substrates prior to widespread application. If aesthetically acceptable, the products should be tested for effectiveness in terms of removal of graffiti applied to the coated surface.

The trial applications of the clear film-forming coating can be removed from the existing locations by following the manufacturer's printed instructions for removal (see attached product data). However, due to the size of the trials and the potential for adjacent joints to be open, it is likely sufficient to spray apply clean hot water and brush the surface with a soft nylon bristle brush to remove the trials.

## **PROTOCOL FOR REMOVAL OF GRAFFITI FROM MASONRY SUBSTRATES**

The following is a protocol for use in graffiti coating removal from masonry. Future graffiti should be removed within 24 hours of its application, if possible. The coating removal system outlined below has been found to be the gentlest, most effective coating removal method in trials to remove existing coatings from the basalt stone substrate at 175 North King Street, and is considered appropriate for graffiti removal from other substrates represented in the buildings included in this study. The first time that the following protocol is used on each substrate, a small scale application should be considered as a trial to evaluate the effectiveness of the process on each substrate as well as to determine appropriate dwell times for each substrate.

If this protocol is used to remove graffiti from an existing painted surface, removal of the underlying paint may result. Overpainting is recommended to address graffiti on historically painted surface.

This protocol includes the use of low pressure rinsing. Open joints were observed between stone columns and the wood window jambs at the building. To prevent water infiltration, open joints must be sealed and the facade must be watertight prior to the implementation of the graffiti removal protocol. If the protocol is to be used at other buildings, water tightness must be confirmed prior to implementation.

### **General:**

1. The purpose of the graffiti removal process is to remove existing graffiti without damage to the masonry surface. The graffiti removal process shall not damage, etch, burn, bleach, streak, or discolor the substrate.
2. It is recognized that variations of the graffiti removal materials and their application may be required as the job proceeds. If variations beyond the limitations noted in the product manufacturer's literature are considered, the manufacturer should be consulted prior to proceeding.
3. Follow all safety precautions recommended by the manufacturer. Maintain a copy of the manufacturer's product literature and Material Safety Data Sheet (MSDS) available for reference during all graffiti removal work.
4. Do not use wire brushes or scrapers. For chemical products, use only brushes that are resistant to the chemicals being used.
5. Use spray equipment only as permitted by the product manufacturer. Use equipment that provides controlled application at volume and pressure indicated, measured at spray tip. All pressure applicators shall be equipped with pressure gauges at the compressor and at the spray nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage substrate.
6. For chemical product spray application, use a low-pressure tank or chemical pump suitable for product indicated, equipped with a cone-shaped spray tip, or other pump as recommended by manufacturer of cleaner. Control wind drift of chemical coating removers if spray application is used.
7. Apply coating removal products to masonry surfaces to comply with manufacturer's written instructions. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

### **Smart Strip Pro:**

Smart Strip Pro is a one-part coating removal system manufactured pH 2, by Dumond Chemicals, Inc., Malvern, Pennsylvania. (Due to the high pH of this product, this product is not recommended for limestone or marble substrates and should not be adopted for these surfaces.)

### **Protection:**

1. Comply with all applicable safety codes and regulations that govern the work, including city, state, water department, OSHA and Federal regulations covering protection and waste water disposal.
2. Take any precautions necessary to insure the safety of workers, pedestrians, building users, and other people and animals in the work area. Protect plants, automobiles, other property, etc. The work required herein includes the use of chemicals that can harm workers, other persons, animals, and plants, and damage other automobiles, other buildings, street furniture, etc. Protect workers, pedestrians, animals, plants, adjacent buildings, parked or moving automobiles, other buildings, street furniture, and other persons and objects that are vulnerable to damage by the cleaning operations.

3. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products.
4. Neutralize, collect, and dispose of runoff from cleaning operations by legal means and in a manner that prevents damage to landscaping and water penetration into building interiors.
5. Protect windows and doors, joints, and other openings from chemicals and water infiltration.
6. Remove all protection materials carefully and thoroughly. Protection materials shall not damage or leave residue on surfaces. Materials to which protection was attached shall be left in the same condition as that previous to the cleaning operations.

***Pre-wetting and Rinsing:***

1. Water for cleaning, pre-wetting, and rinsing, shall be clean, potable water.
2. Pre-wetting and rinsing shall be performed at low water pressures from a hose with a consistent flow of water; warm water should be used if available.
3. For pre-wetting and rinsing, use a stainless steel or plastic spray nozzle.
4. For pre-wetting, only apply graffiti removal chemicals to area that remains wet immediately at beginning of cleaner application. On hot days or in direct sunlight, it may be necessary to proceed with pre-wetting and cleaner application to small areas of surface, or to pre-wet the surface several times during the cleaner application.
5. Rinse off chemical and graffiti residue by working upward from bottom to top of each treated area. Continue rinsing until pH of wall has returned to neutral (6.5 to 7.5). Maintain pH paper on site to check pH of rinsed surface. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed. Recheck pH of wall 48 hours after cleaning has been completed, when substrate is dry.

***Product Application:***

1. Apply cleaner to work area and cover with laminated paper (provided by Dumond Chemicals).
2. Rub gently to create adhesion between the paper and paste and remove air bubbles.
3. Leave in place for 18 to 24 hours.
4. Remove by sliding a plastic putty knife into the dried paste around edges of paper, easing paint, paste, and paper away from the surface in one piece.
5. Collect paper with paint and residue, and place in plastic bags. Properly dispose of all debris in compliance with local, state, and federal regulations.
6. To remove remaining residue, mist surface lightly (50 psi or less) with water spray.
7. Scrub with nylon bristle brush to loosen remaining residue.
8. Rinse with very low pressure water until remaining residue is removed.
9. Test surface with pH paper to confirm that the surface has returned to a neutral pH. If not, continue rinsing until paper indicates pH is neutral.
10. Collect and dispose of residue and rinse water in accordance with local, state, and federal regulations.

**FIGURES**



*Figure 1. General view of 1 North Hotel Street looking northwest.*



*Figure 2. General view of 1 North Hotel Street looking west.*



*Figure 3. General view of 15-19 North Hotel Street looking northwest.*



*Figure 4. General view of 15-19 North Hotel Street looking west.*



*Figure 5. General view of 25 North Hotel Street looking west.*



*Figure 6. View of the second story windows at 25 North Hotel Street looking northwest.*



*Figure 7. General view of 1024-1034 Nuuanu Avenue looking northwest.*



*Figure 8. Parapet graffiti at 1024-1034 Nuuanu Avenue.*



*Figure 9. General view of 1111 Nuuanu Avenue (Perry Block) building looking southeast.*



*Figure 10. View of the Perry Block building from North Hotel Street.*



*Figure 11. Previously painted brick southeast facade of the Perry Block building looking northwest.*



*Figure 12. View of 175 North King Street (Armstrong Building) from River Street looking southeast.*



*Figure 13. General view of 175 North King Street looking northwest.*



*Figure 14. Example of graffiti that has been overpainted at the 1 North Hotel Street building.*



*Figure 15. Example of typical scratched glass graffiti.*



*Figure 16. Spray painted graffiti trial area at 175 North King Street prior to trials.*



*Figure 17. Spray paint removal trials in progress. The Smart Strip Pro trial location is indicated with an arrow.*



*Figure 18. Trial area of Smart Strip Pro prior to application.*



*Figure 19. Trial area of Smart Strip Pro after application. White deposits on the stone surface have been reduced, but deposits in the pores remain.*



*Figure 20. Silver paint removal trial area.*



Figure 21. Trial locations after application.



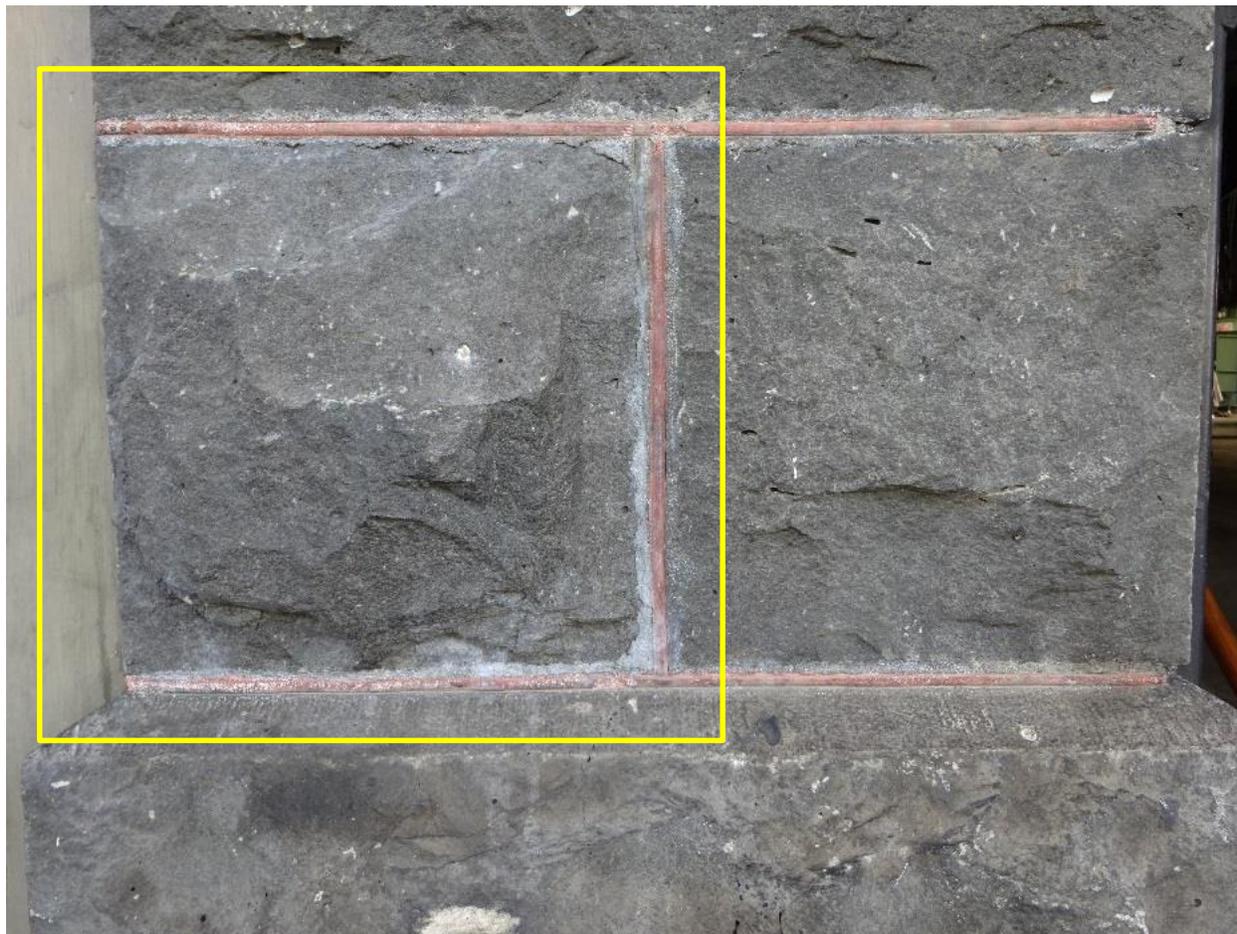
*Figure 22. Smart Strip Pro location after trial.*



*Figure 23. Rectangle indicates area of clear protective coating trial on painted stucco approximately one week after installation. The area is indistinguishable from the surrounding surface.*



*Figure 24. The area of clear protective coating trial on brick approximately one week after installation. The product appears as a milky white haze on the brick surface.*



*Figure 25. The area of clear protective coating trial on stone approximately one week after installation. The product appears as a slight milky white haze on the stone surface.*