ANTI-GRAFFITI PROTECTION OF CONCRETE

INTRODUCTION

The purpose of this technical note is to highlight various technical requirements associated with graffiti removal and anti-graffiti protection, including quality control testing, standards and health and safety issues[1]. Methods to counter graffiti defacement of property include consideration of the overall environment and exposure of susceptible property, selection of suitable graffiti resistant construction materials, psychological understanding of graffitists, coordinated planning, training and education, removal of graffiti and surface protection. Graffiti removal and the application of anti-graffiti coatings to prevent penetration into the substrate and facilitate the removal of graffiti markings, have been identified as the most effective technical means of combating this antisocial activity [1,2,3].

GRAFFITI MARKERS

A variety of marking materials are used by graffitists to deface target surfaces. The degree of usage of the various materials is influenced by the texture of the surface (i.e. smooth, polished. rough, broken etc.) and removability from specific surfaces. Aerosol spray paints and felt-tip pens are the most commonly encountered markers due to their ease of application and their bold, indelible characteristics. A combination of these is also frequently encountered, with felt-tip pen used to outline larger graffiti pieces. Spray paint can be applied quickly on any surface regardless of texture. Other less frequently used materials include brush-applied paint, wax crayon, lip-stick, ballpoint pen, chalk, lead pencil, oil, food and scratchings. The removability of all these depends both on the type of substrate surface and the chemical composition of the marking materials themselves.

RESISTANCE OF EXPOSED SURFACES

The graffiti resistance of exposed surfaces is influenced by the susceptibility of the surface to the penetration of markers and its sensitivity to damage during cleaning. Hard, non-porous, impermeable and relatively smooth surfaces have a good graffiti resistance and cleanability. Permeable or porous surfaces may be difficult to clean. Rough and heavily textured substrates prevent thorough cleaning of the surface. Resistant substrates such as hand glazed ceramic tiles, glass, polished stone, hard glazed brick and metals are used in high risk areas and generally anti-graffiti coatings are not required.

Protective anti-graffiti coatings are increasingly specified and applied however, on newly constructed or even existing structures with lower graffiti resistance substrates. These include concrete, sandstone, limestone, normal brick, timber, cement render and painted surfaces. These surfaces vary in permeability and their ability to absorb certain inks and dyes deeply into their pores. Nevertheless they are all difficult to clean resulting in unsightly shadowing/ghosting if left unprotected. Continual chemical and wet abrasive blasting not only damages such surfaces but also leaves unsightly markings.

ANTI-GRAFFITI COATINGS

Anti-graffiti coatings are applied to exposed surfaces in order to facilitate subsequent removal of graffiti. They act by preventing the deep penetration of markings into pores, and by preventing a firm attachment of the markings to the surface. Such coatings may be applied to many substrates, although their predominant use is on concrete and masonry materials due to their relatively porous nature. Anti-graffiti coatings are available both as clear and as pigmented coatings applied in two or more coats and some are available with a priming sealer. Clear coatings are available as non-film forming impregnations and as film forming coatings. They are used where it is necessary to maintain the natural appearance of the substrate and are available in a range of gloss finish. Pigmented or coloured systems serve a dual purpose of both painting out graffiti and providing subsequent protection. It should be noted that many clear coatings change the appearance of the substrate by making it darker, glossy, or giving it a wet appearance. The higher gloss level is an inherent requirement of the most effective solvent based anti-graffiti coatings.

Anti-graffiti coatings are classified either as long life (permanent) or sacrificial (temporary). Long life coatings are not damaged during later removal of graffiti and can withstand repeated cleaning. They are formulated from two or more components and generally last for about 10 years. They are more expensive compared to sacrificial coating systems. There are three main types of long life coatings, namely, polyurethane (stiffer, harder), acrylic (flexible) and acrylic-polyurethane blends. Generally the two-pack polyurethane and acrylic-polyurethane are the most effective and durable.

Sacrificial coatings are one component, less expensive,

acrylic resin solutions, easily and partially removed during cleaning and later recoated. Often only high pressure water washing is needed to remove graffiti and therefore chemical solvents are avoided. Unlike some long life coatings which form a barrier, sacrificial coatings are vapour permeable and allow the passage of water vapour out of the concrete. They are mainly low sheen products. Generally, sacrificial coatings should only be used in special situations where both a life cycle costing analysis and technical merit clearly support their use. The better sacrificial coatings can last up to 5 years if they are not attacked by graffiti.

Painting out or obliteration of graffiti markings can also be considered as an anti-graffiti option. This solution may be more expensive in the long term as it provides no effective deterrent or protection. Aesthetics will suffer due to contrasting colours. Anti-graffiti coatings may be applied over other repair materials or coatings and in these situations they must be compatible with decorative, anti-carbonation coatings, epoxy, acrylic or other patching materials. Physical and chemical compatibility must be established prior to any use. Trial applications should be undertaken in accordance with Section 685[(1)].

PERFORMANCE REQUIREMENTS

Anti-graffiti coatings should satisfy a number of desirable properties including: cleanability, resistance to ultraviolet radiation, abrasion, graffiti removers, moisture condensation and develop early solvent resistance and film hardness. Other properties considered important are good adhesion and anti-carbonation capability, permeable to water vapour or water resistant where necessary and penetrating properties for impregnating coatings in accordance with Section 685.

PREPARATION & APPLICATION

Thorough surface preparation is very important to ensure good adhesion or sufficient penetration of the protective coating into the concrete. Concrete should be clean and reasonably dry for the coating to adhere properly and be resistant to peeling or blistering. In general surface preparation and application should satisfy the requirements of Section 685. It is also advisable that prior to any full scale applications, trial applications should be undertaken in accordance with relevant performance and specification requirements.

GRAFFITI REMOVERS

There are three main types of cleaning methods available for removal of graffiti markings; abrasive methods, heat and chemical removers. Abrasive methods, which include wet or dry sand blasting, can be too damaging to both treated and untreated substrates. They are also very expensive and not suitable for most situations. Heat related methods such as steam cleaning can be used to remove some paints but a high level of expertise is required to ensure that volatiles are not driven into porous concrete or masonry. Chemical removal agents are the most convenient and least damaging to either treated or untreated surfaces, and are generally recommended for the removal of all types of graffiti markings. There are two main types, organic solvent blends and inorganic, caustic based blends. Organic solvents can break down and are preferred. Caustic based blends do not break down, are not as effective and therefore are not preferred. Inorganic solvents such as acids are not preferred as they attack the concrete.

Generally, chemical solvents soften, swell and partly dissolve the marking medium and allow removal by cloth, brush, scrubbing with water and detergent or low pressure water jet. Chemical removers must be compatible with the associated anti-graffiti coatings. Care should be taken where combinations of anti-graffiti and decorative coatings are used to ensure that the underlying coating is not attacked by the aggressive removers if the contact time is prolonged.

QUALITY CONTROL TESTING

Quality control testing before and after the application of coatings should be undertaken as stated in Section 685. It includes surface moisture condition and moisture content of the concrete, adhesion strength and wet and dry film thickness or the amount of penetration of coatings. Appropriate timings for applications on concrete surfaces should also be observed. The minimum wet and dry film thickness of anti-graffiti coatings should be 175 micron and 100 micron respectively. When an anti-graffiti coating is also used as an anti-carbonation coating its minimum dry film thickness should be 150 micron. The adhesion strength to the concrete substrate should be at least 0.75 MPa.

HEALTH AND SAFETY

Health and safety requirements should be addressed in specifications, and Occupational Health and Safety Acts, regulations. Australian Standards and material safety data sheets should be adhered to. Graffiti removers and anti-graffiti coatings contain a wide range of chemicals which are potentially dangerous. Some sprayed two-pack polyurethane systems for example may release airborne isocyanides. Care must be taken in all facets of anti-graffiti protection and protective clothing, goggles, gloves and barrier creams are frequently required. Special measures such as the use of tarpaulins (to catch spillage), hand brush, roller or non-atomising spraying methods and special containment measures may be required.

STANDARDS

Useful standards include AS 1580.408.5 (Adhesion), AS 1580.602.3 (Boller Test), AS 1627.1 (Cleaning), AS 1627.4 (Abrasive Blast Cleaning), AS 2311 (Painting of Buildings), AS 2700 (Standard Colours), and Australian Paint Approval Scheme (APAS) Specifications APAS 1441 (Permanent Graffiti Barrier), APAS 1442 (Temporary Graffiti Barrier and APAS 1443 (Graffiti Remover).

MANAGEMENT STRATEGIES

There are a number of anti-graffiti protective options available which can be considered when undertaking a graffiti management program, depending on the particular needs of the traffic corridor or geographical area under consideration, and whether initial cost outlay or life cycle costing is the primary consideration.

Sacrificial vs. Long Life Anti-graffiti Coatings

Sacrificial anti-graffiti coatings are considerably cheaper than their more sophisticated long life counterparts and are economical in accessible areas where defacement is less likely and/or less frequent. In terms of a life cycle costing analysis, however, long life coatings may be found to be more cost effective when the requirement for reapplication of sacrificial coatings is considered. Other issues include disposal of the stripped sacrificial coatings which can not be washed down the drainage system and the period required for the substrate to dry out prior to reapplication. Sacrificial coatings mainly offer a satin or matt finish and therefore from a visual impact point of view there is no gloss or strong coating line definition to contend with. This is of particular importance where components such as noise barriers are coated to less than full height or away from a structural line of demarcation. In addition, sacrificial coatings require mainly high pressure water wash (hot/cold) to remove both graffiti and coating and thus exposure to chemical removers is limited. The advantage of long life anti-graffiti coatings is that they can withstand several cycles of defacement/cleaning before recoating is necessary. They are very useful in high risk or frequently attacked areas, in difficult to access areas or where frequent disruptions are unacceptable.

Painting Out (Obliteration of Graffiti)

Painting out or obliteration of graffiti markings can also be considered as an alternative anti-graffiti protective option, particularly as an initial low cost stop gap measure for both low and high graffiti risk areas. In the long term however, painting out may be more expensive and is not considered a long term solution, except where high quality architectural paint finishes have been specified, and painting out is the preferred option for maintaining the architectural integrity of the surface. It provides no effective deterrent or subsequent protection to substrate surface against graffiti markings. Evidence has shown that such areas are singled out for further graffiti attacks due to their fresh inviting effect. It is essential that prior to painting out, any defacement should be totally removed as the stain will almost always bleed through the new coating (Fig. 1). It may be possible in some situations however, to combine painting out with fast growing bushes and other landscaping. Such landscaping can provide a screening effect of walls and other components within about one to two years.

Protection vs. Non-Protection

This strategy can be influenced by a number of factors including the location, exposure and value of the asset, the cost of access to remove any defacement and the degree of offensiveness of the likely defacement. Although the initial cost outlay of anti-graffiti coatings particularly those of long life is relatively expensive, the removal of graffiti from low resistance and susceptible unprotected substrate surfaces (i.e. concrete, masonry, timber, textured etc) can be very difficult and often can lead to substrate damage and unsightly patchwork. Under these conditions the use of even such superfine cleaning systems as sodium bicarbonate additive can leave contrasting patches on a surface, unless an extensive area is cleaned. In addition, repeated cleaning of unprotected substrates can be very expensive. On the other hand anti-graffiti coatings can make removal of graffiti markings rapid, complete and non-damaging to the substrate and thus restoration of a clean appearance at a lower cost.

Non-Protection and Monitoring

This option basically implies that substrate surfaces are left unprotected and a monitoring system is implemented to detect any graffiti markings and high graffiti risk areas. Once these areas have been identified a protection scheme can be put in place. However, the underpinning of such a strategy is a real commitment to a continued and not ad-hoc monitoring of the various assets. It is essential that defacement on unprotected surfaces be detected at a very early stage and removed immediately. The longer the delay, the greater the unavoidable damage to the substrate from removal of deep-penetrating stains. The option of leaving surfaces unprotected should only apply to areas extremely difficult to access by graffitists, or areas which are under at least daily observation. The cost of restoration of many badly damaged unprotected surfaces is many times greater than initial protection.

Partial Protection and Monitoring

Partial protection and subsequent monitoring may be considered for components such as noise walls, vertical elements and other large surface areas within a large traffic corridor. Consideration could be given for example to providing protection to the community side with either a sacrificial or long life coating and no protection on the freeway side and undertake a monitoring program. Once again when high risk graffiti areas are identified apply a long life anti-graffiti coating, keeping in mind the potential problems and prohibitive long term costs for cleaning graffiti from unprotected walls and other elements. Consideration could be given to applying anti-graffiti coatings to the most vulnerable parts of a wall or other component, typically 2.5 to 3 metres above ground level (Fig. 1). Where possible anti-graffiti protection could be applied to a structural line of demarcation which helps to diminish any visual effects.

Use of Anti-Graffiti Coatings as Decorative/Anti-Carbonation Coatings

A number of pigmented long life anti-graffiti coatings can also provide anti-carbonation properties and can therefore serve a dual purpose where both anti-graffiti and decorative/anti-carbonation properties are required for use on concrete surfaces, thus resulting in substantial cost savings. In these dual applications however, to fully satisfy Section 685,

the minimum dry film thickness of pigmented anti-graffiti coatings should be 150 micron.

Rapid Removal of Graffiti

The rapid removal of graffiti can serve both as a psychological means of combating graffiti, as well as a means of underpinning the technical requirements of anti-graffiti protection, thus leading to a more cost effective management of the problem. Quick and repeated removal of graffiti would send a strong message to graffitists that the surrounding environment is cared for and that their efforts to gain attention and notoriety amongst their peers will be wasted. Evidence shows that graffitists tend to move elsewhere if graffiti is promptly and repeatedly removed. From a technical and cost point of view rapid removal ensures that graffiti markings are not allowed sufficient time to either harden or penetrate deeply into the substrate, thus enabling easier, cheaper and complete removal without any substrate damage. Rapid removal of graffiti should be made an integral part of any graffiti management strategy, thus demonstrating a strong commitment to combating this anti-social problem. Graffiti that is of a sensitive nature, such as racist, sexist and obscene should be removed within 24 hours. Normal graffiti should be removed within 48 hours.

Landscaping

The use of fast growing bushes, trees and shrubs can be another effective way of screening abatement and noise walls and thereby making them inaccessible to graffitists. A landscape strategy could be used in combination with other protective options to deliver an effective outcome. Fast growing plants and bushes can effectively screen walls within one to two years. Low but dense bushes which can provide cover and accessibility to graffitists should be avoided.

REFERENCES

1. *VicRoads Standard Specification Section 685 (2002), "Anti-Graffiti Protection".*
2. *Andrews-Phaedonos, F. (1997). "Guidelines for Anti-Graffiti Protection of Concrete & Other Materials", VicRoads, General Report GR 97/19, September, Melbourne.*
3. *Andrews-Phaedonos, F. (1997). "VicRoads Guidelines for Anti-Graffiti Protection of Concrete & Other Materials", AUSTROADS Bridges Conference, Sydney.*

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Fig. 1 Repeated painting out of graffiti, previous markings bleeding through (L), Long life anti-graffiti coating typically 3 m above ground level (R)