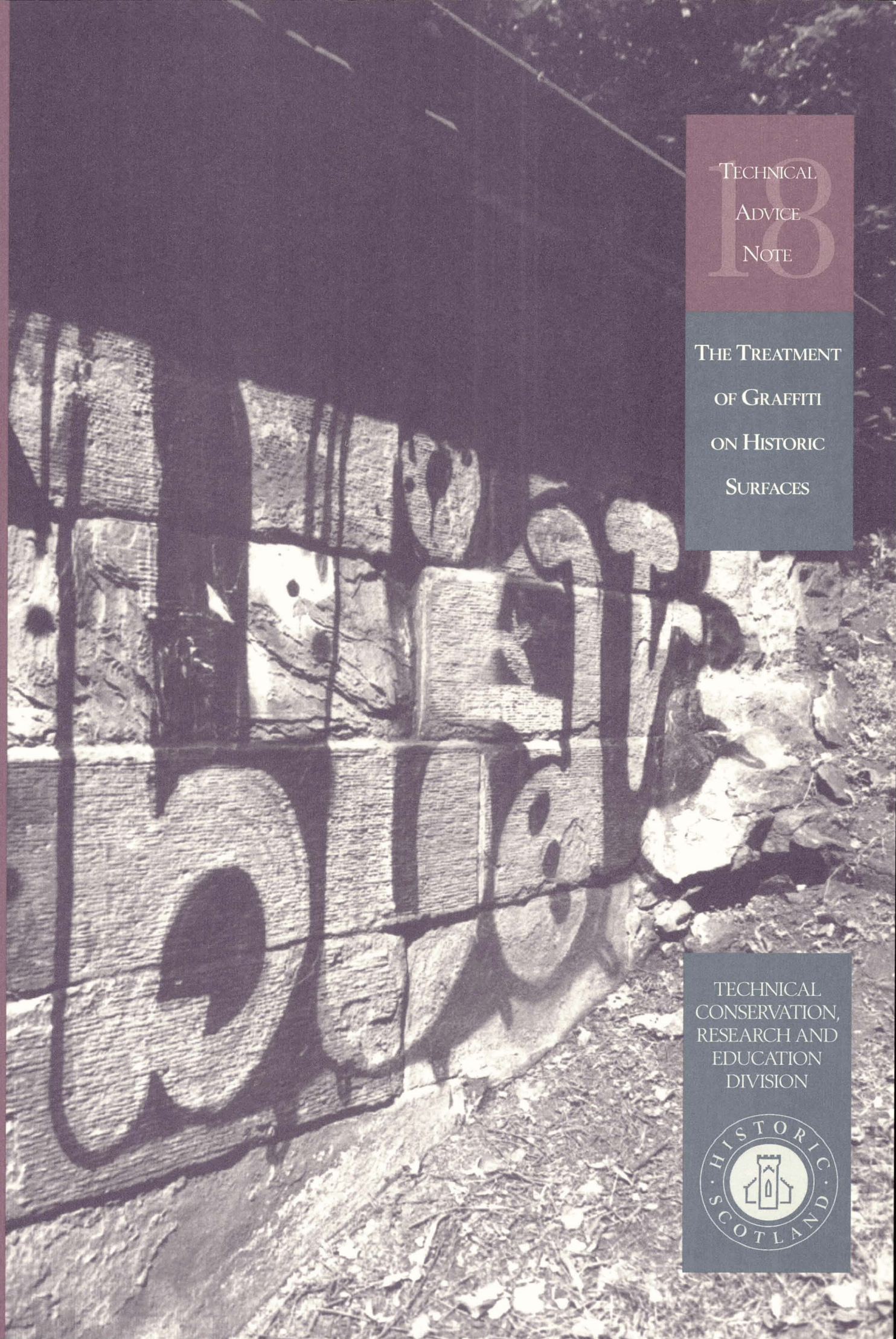

TECHNICAL ADVICE NOTE 18

THE TREATMENT OF GRAFFITI ON HISTORIC SURFACES

TECHNICAL CONSERVATION, RESEARCH AND EDUCATION DIVISION

HISTORIC SCOTLAND

TAN 18

THE TREATMENT OF GRAFFITI ON HISTORIC SURFACES

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TECHNICAL ADVICE NOTE

THE TREATMENT OF GRAFFITI ON HISTORIC SURFACES

Advice on graffiti removal procedures, anti-graffiti coatings and alternative strategies

by
Dennis Urquhart

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The author is grateful for the information and advice received from the staff of Historic Scotland; in particular Steven Gordon, Senior Conservator at the Historic Scotland Conservation Centre, South Gyle, Edinburgh and Neil Ross, Conservation Research Manager, TCRE; and Dr Maurice Whitford, Professor John Ashurst, Dr Stephen Garvin and Dr Carolyn Hayles for reviewing the text.

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PREFACE

The incidence of what might be considered to be graffiti in the built heritage can be seen as a common theme extending down through the ages from earliest times. In the prehistoric era, cup-and-ring markings can be found on bedrock, and in Pictish and early Christian times crosses and other symbols were carved into stone. The Viking plundering of Maes Howe left runic inscriptions of a boastful nature, and as one of Scotland's earliest examples of true graffiti rather than intentional art these are now afforded as much importance as the prehistoric site itself.

In the middle ages the need for stonemasons to identify their own work began a tradition of masons' marks incised, often discretely, into the stonework of their buildings. These provide us with an insight into the building methods of the time, where the skill of a particular craftsman can be identified as an early form of quality control.

Whilst such examples are deemed to have historic value and should be protected, the regrettable modern practice of graffiti is generally regarded as more akin to vandalism. Modern day graffiti can be the work of an individual or often, a well organised group, and can occasionally be of considerable artistic merit. However, there is a growing level of concern amongst building owners and practitioners over the sometimes irreversible damage caused to the substrate on which the images are applied.

This Technical Advice Note combines the results of an unpublished scientific research study by the Building Research Establishment with the pragmatic experience of the Historic Scotland Conservation Centre's stone conservators when dealing with graffiti. By concentrating on a range of typical building materials it aims to offer best advice to practitioners when faced with this issue. The ready availability of a whole range of paints and inks of advanced specification, and the wide variety of methods of applying them to building surfaces means that decisions on their removal must be carefully considered and guided by informed advice.

Due acknowledgement must be given to Stephen Gordon and the Historic Scotland staff for the source material for the text. Advice on practical problems stem directly from their experience of treating graffiti on the most sensitive of historic sites across the country. Ably supported by the work of Tim Yates and his team at BRE, the combined understanding offers a realistic insight into the effective treatment of this widespread problem.

Utilising his exemplary technical skills and knowledge of building materials, Dennis Urquhart has integrated these areas of research with his own experience of the treatment of masonry and other materials. Sections on graffiti policy, planning considerations, alternative strategies and other essential factors have been added. The result is a pragmatic document which will be of value to all those concerned with this modern-day issue.

Ingval Maxwell
Director TCRE
September 1999

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SUMMARY

This Technical Advice Note aims to provide comprehensive advice on the treatment of graffiti on historic surfaces. The emphasis, throughout the book, is placed on the need to preserve, as far as possible, the structural integrity and cultural value of the historic surface. Graffiti removal and treatment, whilst forming an important part of the advice, is always approached within the context of this underlying philosophy. It is important to recognise that the processes involved in treating the graffiti are likely to be more damaging to the historic surface than the graffiti itself.

An appropriate strategy for dealing with the problem, must also recognise that the presence of graffiti on historic surfaces may be considered even more offensive than the disfigurement of more mundane surfaces. There may thus be increased pressure to remove the offending graffiti as quickly as possible. Within the text, the need for suitable policies, which address these pressures in the most sensitive and least damaging way, are defined. However, some graffiti may have cultural value in their own right, and examples of such graffiti are included as an aid to the practitioner when formulating a treatment strategy. The book therefore places the issues relating to graffiti policy before those that address issues such as removal methods and treatments.

A comprehensive review of a range of historic substrate materials and conditions is provided. Materials considered include all the normal masonry materials likely to be encountered, plus metals and timber. An emphasis is placed on porous stone, particularly sandstone, as this is the type of material which presents the greatest problem for graffiti treatment in Scotland. Materials are classified in terms of permeability and porosity, hardness, roughness and reactivity with or resistance to chemical agents. A useful chart provides general guidance on the relative porosity of materials and the ease of removal of paint and permanent marker types of graffiti.

The characteristics of all the normally encountered graffiti markers are discussed, and some of the problems posed by their application to historic surfaces, especially porous materials, are included. This section forms a natural introduction to the following section, which is devoted to graffiti removal methods and materials. Included in this latter section is advice on the identification of graffiti materials, the selection of a graffiti removal method, which covers both chemical and physical methods, and laser cleaning. Two important figures are produced which, in effect, summarise the procedures to be followed in the chemical removal of graffiti from a historic surface, and in the selection of a suitable treatment method or methods. The use of anti-graffiti coatings and their compatibility with historic surfaces is also covered.

Before any graffiti removal, it is important to carry out a detailed assessment of the surface condition to establish its condition. It is also important that an accurate record of the existing condition is made, so that the effects of both trial cleaning and the main cleaning operation can be established. The condition of the surface also has a significant influence on the strategy to be adopted in dealing with the graffiti problem. A short section is devoted to this important subject.

In many cases, the traditional approach involving attempts to remove the graffiti may need to be supplemented by alternative strategies, which may include the use of physical barriers, and appropriate educational and social initiatives targeted at potential graffitists.

Advice is also provided on factors influencing the cost of graffiti treatments and relevant health and safety issues. A pro-forma is given which can act as a template for setting up a system of record keeping for substrate condition, and any graffiti treatments applied to the surface.

1 INTRODUCTION

1.1 Defining the Problem

Graffiti, derived from Italian *graffio*, 'scratching', are defined in the English dictionary as 'drawing etc. scratched or scribbled on a wall etc'. The singular form of the word is graffito. Invariably graffiti are unwanted and, in a modern context, may consist of painting, writing, scratching or gouging using a wide range of materials and implements on practically any surface or material likely to be present in a historic building or monument.

Graffiti are not modern phenomena; they can be traced back in history to much earlier than Greek or Roman times. Romans wrote graffiti, some of them obscene, on the walls of public latrines; much to the annoyance of the authorities who tried to dissuade the graffitists by hanging pictures of deities on the walls. In Scotland, the history of graffiti can be traced back to the Norsemen who infiltrated Maes Howe on Orkney in the mid twelfth century where runic inscriptions were incised into the tomb walls. At a later date, French prisoners, who were incarcerated in Edinburgh Castle during the Napoleonic Wars (1803-1815), also left their marks. These inscriptions are now regarded as part of the history of the monuments themselves; providing a social history of life and events at that time.

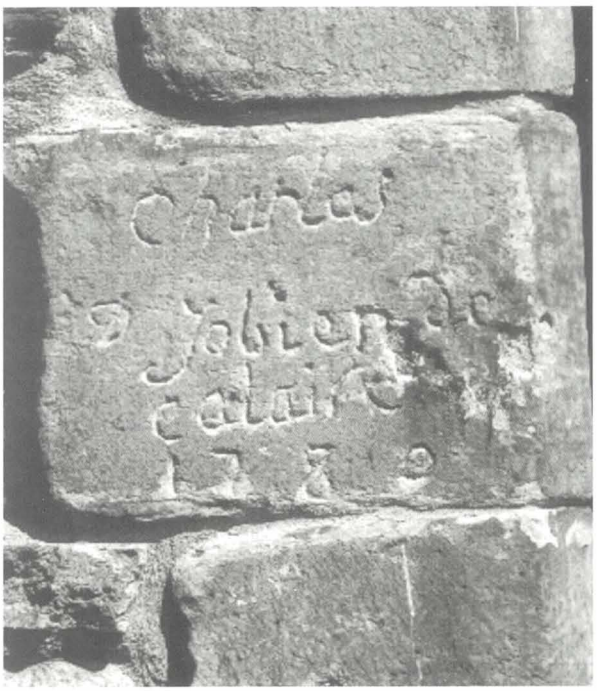


Illustration 1. Historic graffiti at Edinburgh Castle. The surface stains may be removed but the graffiti must be left intact.

The ready availability of cheap, modern, easy to use and highly visible marking materials such as aerosol paints and felt-tip marker pens means that all surface types and textures are vulnerable to attack. Historic surfaces are no exception and the modern graffitists do not generally respect the historic or cultural significance of such surfaces, perhaps through ignorance. Modern graffiti may cover a large surface area due to the ease of application of substances such as aerosol paint. The vivid hues of these substances are also an attraction because they provide a contrast to the substrate material.

The presence of graffiti on historic surfaces may be considered even more offensive than the disfigurement of more mundane or utilitarian surfaces. It may therefore be the policy of an organisation to effect the quick removal of these graffiti to maintain cultural value. However, whilst graffiti may be an eyesore, attempts to remove graffiti from sensitive surfaces using normal graffiti removal methods or stone cleaning techniques, may result in unacceptable levels of damage to the historic surface. Graffiti applied over decorative surfaces such as murals and paintings requires to be treated by a specialist painting conservator.

1.2 Public Perception and the Psychology of the Graffitist

Graffiti are generally regarded by the public as a form of vandalism that contributes to the deterioration of the environment. Many find the presence of such markings threatening, especially those which are of a violent, obscene, racist, sectarian or sexist nature. Pressure is thus placed on those with responsibility for the care and maintenance of property to remove the offensive material without delay. A distinction is sometimes made between a well executed 'piece' on, for example, a drab concrete surface which serves to enliven an otherwise bleak environment and the crude defacement or 'tagging' of public buildings. There are surfaces where even a small graffito could be unacceptable, no matter how neatly executed. A fragile, historic surface or the stonework of an important building are situations where a mark would cause offence.

Applying graffiti to public buildings is someone's way of leaving their mark, their way of telling the world that they exist and is perhaps the only means available to them to do so. They get satisfaction from engaging in an unlawful pursuit that contains an element of risk. Many of those who engage in this activity do not regard graffiti as a serious offence and therefore do not see themselves as vandals. Illustration 2 perhaps reinforces this point, as the graffiti has been applied to the sandstone at the entrance to a Sheriff Court. However, there are some who are motivated by feelings of rejection by society and see this activity as a means of reacting against authority. Most graffitists are adolescents who mainly come from socially disadvantaged areas and the highest incidence of graffiti attack therefore occurs within or adjacent to such areas and in city centres. The graffitist operates either as an individual or as a member of a gang. Within such disadvantaged societies, the prestige afforded to the graffiti writer by his or her peers is related to the 'visibility' of the marks and the risks taken to place the mark. The greater the danger posed, whether through inaccessibility of the site or the danger of being caught in the act, the greater the recognition received by the graffitist from the peer group. In situations where graffiti takes the form of an organised attack, rather than an isolated opportunist incident, the graffitist (either individual or gang) will often leave a unique stylised signature or 'tag'.

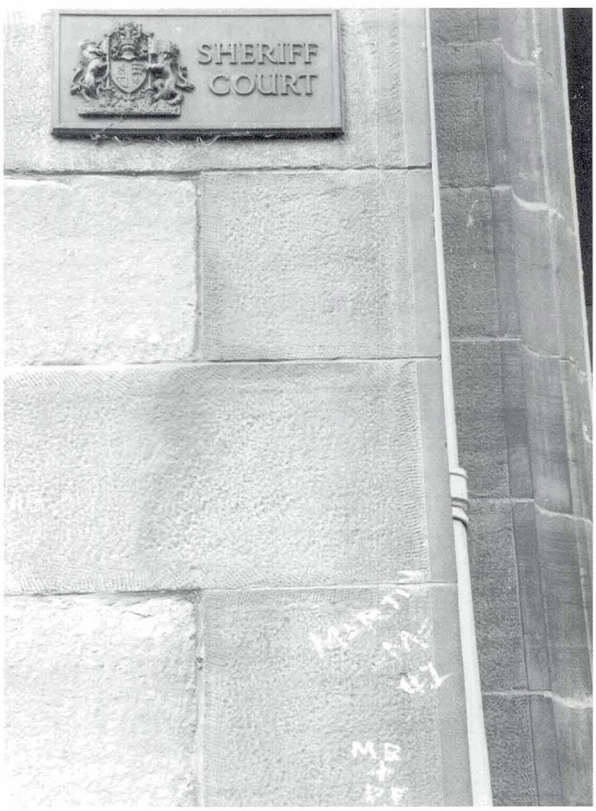


Illustration 2. Graffiti (correction fluid) at a Sheriff Court.

1.3 Special Problems of Graffiti on Historic Surfaces

In Scotland, repeated graffiti attacks on historic surfaces are principally confined to property that is close to areas of urban housing or in town/city centres. In general, remote rural property does not suffer from this problem to any significant extent. Any incident that does occur to property in a rural setting is usually an isolated case but which, nevertheless, will require specialist expertise to deal with the problem.

Illustration 3. Graffiti application, involving a high risk to the graffitist, on a viaduct in Lanarkshire.

Illustration 4, Crookston Castle (O.S. Ref NS525627), is a good example of a historic monument in an urban setting that is regularly daubed with graffiti. The castle is situated on a mound surrounded by housing.

It is not just historic buildings and monuments that are the subject of this advice note. The special problems presented by historic surfaces are also relevant to any surface that forms part of the built heritage. The issue is not simply the effective removal of the graffiti but the preservation of the surface to which the graffiti is applied. It must be recognised that preservation of the surface will be more important than ensuring complete removal of the graffiti.

Sensitive historic or other important surfaces present particular problems when dealing with the issue of graffiti. In the case of substrates of no historic importance; such as metal and plastic materials used

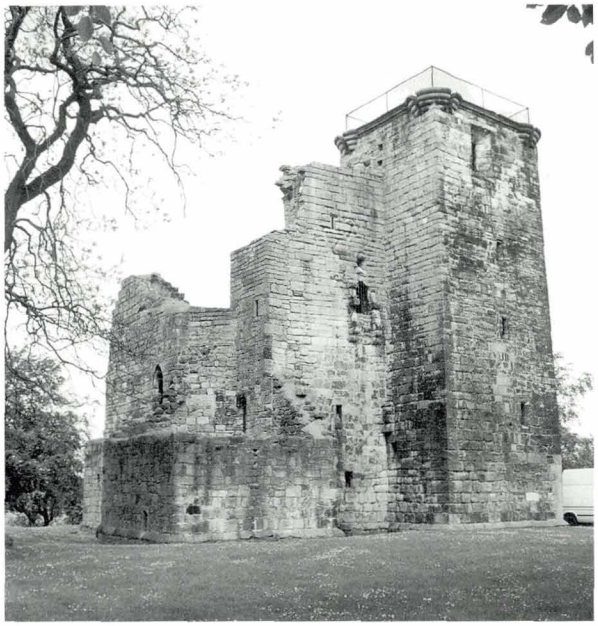


Illustration 4. Crookston Castle, Glasgow.

for railway carriages, bus shelters and the like, removal of the graffiti is the most important issue. Minor scratches and other damage to the surface can be tolerated and, in extreme cases, the material can be replaced if necessary. A historic surface cannot be replaced. Repeated attempts to remove graffiti can leave the surface in a permanently damaged condition, which may render the surface susceptible to more rapid decay than would otherwise be the case.

This publication is intended as a practical guide for those concerned with the care of vulnerable surfaces. It is based upon current knowledge and expertise drawn from a range of sources, including the expertise of the conservators at Historic Scotland's Conservation Centre. It also draws on recent research, commissioned by Historic Scotland, into the treatment of graffiti. This publication recommends procedures to be followed in the identification of graffiti, decisions on actions to be followed, trials of different removal methods, steps in the removal process and recording of results.

Whilst most of the available information concentrates mainly on graffiti removal techniques and products, it should be remembered that the presence of graffiti is the result of a number of interconnected factors. These factors include social, psychological, environmental, economic and cultural issues relating to the background of the perpetrators, acting in combination with the management policies of the property owners or managers. To tackle the graffiti problem on a historic surface requires a holistic approach; an approach that recognises that alternative or supplementary strategies to chemical or physical removal of the graffiti may be necessary to comply with good conservation practice. In many cases, total removal of the graffiti may not be the best option.

Successful removal of graffiti from historic surfaces therefore requires a balance to be achieved. The balance is between breaking the bond of the graffiti and the surface without causing damage to the surface material. This generally requires knowledge of the applied materials, the surface on which the graffito has been applied and the cleaning materials and methods that can be used. A particular problem that occurs when dealing with historic surfaces is that specialist graffiti removal contractors are often employed. Some contractors may have considerable expertise in graffiti removal, but may have little appreciation of the nature of the historic surface, or its vulnerability to standard graffiti removal procedures. Also, whilst many graffiti removal products are marketed as suitable for masonry, many may be too aggressive for use on decayed stone surfaces, or may leave harmful residues in the stone.

Removing graffiti from historic surfaces without causing damage to the surface is therefore a job for properly trained staff and, in some cases, where the surface is of special significance or in a fragile or decayed condition, the services of a professional conservator may be necessary. In general, untrained people should never attempt graffiti removal work.

1.4 The Cultural Value of Graffiti

When considering graffiti on historic surfaces, it may be appropriate to consider whether the graffiti has any cultural value in its own right. Clearly, the examples of graffiti identified in section 1.1 do have cultural value. In general terms, the older the graffiti the greater the cultural value, but even some recent graffiti may mark a historic event relating to a building, such as the closure of a building for production. Graffiti was often used to record the names of tradesmen carrying out work on a building and, as such, affords valuable clues, to the building archaeologist and persons carrying out repair work today, on past maintenance, repairs and alterations.

Some unauthorised graffiti has artistic qualities, as well as carrying social historical messages. Examples from World War Two are imagery in Abbots House, Dunfermline and murals of Polish soldiers sampling village life in Innerleithen. Not all graffiti should therefore be erased in the interests of creating a mummified impression of the past. A judgement therefore needs to be made as to whether removal of the graffiti will improve on, or detract from, cultural value. If the graffiti is to remain, it should be recorded and either left exposed or covered up again (e.g. if found behind paint or wallpaper during maintenance) in a manner that allows easy examination in the future.

A historic surface may be defined, for the purposes of this Note, as any surface that has historic or cultural significance. Such surfaces will include painted murals as well as the normal building materials.

2 GRAFFITI POLICY

2.1 Strategy

Given the sensitivity of historic surfaces and the risk of damage to the surface through ill-advised and poorly executed graffiti removal procedures, there is clearly a need for a comprehensive strategy for dealing with the problem. Recognition should be given to the fact that no solution will be able to cope with those individuals who may be determined to apply graffiti, despite the best efforts to prevent an attack. Appropriate strategies for dealing with graffiti are well established within those organisations for which persistent graffiti attacks are a major problem e.g. London Underground Ltd. These strategies will include design recommendations for choice of finishes and materials, explicit management policies and advice on materials and methods to be used for graffiti removal.

In the case of historic surfaces, the need for such an approach is obvious, but is made more difficult because it is not possible to alter the substrate material to make graffiti removal an easier and cheaper process. However, the formulation of a policy for this situation must consider the following questions. Each site should be assessed on an individual basis and a site-specific policy prepared.

- Is the attack an isolated event, or is the site subject to repeated attacks?
- How robust is the surface; can it tolerate normal graffiti removal or treatment processes or is it likely to be eroded or damaged in some way?
- Have previous graffiti removal processes already damaged the surface?
- Is rapid removal of the graffiti a priority?
- Have all hazards been identified and health and safety regulations followed?
- Has a list of approved materials and methods been prepared? The approved list may need to be supplemented to cope with special circumstances.
- Can access to the graffiti prone areas be restricted to reduce the risk of further attack?
- Is it possible to improve site security?
- Can procedures be set in place to conduct regular inspections?
- Are employees familiar with the procedures to be adopted in the event of a graffiti incident?
- Does the policy include involvement with the surrounding community?
- Is there collaboration with other interested bodies?

Most of these questions will be addressed later in the Note. However, once a policy has been prepared it is important that it is made known to all employees who may be involved in the care of the site. When a site is subject to repeated attacks there is a danger that staff may become dispirited and demotivated and thus fail to follow recommended policies for that site. It is therefore important to maintain the motivation of everyone involved in the process so that a properly considered approach is taken towards each incident.

2.2 Rapid Removal of Graffiti

It is well recognised that, in normal circumstances, graffiti should be removed quickly otherwise more graffiti will be added. Rapid removal of graffiti has been shown to act as a discouragement to the graffitist when their 'tag' is not allowed to be displayed. They tend to move on to other sites where their efforts are on more permanent view. Studies have also shown that, on sites where graffiti is evident, other anti-social activities such as vandalism, fly posting and dropping litter increase. Allowing graffiti to accumulate can therefore have a detrimental effect on the local environment. This then promotes a cycle of further attacks and may be seen as a sign that society does not care enough to act to remedy the environmental decay. A well-maintained environment is therefore an important factor in an anti-graffiti policy.

In the case of a historic site, the presence of graffiti may be considered to be even more unacceptable than on less culturally significant properties, making the need for a rapid response to the problem a priority issue in the minds of the property managers. As with any anti-graffiti policy, the physical symptoms of neglect should be removed quickly. Litter, especially that which signifies that drunks and drug addicts have used the area, and the 'tools' of the graffitist's trade should be cleared away. However, the presence of empty paint-spray cans and the like can provide useful evidence for the conservator in identifying the graffiti

materials used. The graffiti policy should thus encourage maintenance staff to retain these items and to note the location in which they were found.

It is at this point, however, that a conflict arises between the need for rapid removal of the graffiti to discourage further attacks and the conservation needs of the historic surface. The conservation policy should make it clear that no action to deal with graffiti will take place until a full assessment of the site has taken place. The preservation of the surface will be the primary concern in most cases. If the maintenance staff is not fully conversant with the policy and, having done its bit in reporting the incident, staff may assume that because immediate action to remove the offending graffiti has not been taken its good work has been ignored. This may lead to a failure to report further incidents. The policy must also recognise that any delay in removing paint-type graffiti will increase considerably the difficulty of its removal. Most paints that have been exposed for a number of weeks or months will have completed their hardening processes and will thus have reduced solubility in removal chemicals, making the graffiti much more difficult to remove. A balance has therefore to be struck between rapid removal to reduce the possibility of further attack and allowing sufficient time to investigate the incident to permit the most effective approach for dealing with the problem to be implemented.

2.3 National and Local Policies

Given the desirability for anti-graffiti action to be taken within a well defined policy, a recent approach to the major urban local authorities and other bodies in Scotland yielded the rather surprising conclusion that graffiti removal from historic surfaces, or important public buildings, was treated in basically the same manner as graffiti removal from any other surface. None of the authorities approached had a written policy for dealing with graffiti on public or historic buildings and the general view was that this is not a significant problem. However, there was a general reluctance to use chemicals to remove graffiti, perhaps as a result of the well publicised problems of the damage caused by chemical cleaning of sandstone buildings in Scotland. Some authorities were using abrasive methods to remove graffiti from stone. The issue of dealing with repeated attacks on the same surface had not, generally, been considered.

This view from local authorities is not surprising. In the context of the battle against graffiti and other forms of vandalism, the number of historic sites attacked is comparatively small and the scale of each attack tends to be limited. Most authorities do not have the technical expertise available to cater for the special needs of historic surfaces and, consequently, there is perhaps a tendency to underestimate the nature of the problem. A further consideration is that the majority of important urban buildings are held in private ownership and are therefore not the responsibility of the local authorities. The natural reaction of the owners of such buildings is to instruct a cleaning contractor to effect removal of the graffiti as soon as possible. The owners are unlikely to be aware of the risk of damage to vulnerable stonework.

2.4 Monitoring and Records

An integral part of a graffiti policy is regular and frequent inspections of sites that are vulnerable to graffiti attack. This poses a particular problem for historic sites that are permanently open or accessible to the public and which do not have a caretaker on site. In such cases maintenance inspections are likely to be carried out, if at all, on a regular but relatively infrequent cycle which may be months or even years apart. The policy should therefore include for regular monitoring. The period between inspections will be dictated by the vulnerability of the site to attack and the policy should therefore recognise the unique nature of each site in determining the frequency of inspections. The frequency may range from daily at frequently attacked sites to weekly, monthly or even longer at less vulnerable sites. However, within the policy, recognition should be given to particular periods of high risk such as school holidays and during the winter months when darker evenings offer a degree of anonymity to vandals. At these times the location, layout and nature of many historic buildings, when taken together with an unmanned site, offer a convenient, sheltered and secluded meeting place for the youth of the surrounding area.

Evidence indicates that historic sites are unlikely to be a priority site in any planned graffiti attack within a neighbourhood. Generally, historic surfaces are not the best surfaces on which the graffitist can express his 'art'. They tend to be rough textured, do not present a large homogeneous surface and may not be the most publicly visible sites in the vicinity. For this reason, it is usually, but not always, the case with historic buildings that graffiti takes the form of an opportunist attack, expressed as relatively small scale daubing or scratching. There are, within an urban neighbourhood, more interesting sites for concentrated and large-scale attack. Whilst an attack may be small in scale, a large variety of marking materials are likely to be used. Inspection staff must therefore recognise that, even if an attack on a historic surface is very minor in relation to graffiti attack on adjacent property, the incident should be recorded and reported in an appropriate way.

Record keeping is an important aspect of graffiti policy. It is only through accurate records that the

nature and frequency of attacks can be established. Individual stones and other materials that have been attacked are identified and the details of past intervention and its results, whether for good or ill, are available to aid the decision making process.

2.5 Community Involvement

Community involvement is recognised as an important aspect of any anti-graffiti policy and can help to reduce the incidence of graffiti by encouraging people to develop a sense of ownership of the area, including the historic site. If a site is seen as belonging to some remote authority, for example the Government, and there is no local involvement in the care of the site or monument and the significance of the site or monument is not made apparent to the local youth, then there is an increased risk of attack. The 'place' of the site or monument within the community should be established, perhaps by a programme of information and education through local schools and community centres. However, it is desirable that this is undertaken as part of a larger programme by working with all the other bodies who might be involved in tackling vandalism and graffiti in the area. This will include regular and effective contact between all parties involved in the anti-graffiti initiative.

2.6 Site Assessment

A graffiti-prevention policy should include an assessment of each site. It is likely that the owner of a historic building or monument will have existing records, including drawings and photographs. These records will have been prepared with a view to the conservation needs of the site and are unlikely to have been prepared with graffiti control in mind. These records, where they exist, may need to be augmented by additional information relating to the need to control the graffiti problem. A site assessment, for graffiti control purposes, may therefore include the following details:

- The location of the site within its immediate environment, including its proximity to residential areas from which the local youth who are creating the problem are most likely to reside.
- Identification of the local schools, both primary and secondary, and community centres with the names of contact persons regularly updated.
- Names and addresses of other local groups and organisations involved in a common anti-graffiti initiative. This will typically include the relevant local authority departments, community councils, community police, housing agencies, public utilities and transport companies.
- The parts of the building which are attacked and the frequency of attack.
- The nature, type and condition of the stone and other materials that have been subjected to graffiti attack. Note any alteration to the material as a result of previous graffiti removal processes.
- Details of how and when access to the site is obtained.
- The form of graffiti (type of applied materials and/or scratching, carving etc.).
- Occurrence of 'tags' from which, in collaboration with local groups, it may be possible to identify the graffitist. A photographic record is useful both as a form of evidence and for comparison with graffiti from subsequent attacks. This is also useful for comparing the condition of the surface before and after treatment.
- The general condition of the site. Note the type and extent of any litter and areas that have been used as 'meeting points' for smoking, drinking, drug taking etc. The relationship of these areas to graffiti sites may show a correlation and may thus inform the graffiti-prevention policy for the site.

2.7 Conducting Trials

In the treatment of any graffiti incident on a historic surface, the policy should require that, where removal is judged to be the most appropriate strategy, small-scale trials be conducted on each graffiti material and on each substrate material so that the least aggressive and damaging cleaning materials and techniques can be found. The trials should be conducted on small, inconspicuous areas that are representative of both the substrate and the graffiti materials. In the case of a major incident, a mock-up may be constructed which, as far as possible, is representative of the substrate and the graffiti. This will permit the testing of the larger scale removal systems that are likely to be employed in such a case. The sample area or areas should be retained until the contract has been completed.

The policy should include a statement that complete removal of the graffiti may not be necessary, or even desirable, in many cases. Attempts to achieve removal of the last traces of the graffiti are likely to be damaging to the historic surface. In the trials there should be established an agreed level of 'cleanliness' which should be accepted by all the participating parties. In situations where the substrate material is particularly important and fragile or the graffiti material is not identifiable by normal site inspection processes, more sophisticated laboratory investigations may be required. The possible requirement for laboratory analysis should also be identified within the policy.

Illustration 5. Loss of sandstone surface by over aggressive graffiti removal.

Detailed records should be kept of all materials and methods used to achieve the desired level of graffiti removal. This will form a valuable reference source both in the execution of the main cleaning operation and in the event of subsequent attacks in the same area.

2.8 Extent of Cleaning and Listed Building Consent

The extent to which a surface should be cleaned to remove graffiti can be a complex decision. The issues to be considered will be:

- Should the cleaning be confined to the removal of the graffiti only?
- Should the cleaning be extended over the whole area of each stone or individual element of material which has been affected?
- Should a larger area of wall be cleaned to avoid a 'patchwork' effect?
- Should the graffiti be left untouched?

These questions are particularly significant where graffiti has been applied to historic or other important stone buildings and monuments. In Scotland, under the terms of the Town and Country Planning (General Permitted Development) (Scotland) Order 1992, there is a requirement, in some cases, to obtain either listed building consent or planning permission for stonecleaning. The order states that stonecleaning is not a permitted development where the building is listed or within a conservation area. Therefore all proposals to stoneclean listed buildings require listed building consent or, in the case of unlisted buildings within a conservation area, planning permission. Clearly, if it is decided that a larger area of a building has to be cleaned then the above requirements must be recognised. It will be a matter for the local authority concerned to decide whether or not listed building consent or planning permission will be necessary under these circumstances.

In addition, there is the need to obtain Scheduled Monument Consent for graffiti removal from monuments that are scheduled, because the appearance and character of the building may be affected. Listed Building consent would not normally be required for removal of small graffiti as this would be regarded as building maintenance. Anti-graffiti coatings which change the sheen and patina of stonework may also require consent.

Where graffiti is applied to a scheduled monument, Historic Scotland and the police should be informed, and no attempt should be made to remove it without the prior written consent of the Secretary of State for Scotland. It is a criminal offence to apply graffiti.

Illustration 6 is an example of ill-considered large scale cleaning to remove a comparatively small area of graffiti. In this case, the building façade has been left with two highly contrasting levels of soiling which have a significant effect on the aesthetics of the building. In addition, the over aggressive cleaning has removed the surface patina and opened the pores of the sandstone, creating the potential for more rapid decay than might otherwise have been the case. A large pristine, light coloured stone surface offers an attractive 'canvas' for the graffitist.

Illustration 6. Part cleaning of a sandstone façade.

Illustration 7. Graffiti cleaned from soiled sandstone around 30 years previously.

Conversely, cleaning the graffiti only from the surface of a previously soiled stone will produce a clean area of stone that reflects the area covered by the graffiti. The effects of this approach will mean that although the applied material has been removed, the imprint of the graffiti will remain visible for many years due to the contrast between the soiled and cleaned areas. Illustration 7 is an example of just such an effect. The original graffiti, which was applied by students during a campaign for the election of a Rector, was cleaned circa 30 years previously but the imprint is still sharply defined. In this type of situation, the least visually obtrusive approach may be to clean gently the whole stone without necessarily trying to remove all traces of the paint. The stone will still contrast with the surrounding masonry but in a less obtrusive way. The stone will gradually resoil over time thus reducing the contrast effect.

However, it is the case that most graffiti is applied to surfaces that are relatively free from surface soiling as this will heighten the effect of the graffiti. In this case, the best approach may be to remove gently the graffiti material only without causing staining or bleaching of the substrate material. This approach is shown in Illustration 8 where some residual graffiti may be seen. This exemplifies the minimalist approach that is recommended for sensitive surfaces. However, after graffiti has been cleaned it is still possible that stained or lighter coloured areas defining the original graffiti may result. To reduce this effect, further gentle cleaning adjacent to the graffiti afflicted area can blur the edges of the zone and reduce the visual impact of the damaged surface.

Before any decision is made to clean-off graffiti, it should be recognised that many applied types of graffiti will eventually fade or fall away from the surface of the material, especially those surfaces exposed to the external environment. Some dyes, for example, will fade within weeks in direct sunlight. The policy should therefore recognise the transient nature of applied materials when taken in the context of the life of a historic building, and that damage to the surface is more likely from attempts to remove the graffiti than from the graffiti itself.

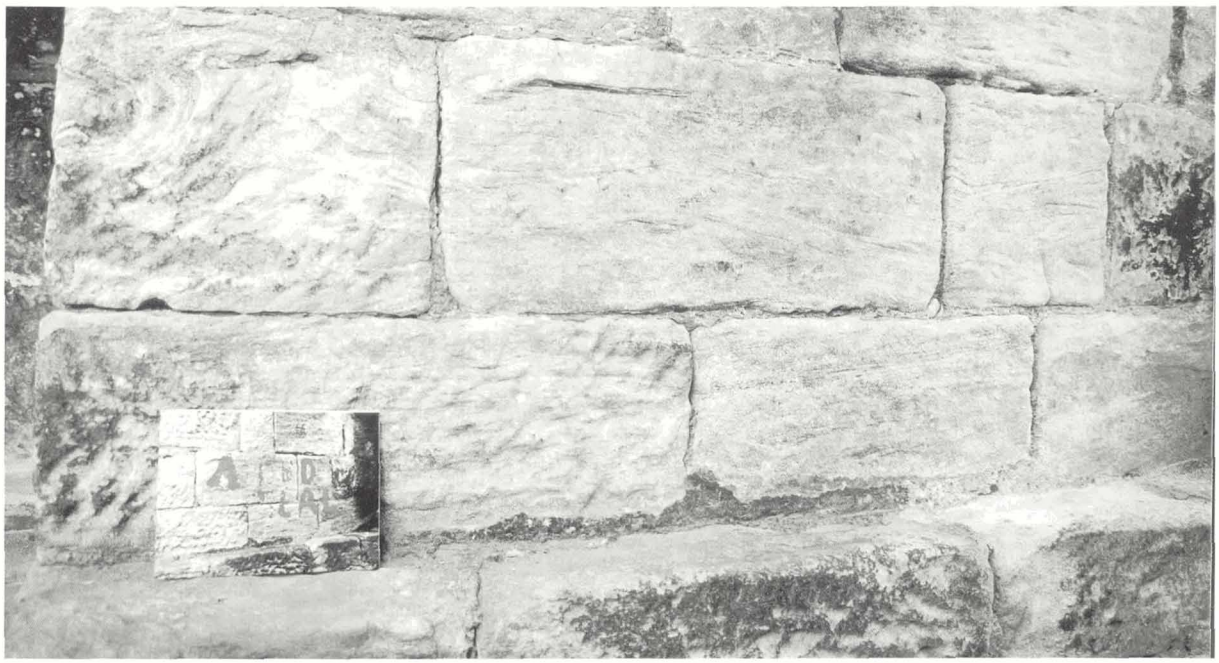


Illustration 8. Graffiti removed from an historic sandstone surface. The inset photograph shows the graffiti before removal. Complete removal was not attempted and some residual paint remains after cleaning. (Crookston Castle)

3 TYPES AND CONDITION OF HISTORIC SURFACES

3.1 Classification of Historic Surfaces

The historic substrate must be accurately identified if the most appropriate method of removal is to be employed. Knowledge of the type and condition of the surface on which graffiti is applied is a vital prerequisite to the selection of the removal method because, as stated previously, many graffiti removal materials and procedures can be damaging to historic surfaces, by physical and chemical mechanisms. The more detailed the knowledge of the surface, the more accurately the removal procedure can be tailored to the needs of the substrate material. For example, if oil-based graffiti were applied to an oil-based paint layer, great care would be required when removing the graffiti to ensure that no damage was caused to the painted surface by solvents in the paint remover. Many solvents contained in proprietary graffiti removers are capable of softening painted substrates or leaching out colour. The roughness and permeability of the surface also affect ease of removal.

The essential characteristics of a substrate material are as follows:

3.1.1 Permeability and porosity

This is the ability of the surface microstructure to permit the penetration of pigments, dyestuffs and oil based materials. Materials that are porous have a poor resistance to graffiti penetration and, once the graffiti material has penetrated the surface, it is very difficult to remove. Some materials, even when apparently hard, smooth and non-porous may have considerable surface permeability. Good examples of such materials are granite and gloss and emulsion paints. Capillary absorption of graffiti paints, dyes and cleaning chemicals will be affected by the pore characteristics of the substrate rather than the total porosity. Granite, for example, is a hard dense stone with a low porosity, but the exposed face will contain many interconnected fine capillaries as a result of micro-cracks between the grains. Granite can thus absorb fluids, such as the solvent in felt marker pens. This has been found in recent research to penetrate almost twice as deeply into granite as into a porous sandstone. The porosity of granite is typically 1.5% whereas the porosity of the sandstone in question was 25%.

Illustration 9. Decayed sandstone showing increased damage because of attempts to remove graffiti paint. The undamaged surface is an area of plastic repair.

3.1.2 Hardness

This reflects the ability of a material to resist scratching, gouging or abrasion, from both the graffiti and the removal processes. In Scotland the most common historic surface affected by graffiti is sandstone, which is generally not sufficiently hard or coherent to resist this form of attack. A surface which is decayed and friable will be permeable to graffiti pigments and dyes. Graffiti removal from such a surface is almost impossible without further damaging the substrate material. Illustration 9 shows an example of decayed sandstone with a graffiti application. In this case, attempts to remove the graffiti have caused significant damage to the stone surface.

3.1.3 Roughness

The roughness or surface texture of a material may have an important bearing on the likely success in removing graffiti. Rougher surfaces may provide a better key for paint than smooth surfaces and make the graffiti more difficult to remove. The roughness, or texture, of a surface can be difficult to describe accurately and, in the context of graffiti removal, a surface may appear smooth to the touch but on examination under a microscope, surface roughness

may become obvious. The following tables should therefore be read with this distinction in mind. However, if the material is essentially hard and smooth to the touch, it is likely that it will be more easily cleaned than an obviously rough textured surface. Highly accurate instruments are available to measure the magnitude of surface roughness. They are laboratory based and thus require a surface cast to be made if measurement is required. These instruments are not suitable for use with highly irregular or rough surfaces. In most cases, the use of sophisticated equipment of this nature would not be justified, unless the artefact is of major importance and cleaning will be undertaken in a conservation laboratory.

3.1.4 Reactivity with or resistance to chemical agents

Surfaces which are permeable or decayed will generally have a high absorbency of chemical cleaning agents. The cleaning agents are likely to be retained within the surface of the material for some considerable time. This is particularly true for sandstone and other porous masonry materials. Water rinsing can reduce the extent of chemical penetration. However, great care must be exercised when the surface is in a decayed or otherwise fragile condition, as even gentle water rinsing is capable of removing loosely attached surface materials. Surfaces, especially masonry surfaces, may also be classified in terms of their resistance to acids and alkalis.

Graffiti attack is frequently not a one-off phenomenon. It is unfortunately the case that some sites are prone to repeated attacks and therefore may be subject to repeated cleaning. Under these circumstances, the treatment of graffiti should not be considered simply in terms of its removal, but on a wider and more holistic basis. Such an approach is discussed in Chapter 7.

A surface that is capable of offering resistance to the effects of repeated cleaning without damage must be:

- Smooth with a glazed finish.
- Impermeable.
- Hard, to resist scratching.
- Resistant to the action of chemical agents.

A surface that is vulnerable to damage to cleaning will exhibit one or more of the following characteristics:

- Have a rough texture or be highly profiled.
- Be highly permeable.
- Be soft.
- Be reactive to applied chemicals.

The above characteristics have to be considered in the context of historic surfaces and the need to recognise the intrinsic cultural value of the surface. Historic glass within a window or medieval glazed wall tiles, for example, whilst notionally falling into the category of offering resistance to repeated cleaning, must be regarded as vulnerable surfaces and require careful treatment to ensure their preservation. Table 1 provides some guidance on the potential difficulties in removing graffiti from a range of material types. The table refers to surfaces in sound condition. In the case of a surface in a decayed or friable condition, the surface porosity or permeability will be increased and graffiti removal rendered more difficult than indicated.

3.2 Criteria for Graffiti Removal from Historic Surfaces

Many graffiti cleaning processes have resulted in irreversible damage to the surface. Loss of historic surface may be the result of inappropriate cleaning

Porosity	**Ease of Removal**	*becoming increasingly more difficult* →				
Very porous material	***Very Good***	***Good***	***Fairly good***	***Fairly Poor***	***Poor***	***Very Poor***
						Plaster
						Soft mortar
					Sandstone	
				Marble	Limestone	Paint (gloss, emulsion)
					Common brick	
				Timber		
					PVC	
			Engineering brick	Granite		
	Polyurethane lacquers	GRP		Concrete		
	Ceramic tile					
Non porous material	Glass	Stainless steel	Aluminium Cast & Wrought iron			

Table 1. A general guide to the relative porosity and ease of removal of paint and permanent marker types of graffiti from different materials. Note: The vertical position of a material in the table provides a rough indication of its porosity. The higher the rank position of the material is its porosity.

materials and systems as well as from a lack of skill and experience by the operatives. Significant loss of material or other changes to the surface are not acceptable in the case of a historic surface. Amoroso and Fassina (1983) have drawn up a set of criteria for the selection of cleaning techniques for natural stone. These criteria have been adapted and are applicable to graffiti removal from all historic surfaces.

- They must not cause direct or indirect harm to the surface concerned.
- They must allow the widest possible preservation of the noble patina [1].
- They must not generate by-products which, remaining within the material, may affect the future preservation (e.g. soluble salts).
- The pressure, speed and concentration must be controllable so that the operator can adjust and interrupt the cleaning instantaneously.
- Remove graffiti material only to the point where further cleaning will damage the surface and accept any residual graffiti.

Removal methods must be determined for each individual case, especially where historic or artistic values are at stake. For less important, utilitarian surfaces less stringent criteria may apply.

Other factors, identified by Amoroso and Fassina, to be considered are:

- The chemical, physical and mineralogical (where appropriate) structure of the material.
- State of decay.
- Type of pre-existing soiling or patina present and the effect that graffiti removal will have on these.
- The cost factor, the time required and the availability of appropriately skilled workers.

Where an important historic surface is involved, the cost factor can be considered to be of secondary importance to the preservation of the surface.

3.3 Types of Surface

Graffiti can be encountered on any material found in buildings and other structures. The range of these materials is therefore extensive and it is beyond the scope of this Note to explore the problems associated with graffiti removal from this broad range. The materials covered are therefore those found in historic buildings that are most likely to be affected by graffiti.

1 Noble patina is defined here as the patina formed as a result of natural weathering process and is thus part of the fabric of the material.

In this context, the materials most likely to be affected are masonry materials, timber, metal and glass. The term 'masonry' is used as a generic term to encompass all types of natural stone, fired clay materials (brick, tiles, terracotta), concrete, mortars, plasters and renders.

Stone and brick structures present additional problems because of the lack of homogeneity in a wall due to the presence of mortar joints. It is frequently more difficult to remove graffiti from the joints than from the stone or brick.

3.3.1 Sandstone

Sandstone is the most common structural material encountered in historic buildings in Scotland. Many of the structures in the care of Historic Scotland, whether ruinous or intact, and much of the built heritage of our towns and cities are constructed from sandstone, of a variety of types, obtained from a large number of quarries. Most of these quarries are now closed and many have disappeared completely. The variety of sandstone types that are likely to be encountered, and the differences in their characteristics, means that stones will vary in permeability and thus in their ability to absorb graffiti pigments and dyes and cleaning chemicals. In many urban situations, the quarry from which the stone was extracted is known and it may be possible to determine the properties of the stone (such as porosity) from existing sources. If the type of sandstone cannot be properly identified, it will be necessary to proceed with caution.

The majority of sandstones consist of grains of quartz, a crystalline form of silica, (SiO_2), cemented together by silica in a less well crystallised form. The sandstones found in Scotland can vary in porosity and therefore in permeability, ranging from a porosity of virtually zero up to about 30-35%. Values are commonly in the range 15-25%. As well as being variable in terms of porosity, the mineral composition will vary between different sandstones. Many different minerals can occur as cement in sandstones. The most common cement types are quartz (silica), clays, calcite, dolomite and iron oxides. Any one sandstone can contain a number of different cements deposited at different times as the chemistry of the pore waters changed.

It is important therefore to understand the nature of the sandstone before attempting to remove graffiti from its surface. Apart from quartz, which is a stable mineral, the other cementing materials may react in different ways to the application of chemical cleaning materials. Clay minerals can adsorb cleaning fluids and some are capable of expansion and contraction as they adsorb and release moisture from their structure. Calcitic and

dolomitic cements are acid-sensitive and may be adversely affected by acid-based cleaning fluids and gels. Ferruginous (iron-rich) cements are commonly red in colour. The iron-rich cement may be present as only a thin coating on the surface of the detrital grains. Despite their sometimes deep red colour, for example Locharbriggs sandstone, the iron oxide content is usually only a few percent.

Over aggressive chemical cleaning can change the colour of the sandstone substrate. The stone may take on a bleached appearance due to the dissolution and removal of iron oxides from the immediate surface zone. Alternatively, cleaning may result in the deposition of iron-rich minerals at the surface producing an effect similar to iron staining.

Graffiti removal from sandstone surfaces must therefore proceed with great caution. In general terms the characteristics of a sandstone substrate are those that render the surface vulnerable to damage. The option to apply strategies other than removal may need to be considered in circumstances where unacceptable damage may be caused to the stone surface.

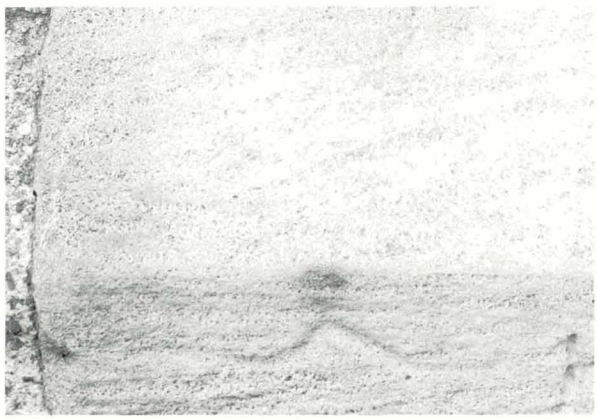


Illustration 10. Graffiti removal from sandstone showing loss of iron-rich minerals and 'bleaching' of the surface.

Characteristic	Comment
Texture	Rough. Degree of roughness depends on grain size.
Permeability	High.
Hardness	Variable depending on surface condition. Total hardness range 3 to 7 Mohs[2] hardness. Vulnerable to damage from grain loss and scratching.
Surface reactivity	Variable depending on mineral composition. Calcareous sandstone acid-sensitive.

Table 2. Summary of characteristics of sandstone surfaces.

2 Moh's hardness is a hardness scale that ranges from diamond, with a hardness number of 10 to talc with a hardness number of 1.

3.3.2 Limestone

Limestone is not a common building stone in Scotland, where only a very few buildings are constructed from limestone. The material is, however, sometimes encountered in monuments and carvings, either on its own or in combination with other stone types. Illustration 11 is an example of a limestone monument on a granite base. In this case, both the limestone and granite have been subjected to graffiti attack. The limestone has been subjected to previous stonecleaning intervention that has left the stone surface in a roughened condition. This increased surface roughness will increase the difficulty in removing the graffiti without causing further damage to the surface. The difficulty entailed in graffiti removal from decayed limestone is exemplified in Illustration 12.

Limestone is a sedimentary rock deposited from solution in water (including chemically precipitated material) composed principally of calcium carbonate or, in the case of magnesian (dolomitic) limestone, the double carbonate of calcium and magnesium. The original deposited materials consisted of loose, uncemented particles that have been cemented together to form the rock. Water carrying calcium carbonate in solution is the chief cementing agent. Limestones can vary considerably in both colour and composition. All limestones are therefore acid-sensitive.

Illustration 11. Graffiti attack on limestone and granite monument. Note the greater variety of graffiti marker types used on the granite.

Illustration 12. Graffiti on decayed limestone surface.

Generally, limestone used in buildings has a lower porosity than sandstone, although the total porosity can range between 5% and 20%.

Characteristic	Comment
Texture	Rough. Degree of roughness depends on extent of surface erosion.
Permeability	High.
Hardness	Variable depending on surface condition. Total hardness around 3 Mohs hardness. Easily scratched.
Surface reactivity	Acid-sensitive.

Table 3. Summary of characteristics of limestone surfaces.

3.3.3 Granite

Granite is an important stone in the built heritage of Scotland where it is used as the principal building stone in the north east and south west of the country. In addition, granite has been used as base courses, plinths and decorative features on many sandstone buildings and monuments. The generally dense, smooth surface of granite tends to encourage the application of graffiti in vulnerable locations.

A number of different igneous rocks are encountered in the walls of historic buildings in Scotland and it is common for a number of similar rock types to be referred to under the broad definition of 'granite', although they may not conform to the strict geological definition of the term. Usually, the term 'granite' is used for light-coloured, coarsely grained rocks and 'basalt' for dark-coloured, fine textured rocks that have a porosity similar to granite. Whinstone, which is a basalt or dolerite is occasionally found in buildings in Scotland. Granitic rocks encountered in buildings are therefore light-coloured, medium to coarse-grained and are predominantly composed of quartz, feldspar, mica

Illustration 13. Graffiti attack by aerosol spray paint on a city centre granite structure.

and other minerals in varying proportions. In comparison to sandstones and limestones, granites have a low porosity in the range 0.5% to 1.5%. The quartzes and feldspars present determine the hardness of granite, with a Mohs hardness range between 6 and 7 (Winkler 1994). Granite is therefore a hard, low-porosity stone.

Granitic stones are, however, not immune to the effects of graffiti or to the attempts to remove the graffiti, and considerable damage can result from repeated cleaning of graffiti from granite. A good example of the damage caused to granite by repeated graffiti removal is shown in Illustrations 14 and 15.

Whilst granite is a low-porosity material, the action of weathering, decay and the working of the stone surface affects the structure of the granite at the exposed surface. Crystalline rocks are an interlocking mosaic of well-formed crystals. The grain boundaries are the planes of weakness and the action of the above agencies results in the formation of micro-cracks at the grain boundaries. The surface of granite can therefore be in a weakened state due to weathering of potash feldspars, opening of grain boundaries and intense micro cracking. As a result of these actions, the surface zone of weathered granite can be highly permeable to the penetration of dyes and solvents. Complete removal of graffiti from such a surface, without causing damage to the surface, is likely to be extremely difficult.

A distinction must be made between normal dressed granite and polished granite. A smooth newly polished granite surface is comparatively easy to clean because the ability of dyes and paint vehicles to penetrate into the grain boundaries is greatly reduced (Weaver 1995). However, both strong alkalis and strong acids can damage the polished finish.

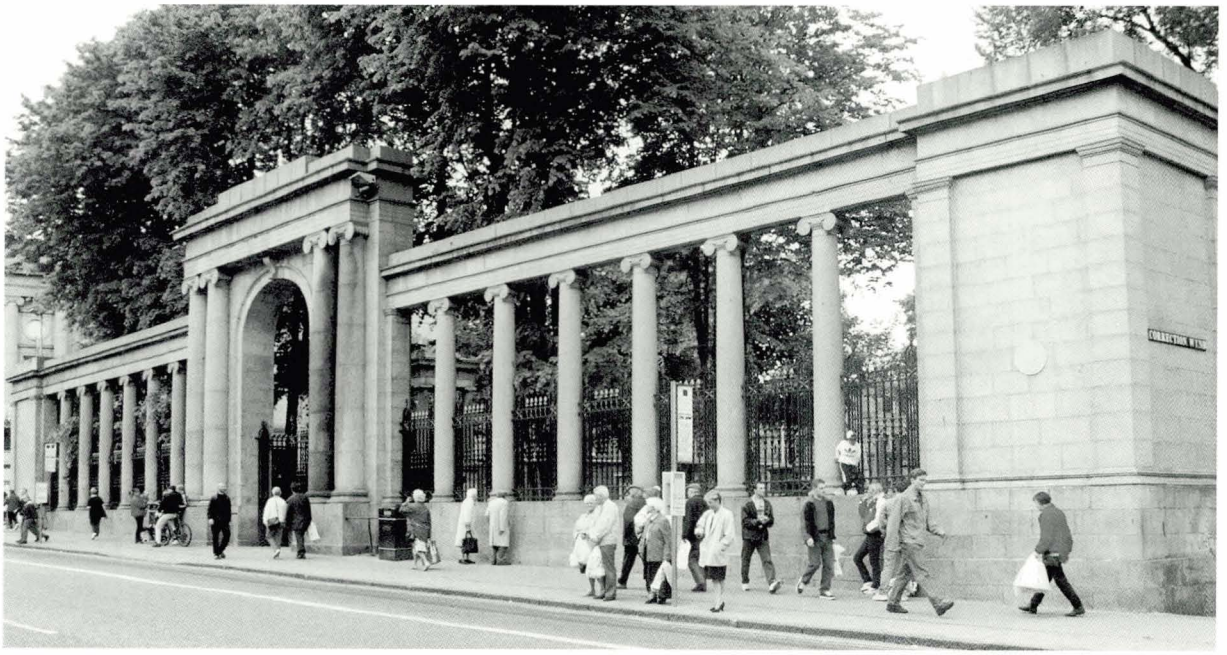


Illustration 14. The John Smith Screen, Union Street, Aberdeen (1829). The screen separates St Nicholas Church Yard from Union Street and is centrally positioned on the main shopping thoroughfare in Aberdeen. Note also the siting of the bus stops, which act as a meeting place for youths.

Characteristic	Comment
Texture	Polished granite. Smooth Dressed granite. Rough. Degree of roughness depends on tooling and extent of surface erosion.
Permeability	Polished granite. Low Dressed granite. High surface permeability, very high on weathered surfaces.
Hardness	Variable depending on surface condition. Total hardness 6 - 7 Mohs hardness.
Surface reactivity	Non acid-sensitive but loss of polished finish from application of strong acid and alkali based cleaners.

Table 4. Summary of characteristics of granite surfaces.

3.3.4 Marble

In Scotland, marble will be found as thin panels on walls, as floor and wall tiles and as sculpture.

Marble is a crystalline metamorphic rock composed predominantly of one or more of the following minerals: calcite, dolomite, or serpentine. Marbles have a densely packed structure as a result of pressure and heat during formation with a minimum of available pore space as a consequence. The normal porosity range for marble is 0.5% to 2.0%. The hardness of marble is similar to limestone, around a Mohs hardness of 3. It is therefore a relatively soft stone that is easily scratched.

Although the porosity of marble is low, the surface of marble tends to be highly permeable to graffiti dyes

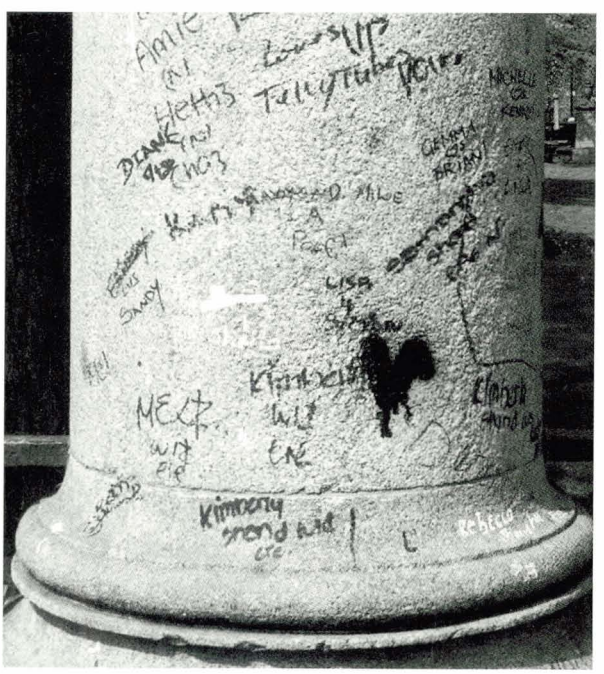


Illustration 15. Typical graffiti on a column base. Note the variety of materials applied. The roughened texture of the granite surface is apparent as the result of repeated cleaning.

and pigments. Like all stones, marble will weather and decay over time. This is a complex process and the result is that most crystalline marbles form micro-cracks readily and rapidly from the surface inward (Winkler 1994). Moisture movement in the stone, like that in sandstone, may lead to the development of a thin surface shell with a weaker zone underneath. The surface of marble is therefore porous to graffiti dyes and pigment vehicles and to cleaning fluids.

Characteristic	Comment
Texture	Generally smooth for fine grained marble found in buildings and monuments.
Permeability	High.
Hardness	Relatively soft. Total hardness around 3 Mohs hardness. Easily scratched.
Surface reactivity	Acid-sensitive. Polished surfaces may be damaged by strong alkalis.

Table 5. Summary of characteristics of marble surfaces.

3.3.5 Bricks, terracotta and faience

Bricks

Whilst the traditional masonry material in Scotland is considered to be natural stone, predominantly sandstone, it is also the case that the use of brick (fired clay) dates from at least the mid seventeenth century. Brick may therefore be regarded as a traditional building material, although most examples are more recent.

Brick is generally a porous material, although the difference in porosity between bricks can be high. For example, the porosity of a Class A engineering brick will be around 3% and can be as high as 50% for some common bricks. In addition, the surface texture can range from glazed to very rough.

An important consideration when dealing with graffiti removal from brickwork, especially historic brickwork, is the high ratio of mortar to brick surface. In general terms, the mortar will be softer and more porous than the brick and this will thus present significant problems in removing graffiti. Graffiti removal from soft porous bricks will be difficult and it is unlikely that complete removal of the graffiti will be possible without damage to the brick. In the case of dense, vitrified bricks with a glazed finish, the results of graffiti removal are likely to be more successful.

Characteristic	Comment
Texture	Common and facing bricks. Rough and may be crumbly. Engineering. Rough to semi-smooth.
Permeability	Common and facing bricks. Generally high. Engineering. Low or fairly low.
Hardness	Common and facing. Soft or medium-soft depending on degree of weathering. Some easily scratched. Engineering. Medium-hard. Not easily scratched.
Surface reactivity	Non-acid sensitive. Glazed brick – acid-sensitive.

Table 6. Summary of surface characteristics of brick.

Terracotta and faience

These are moulded clay products manufactured from fine, pure clays mixed with other materials such as sand and pulverised fired clay. The products are usually well vitrified and are thus harder and more compact than most bricks. They also possess a sharpness of detail not normally associated with brick. Faience often refers to units with a glazed finish. The natural finish to terracotta is a fireskin, which is a hard, thin, vitreous, unglazed skin. Damage or loss of the fireskin is the most common form of deterioration and, whilst the fireskin remains intact, the surface is relatively impermeable. In the case of glazed finishes, these can become pitted and powdery as they weather.

Graffiti applied to these surfaces can therefore present a range of difficulty in its removal, from fairly good in the case of an intact glazed finish to very poor in the case of terracotta that has lost its fireskin.

There are relatively few terracotta and faience buildings in Scotland, mostly dating from the late nineteenth and early twentieth century. A patent form of terracotta, Coade Stone, was used in the late eighteenth century. Faience, in the form of thin cladding, continued to be used in the frontage of buildings such as shops, cinemas etc. until the 1930's.

Characteristic	Comment
Texture	Terracotta. Semi-smooth. Faience. Smooth to semi-smooth. Glaze can become pitted and powdery from weathering.
Permeability	Terracotta. Generally low when fireskin is intact. Faience. Low.
Hardness	Terracotta. Medium-hard when fireskin intact. Faience. Medium-hard. Not easily scratched.
Surface reactivity	Terracotta. Non-acid sensitive. Faience. Strong acids and alkalis can damage glazed surface.

Table 7. Summary of surface characteristics of terracotta and faience.

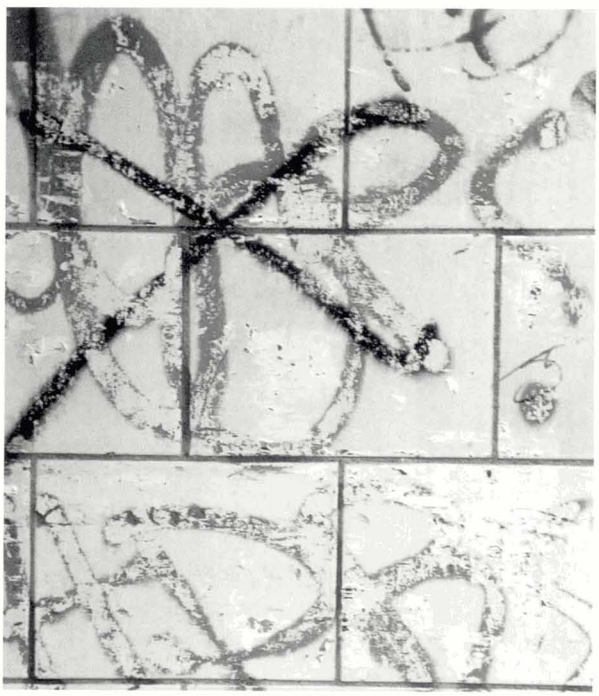


Illustration 16. Graffiti on faience and remains of fly-posters.

3.3.6 Mortars, renders and plasters

Historic mortars, renders and plasters are invariably lime based. They are therefore soft and porous materials that present major problems when graffiti has been applied. The high porosity of these surfaces means that graffiti dyes and pigment vehicles can penetrate quite deeply below the surface. Even the action of applying some forms of graffiti can cause permanent damage to the surface. The surfaces are particularly sensitive to damage by scratching or gouging. It is unlikely that graffiti can be removed from these surfaces without causing further irreversible damage to the surface. Where graffiti has been applied to lime-washed surfaces, the best strategy for dealing with graffiti may be the application of further washes, using the same mix as the original wash, after preliminary cleaning of the surface to reduce the intensity of the graffiti.

The area of exposed mortar joints on some types of masonry walls can be quite high in relation to the area of brick or stone. As the graffitist does not usually discriminate between materials when applying paint materials, removal of graffiti from two different porous surfaces adjacent to one another will require careful consideration and a willingness to accept that the degree of removal is unlikely to be the same for the two materials.

From the late nineteenth century, smooth renders and stuccos utilising Portland Cement were in common use. The smooth nature of these surfaces can be attractive to the graffitist and, in vulnerable situations, can display a full range of graffiti materials. Portland Cement based mortars are harder and less porous than lime based mortars but will still permit relatively deep penetration of dyes, pigments and cleaning solvents, making removal a difficult task.

Illustration 17. Aerosol spray-paint on harled surface of a listed building. Removing the graffiti in this case is made more difficult by the continuation of the graffiti onto the granite window margin.

Textured renders known as harling, roughcast or wet-dash are common on historic walls in Scotland. Whilst the surface is irregular and rough, such surfaces are, however, attractive to the graffitist as they present a large uniform area free from joints. The generally white or light coloured finish provides a good contrast for the graffiti materials. This type of surface, like other rendered surfaces, is highly permeable to graffiti dyes and pigment vehicles, thus complete removal of the graffiti is very difficult to achieve. The most usual form of graffiti on harled surfaces is by aerosol spray-paint.

Characteristic	Comment
Texture	Rough. Frequently powdery and friable.
Permeability	High. Deep penetration of dyes and pigments and cleaning solvents.
Hardness	Soft. Easily scratched. Gentle brushing with a soft brush may cause surface loss on friable surfaces.
Surface reactivity	Acid-sensitive.

Table 8. Summary of characteristics of mortar and plaster surfaces (Lime and Portland Cement based).

3.3.7 Concrete

Mass concrete has been used in Scotland since the early nineteenth century and reinforced concrete from the early twentieth century. A number of listed buildings and structures, including some from the Second World War, are constructed from concrete.

Concrete surfaces may vary considerably in permeability and therefore affect the extent to which marking agents and cleaning solvents can penetrate into the surface. Most normal concrete surfaces may therefore be regarded as porous and the presence of surface features, such as pitting and cavities, will further increase the difficulty in removing graffiti. The range of surface textures encountered will present additional difficulties in dealing with graffiti. Surface finishes can range from smooth (almost polished in some cases) to rough. Weathering and chemical degradation of the surface over time will further increase the degree of surface roughness. As with smooth renders, plain concrete surfaces are attractive to the graffitist.

Illustration 18. Graffiti on concrete at Crookston Castle.

Characteristic	Comment
Texture	Smooth to rough. Many different finishes available e.g. plain, ribbed, exposed aggregate.
Permeability	Generally high for normal concrete finishes. Very difficult to remove felt marker pen dyes. Success in paint removal is fair.
Hardness	Medium-hard.
Surface reactivity	Acid-sensitive.

Table 9. Summary of characteristics of concrete.

3.3.8 Metals

In general terms, the effects of graffiti on historic metals will not pose a threat to the integrity of the surface because the traditional metals, such as wrought iron and cast iron, will require regular maintenance and painting to prevent corrosion. Whilst the painted surface of these metals is often subject to graffiti attack, and graffiti is extremely difficult to remove from a painted surface, regular over-painting can obscure the offending graffiti.

Illustration 19. Graffiti on painted historic metal strap at an ancient monument.

Lead is a soft metal, easily abraded and damaged by scratching and gouging. Lead has a Vickers hardness number (VHN) of 6 kgf/mm2 (diamond has VHN of 8,400kgf/mm2). It is not damaged by the paints and dyes in normal graffiti materials but is attacked by organic acids.

Copper is resistant to most corrosive agents, but is attacked by mineral acids and ammonia. In a damp atmosphere copper forms an attractive green patina of copper sulphate. Whilst the application of normal graffiti agents will not damage the copper surface, removal of graffiti from a patinated surface may destroy the patina and leave the 'image' of the graffiti on the exposed copper. In time, the patina will reform. Copper is a harder metal than lead (VHN of 47 kgf/mm2), but may be scratched with a sharp implement.

Bleach, ammonia and other alkalis attack aluminium and anodised aluminium. Weathered aluminium is a medium-hard material with an impermeable surface. Over time, the surface of aluminium can become open-textured which can make graffiti removal more difficult. Paints containing copper, mercury, lead or graphite may be harmful to aluminium.

3.3.9 Timber

Wood is a fibrous and porous material and untreated wood is highly vulnerable to the effects of applied graffiti materials. If a dye or pigment is absorbed into the wood, it is extremely difficult to remove. An important piece of historic timber may be best dealt with by carefully dismantling the piece and removing it, where this is possible, to a conservation laboratory. Scratching or gouging also easily damages timber surfaces. In situations where the wood is likely to be subjected to repeat graffiti attacks, treating the wood with a wood sealer can help to reduce the penetration of dyes and pigments. However, this may alter the characteristics of the historic timber surface and trials should be conducted on an inconspicuous area. There is also a risk of encouraging wood decay by sealing the surfaces unless the sealant is microporous.

The example of graffiti on wood shown in Illustration 20 may serve to exemplify the need for an alternative strategy for dealing with graffiti. In this case, the timber is the only remaining example of the original joinery in the castle. However, as far as the casual graffitist is concerned it is simply a piece of old wood in rather poor condition. It is possible that a small notice, adjacent to the timber, explaining the significance of the piece will be sufficient to persuade a potential graffitist to refrain from causing further damage.

Illustration 20. Graffiti on an original timber door frame in a castle. Note also the scratches and gouges on the timber.

3.3.10 Glass

Glass is a hard, impermeable material from which applied graffiti might be expected to be removed with relative ease. However, historic glass is highly vulnerable to the effects of chemical cleaning and it must be recognised that even water and gentle brushing can be damaging to glass that is in a fragile condition. Historic glass surfaces can be etched by atmospheric pollution. Alkalis, which occur in chemical paint strippers, attack glass and destroy the smooth surface and light transmission properties. When dealing with historic glass, detergents, bleaches, caustic soda, ammonia and acids (especially hydrofluoric acid) must not be used. Graffiti removal from historic glass is therefore a specialised task. Any method that causes abrasion of the surface of the glass should be avoided as this can accelerate the development of pitting and corrosion of the glass.

Unfortunately, much of the graffiti on glass takes the form of scratches on the surface. Some scratchings on glass have become important in their own right. Perhaps the most famous example in Scotland of such inscriptions are those done by the Glencalvie people on a window of the church at Croick, Ross-shire where they took shelter in 1845 during the Highland Clearances, (Illustration 21). The message reads *'Glenclal peopl was in the church here may 24 1845'*. This message is one of 22 separate inscriptions scratched on the outside of the window glass.

More usually, the scratchings on glass are a form of vandalism and, apart from replacing with appropriately fired modern glass, the scratched surface may have to be tolerated. The application of a 'protective' varnish or sealant is not recommended.

Illustration 21. Message scratched on window glazing at Croick Church, Ross-shire.

4 TYPES OF GRAFFITI MARKERS

Once a decision has been made to remove graffiti from a surface, it is important to identify correctly the type of marking agent used and the nature of the substrate to which the graffiti has been applied. The essential task is to break the bond between the applied material and the surface, without damage to the surface material. Attempts to remove graffiti without knowledge or understanding of the graffiti marker used, or of the substrate material, can result in irreversible damage to the surface. The method of removal will be determined by the nature and condition of the substrate and on the chemical composition of the marker and the extent to which it has penetrated into the substrate material.

A number of graffiti marker types are commonly found on historic surfaces. Those most frequently encountered are paints, felt-tip markers, correcting fluid, ballpoint pens, waxy substances (such as crayon and lipstick) and chalk. Other materials that are sometimes used include charcoal and oils (both light and heavy). Also encountered are fly posters and sticky labels, or their remains. The range of materials found is likely to be extensive because the graffiti attack on historic surfaces is often not premeditated. It is frequently an opportunist application, using any suitable marking materials available at the time. To further complicate the identification of the graffiti materials and their removal is the added difficulty that different materials may be encountered on the same site, often superimposed on each other. The use of colour photographs can assist in identifying the materials, and in determining the sequence of their removal. Illustration 22 shows the complexity of the problem. In this example, a range of graffiti markers has been applied to the stonework of a historic bridge. Two different stone types are present, sandstone and granite.

Illustration 22. Graffiti applied to underside of stone arch at Bridge of Dee, Aberdeen (built 1518).

Paint type	Hardening mode	Binding agent	Solvent	Reversible
Oil –based	Polymerisation	Alkyd resins	Organic	No
Polyurethane	Polymerisation	Polyurethane	Organic	No
Emulsion	Coalescence	PVA, Acrylic	Water	No
Cellulose	Evaporation	Nitro-cellulose	Organic	Yes
Bituminous	Coalescence or	Bitumen	Water or	No
	Evaporation		Organic	Yes
Chlorinated rubber	Evaporation	Rubber	Organic	Yes

Table 10. Characteristics of common paint types.

4.1 Paints

Paints are composed essentially of a vehicle and a binder that holds the pigment together and to the substrate. The vehicle is responsible for setting, gloss and impermeability and the pigments responsible for opacity, colour and to some extent, strength. Also present may be other materials such as dryers, solvents and extenders. Once applied, the coating will harden within a few hours. The hardening process can be by one of the following methods:

a Polymerisation by chemical reaction with oxygen or a hardener or, in some cases, moisture in the air

b Coalescence of an emulsion

c Evaporation of a solvent.

Paints in category (a) and (b) are referred to as convertible coatings because, on hardening, they cannot easily be restored to their previous liquid state. Type (c) paint hardens solely by the evaporation of a solvent and is non-convertible (reversible), since the liquid state can be restored by adding a suitable solvent. This category of paint can be readily removed by applying its solvent.

A broad classification of paints is according to the medium used to thin them in their liquid state i.e. organic solvent or water. The greater the solvent content of the paint, the greater the flow rate and thus the increased ability of the paint to penetrate into porous materials.

Once paints are dry, it is extremely difficult to identify the different types of paint without resorting to laboratory testing, which can be expensive and time-consuming. In practice, it is generally more appropriate to follow a sequence of steps of increasing severity to establish the least damaging removal system. These steps are outlined in Section 5.

4.2 Felt-Tip Markers

Felt-tip marker pens may be either solvent-based (permanent) or water-based (non-permanent). The water-based marks are easily removed from most surfaces and as they can be smudged when wet are readily identified. The felt-tip marker pen is available in a range of tip sizes, from quite broad to pointed. The pen releases a dye in water or solvent on contact with the surface. The solvent-based markers may use alcohol, ethers or hydrocarbons as the solvent. The solvents draw the dye into a permeable or porous surface, such as sandstone or granite, and the depth of penetration can be greater than for paints. Solvents, with the dyes, migrate into permeable and porous surfaces, including materials such as paints and terrazzo. Using a solvent-based removal system will further mobilise the dyes and cause even deeper penetration, resulting in 'ghosting'. A bleaching product is sometimes used on porous materials, but this may also bleach the substrate material. In addition, most bleaches are based on calcium hydroxide and chlorine which could cause residual problems for the stone in the longer term, if not completely flushed out. Because of these problems, bleaching agents are not recommended for use on porous stones. It is interesting to note that, in research carried out for Historic Scotland by the Building Research Establishment, the penetration of felt marker solvent into weathered granite was greater than for any of the sandstone types tested.

A variety of dyes is used and coloured dyes exhibit different degrees of permanence. Most dyes will fade in strong sunlight after a comparatively short period of exposure. The dyes used for black and red pens are the most difficult to remove as the dyestuffs can be particularly strong.

4.3 Correcting Fluid

Whilst this material is encountered regularly, it will usually be applied only in small amounts because of the limited size of the containers. The usual method of application is by means of the little brush supplied with the container. The material itself is essentially a type of rapid-drying, viscous paint, which, because of its viscosity is unlikely to penetrate permeable or porous substrates to the same extent as other, thinner paints. Methods for removing paints will apply in this case.

4.4 Ball-Point Pen Ink

Markings from ballpoint pens are not commonly found on rough masonry materials, but are found on smoother surfaces such as wood and metals. The fine point to these pens ensures that the graffiti are small scale. Perhaps the most significant problem with this form of graffiti on vulnerable historic surfaces is the damage that may be caused to the surface by scratching or gouging by the sharp point. The composition of ballpoint pen inks is similar to that found in felt-tip marker inks, but includes a high proportion of resins to make the ink more viscous. The dye is also more concentrated than in felt-tip markers, which can make it more difficult to remove from permeable surfaces. As with felt-tip marker dyes, solvent-based removers should not be used on porous materials.

4.5 Wax Crayons and Lipsticks

Wax crayon and lipstick tend not to be widely used as a graffiti medium. However, they are encountered on historic surfaces because they are materials that may be available for an attack that has not been premeditated. There are a number of different types of wax crayons. Those that contain a higher proportion of pigment and a reduced amount of wax are more difficult to remove, especially from porous surfaces. Crayons based on petroleum wax are easier to remove.

Lipsticks are made from vegetable-based waxes and insoluble or oil-soluble dyes and pigments. They tend to present fewer problems of removal than crayons.

For both crayons and lipsticks, removal methods are similar to those employed for ballpoint pens.

4.6 Chalk

Chalk is widely used as a graffiti material. It is also one of the oldest substances used for this purpose. Chalk is based either on whiting (calcium carbonate) or on gypsum (hydrated calcium sulphate). Fortunately, either type is easily removed by applying water and gently scrubbing with a soft nylon brush. In a situation that is exposed to the weather, chalk marks will fade quite quickly and no direct intervention may be the preferred solution in some cases.

4.7 Fly-Posters and Adhesive Labels

Whilst these are not graffiti in the accepted sense, they are closely related to the graffiti problem because, together with graffiti, they present an image of an area or property that is uncared for and thus may encourage further graffiti and fly-posting. The problems associated with the removal of paper posters and sticky labels are not dissimilar to graffiti removal problems. As well as defacing the surface, fly-posters and labels can cause damage to the surface when they are removed, especially to weathered, friable surfaces. Often, residual adhesive remains attached to the surface when the poster or label is removed. The adhesives used for paper posters are a water-soluble paste and the adhesives for labels are normally synthetic, solvent-based types.

Removal of label adhesive from hard, dense glazed surfaces is relatively easy using scraping, combined with a suitable graffiti removal solvent. However, such a method when used on a vulnerable, porous surface can cause damage to the surface. Gentle abrading of the surface of the label, before the application of the solvent will often encourage the label to detach completely from the surface. A low-pressure steam cleaner with a pencil-sized nozzle has proved to be

Ilustration 23. Remains of fly-posters on glazed tiles.

very effective for removing adhesive labels, without causing damage to the substrate material. As is the case with all graffiti removal work, a small test area will indicate whether a system will be successful in removing the label and adhesive and will not cause damage to the substrate material.

As most posters are attached using a water-soluble paste, removal is usually quite simple. Gently scoring the paper, soaking with water and gently removing the paper with a scraper will be successful in many cases.

4.8 Scratches

Implements that scratch or gouge the surface of historic materials are destructive to the surface and can be removed only by a process of abrasion. The removal process can therefore be more damaging to the historic material than the initial graffiti. This form of graffiti is very common on sandstone where the relatively soft surface is easily damaged by any sharp or hard implement.

An unusual example of scratched graffiti is shown in Illustration 24. In this case a gravestone has a heavy soiling layer, composed of both particulate and biological soiling, that is easily scratched by a finger nail. In this case, the scratches may be at least partially removed by cleaning the gravestone to remove the soiling layer. However, such an approach is likely to be unacceptable in a historic graveyard, unless the marks are offensive or racist.

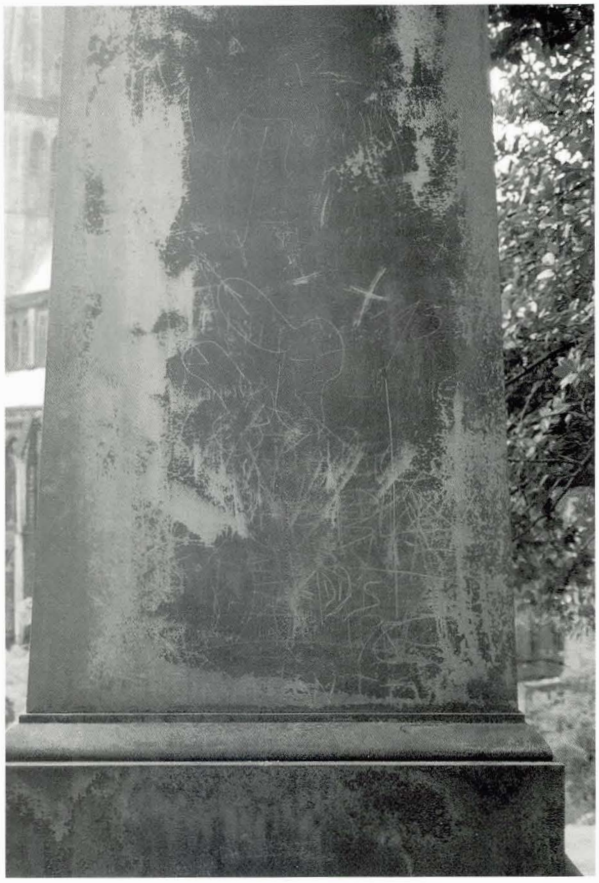


Illustration 24. Graffiti scratches on soiling on a sandstone headstone in a historic graveyard.

5 GRAFFITI REMOVAL METHODS AND MATERIALS

The decision to remove or otherwise treat graffiti on a historic surface must be based on a clear policy that has been defined by the owner of the building, in accordance with the criteria outlined in Chapter 2. The option not to clean must always be a consideration if the removal process contains a risk of irreversible damage to the surface. Before any decision is made, it is essential that an accurate assessment is carried out of all the surfaces to be treated and, as far as possible, accurate identification of the graffiti materials is made. The person responsible for the task of treating the graffiti should be involved in the assessment process and in the selection of the removal system or systems to be employed.

As modern graffiti can take many forms, and as different graffiti materials can be superimposed upon each other, it is not feasible to produce a standard treatment that will be appropriate for all eventualities. There are also many proprietary cleaning systems currently available. The vast majority of these systems have not been designed with the needs of sensitive historic surfaces in mind and the manufacturers' information should therefore be carefully scrutinised. It will be impossible to remove graffiti in the form of scratches or gouging without redressing the surface. This is likely to be unacceptable on historic surfaces.

Proprietary systems vary considerably in their chemical composition, their ability to cause damage to the substrate, speed of removal and cost. When selecting a graffiti removal system, the guiding principle should be always to select the gentlest method possible to achieve the desired degree of graffiti removal, without causing damage to the substrate. It is however important that a systematic approach is adopted to ensure that there is no further damage caused to the historic surface by the removal process. Successful graffiti removal frequently requires a combination of methods and materials.

5.1 Identification of Graffiti Materials

Accurate identification of the material used for graffiti can be very difficult without resorting to chemical analysis. However, there are certain characteristics of graffiti materials that can assist in an on-site identification.

- Aerosol spray-paint usually gives an even coating with no visible brush marks. The edge of the graffito is not sharply defined, unless a stencil has been used.
- Brush applied paint usually leaves brush marks and the application may be less even.
- Marker pens are usually identified by marks of consistent width and, on rough surfaces, will tend to leave areas of low relief unmarked.
- Gentle brushing with water will identify those materials that have a water-based solvent.
- Discarded containers adjacent to the site of the graffiti may provide additional evidence for identification.

5.2 Selection of Graffiti Removal Method

There are three main systems available for graffiti removal:

1. Chemical removers (including proprietary systems).
2. Physical removal systems.
3. Laser cleaning systems.

Selection of the removal method may depend on a number of factors, amongst which are:

- The type and physical condition of the substrate material.
- The absorbency of the surface. This is an important characteristic, as it will influence the penetration of the graffiti marker and the cleaning solvent into the material. As a rule, the more porous or permeable the surface, the more difficult it will be to remove graffiti. An indication of the surface absorbency may be obtained by observing the rate of absorbency of water droplets on a dry surface.
- The surface area to be cleaned. This will determine the scale of the operation and the equipment to be used.
- The chemical composition of the graffiti marker.
- The strength of the bond between the graffiti and the substrate.

- The desired degree of graffiti removal. Complete removal of the last traces of graffiti greatly increases the risk of surface damage to porous or permeable materials.
- The chemical effects of the graffiti remover on the substrate material and the retention of potentially harmful residues within the surface zone.
- Time available. In the case of sites where graffiti attack is a frequent occurrence, rapid removal may be required to reduce the incidence of further attacks. Selection of a system, which can remove graffiti simply and quickly, may seem an attractive option but the removal of most graffiti materials from sensitive surfaces will almost certainly demand a high level of care and will therefore be time-consuming. Preservation of the historic surface should not be compromised in the interests of saving time and money.
- Cost will undoubtedly be an important consideration, but should not be allowed to influence the selection of the most appropriate materials and systems of graffiti removal from historic surfaces.
- The outcome of test cleaning. No graffiti removal should take place without first conducting test cleaning, using the selected systems, on the range of graffiti materials to be removed.
- Health and safety issues. Many of the chemicals used are hazardous and/or flammable to some extent and safety of the operatives, the general public and the environment at large must not be compromised. Proper safety equipment and procedures will be required to be set in place.

5.3 Chemical Graffiti Removal Systems

Where the nature of the graffiti marker has been accurately identified an appropriate solvent or other removal substance can be selected to treat the affected area. However, applying an agent or solvent directly on to a porous substance, such as sandstone or granite, may only serve to push the graffiti dyes and pigments further into the material. This will increase the difficulty of graffiti removal.

On very porous materials it is likely that some 'ghosting' will remain due to penetration of the graffiti dyes and pigments below the surface of the material. The only effective way of removing the ghosting is by removing the surface layer by physical abrasion. On historic surfaces such an approach is clearly unacceptable and, as previously identified, a compromise must be reached between leaving some graffiti on the surface and avoiding further damage to the surface.

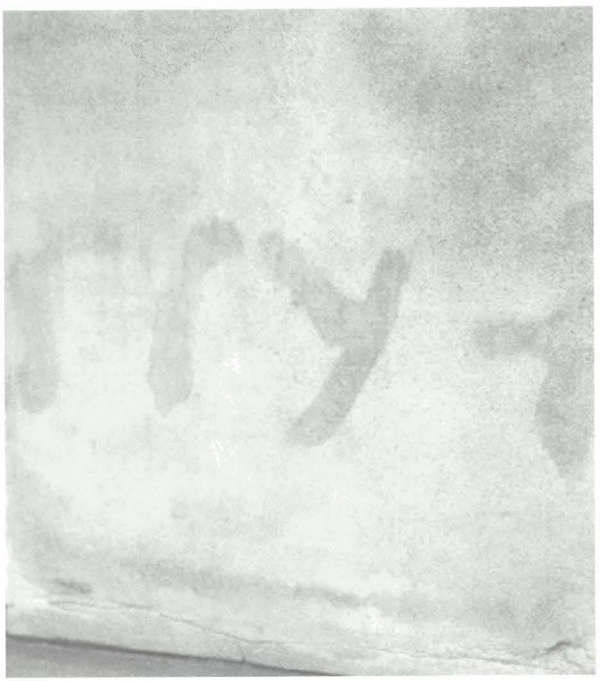


Illustration 25. Ghosting on sandstone, Edinburgh church.

Graffiti markers fall into two broad categories; those that are reversible and those that are non-reversible. In the case of a reversible mark, the substance will revert to the liquid state when it comes into contact with a suitable solvent. In the case of a non-reversible substance, such as an oil-based paint, the effect of a solvent is to cause the paint film to swell and detach from the surface. Removal is aided by the additional action of agitation and rinsing with low-pressure water, brushing with water and detergent or steam cleaning. If a detergent is to be used on a porous masonry surface, the detergent should be of a non-ionic type.

Oil-bound paints such as alkyds can be broken down by contact with caustic alkalis through a process known as saponification. Although not strictly a graffiti removal process, it is useful to recognise that many building materials such as lime mortars and plasters and Portland cement are strongly alkaline, especially when fresh. If such surfaces are coated with an oil-bound paint, a process of saponification may occur in the presence of even small quantities of moisture. This may cause the paint to blister when the attack is mild or develop yellow soapy runs when the attack is more severe.

An important consideration when using any chemically based graffiti treatment system is air temperature. Most chemical systems are temperature sensitive and become less effective at low temperatures. Normally they should not be applied when the ambient air temperature is less than 10°c, or when frost is expected. It should also be remembered that with stone surfaces,

for example, there will be a time lag between a rise in the ambient air temperature and a rise in temperature of the stone surface, due to the high thermal capacity of the stone. The stone surface may remain well below the minimum temperature for the treatment for some time after a rise in the air temperature. This may explain why the efficacy of a treatment may produce different results when other factors are essentially the same.

Some proprietary systems require steam, or more usually, high-pressure water washing equipment to remove graffiti and solvent residues. The use of such equipment on decayed, friable or soft surfaces can cause significant loss of material and should therefore be avoided.

5.3.1 Non-proprietary graffiti removers

Graffiti removal should always start with the least aggressive system possible. When water-soluble graffiti are freshly applied, i.e. within twenty four to forty eight hours, the application of water, especially hot water, aided by a non-ionic detergent and gentle brushing with a nylon bristle brush may be sufficient to remove most of the graffiti without damage to sensitive masonry surfaces. The surface should be rinsed with water after treatment to remove any surface residues.

The application of strong alkalis having a pH 13-14, such as sodium hydroxide (caustic soda), should not be used on masonry surfaces as they have the potential to form damaging salts within the material if they are not properly neutralised. Neutralisation using an acid may also be damaging to acid-sensitive masonry. Some paint removers are sodium hydroxide-based.

5.3.2 Proprietary graffiti removers

There are numerous propriety graffiti removers available for the removal of paints, felt tip pen markings, crayons and ballpoint pen inks. Because they are designed to cope with a range of marker and substrate types, they generally consist of complex chemical mixtures designed to perform a number of functions. They often contain solvents to dissolve the medium, activators that cause the medium to swell and to break down the medium and surfactants, which loosen the bond with the substrate material. Other ingredients may include emulsifiers, thickeners and evaporation retarders.

Proprietary graffiti removers vary in both their chemical composition and consistency. Whilst the chemical composition of many proprietary removers is similar, the precise nature of the ingredients may not be identified either on the product or in the manufacturer's literature. Reference to the Product Data Safety Sheet, produced in accordance with Health and Safety legislation, may help to identify the solvents present in the formulation. Because of the uncertainty regarding the nature of the mixture and the effect on sensitive surfaces, it reinforces the need for tests to be conducted on a small sample before full-scale cleaning is started.

The main types of proprietary removers are:

- water-soluble sprays or aerosols
- solvent-soluble sprays or aerosols
- gels
- poultices
- bleach-based.

For porous substrates of the type normally encountered in historic buildings and monuments, gels and poultices may be the most effective form of cleaner. The low viscosity of sprays and some aerosols can result in the liquid running down vertical surfaces too quickly for the solvent to act on the graffiti. Proprietary graffiti remover impregnated cloths and swabs are available and may be suitable for small areas. Gels and poultices adhere to vertical surfaces thus ensuring that contact time is sufficiently prolonged to allow a reaction with the graffiti marker.

Many gels contain strong solvents, of which N-methyl-2-pyrollidone (NMP) is a good example, and require prolonged contact to be effective. A contact time of 30 minutes is normal but may be speeded up by agitating the gel with a bristle brush, particularly where the graffiti has 'aged'. However, because the solvent is likely to be aggressive, prolonged contact with painted or soft porous surfaces should be avoided.

Poultices may be an effective means of graffiti removal because they allow the cleaning solution to be kept in contact with the surface and, at the same time, disrupt the graffiti marker and absorb the marking solution into the poultice. A poultice can be prepared from an absorbent material such as a clay (kaolinite or sepiolite) or a cellulose material such as shredded paper, mixed with a cleaning solution to form a paste which can be applied with a trowel. A range of liquid reagents may be employed to suit the particular circumstances. The liquids that are incorporated may be water, organic solvent, paint stripper or bleach. Covering the poultice with a plastic sheet will reduce the rate of evaporation of solvent from the poultice. The process of removing a poultice by scraping and high-pressure water washing can cause damage to fragile surfaces.

A poultice can be used to draw pigment from sub-surface pores without disrupting the surface. However, Butlin et al. (1992) report that it is difficult to find a powdered substance which can make contact with paint lodged in tiny pores and which is also capable of

holding sufficient solvent to loosen the bond between the graffiti paint and the stone.

A number of proprietary systems contain methylene chloride, which is the active ingredient in most paint strippers. It is available in liquid or gel form and is water or spirit rinsible. Methylene chloride based materials should not be used on painted surfaces where preservation of the paint is required.

Bleaches are often incorporated in agents used for the removal of graffiti, such as felt-tip pen marks and inks, from porous brick and concrete, where the pigment in these substances is destroyed. Bleaching agents are normally supplied in the form of a gel or mortar. Alkali-based bleach can be successful on some dyes when it is contained within a poultice. A bleach-based agent will be ineffective on aerosol spray paints because of the polymer content of these paints.

As noted in section 4.2, bleaches may bleach the colour from porous stone and commonly contain calcium hypochlorite, which has the potential to form salts in porous stone. It is therefore recommended that bleaching products should not be used on this type of substrate.

5.3.3 Procedures for chemical removal of graffiti

The adoption of a systematic approach to the selection and use of chemical methods of removal, such as outlined in Figure 1, is essential if the intrinsic cultural value of the historic surface is to be maintained. It should always be recognised that complete removal of the last traces of the graffiti may not be achieved without unacceptable change to the surface. Whilst correct identification of the graffiti marking agent and the substrate material is of primary importance, the selection of the removal procedures will also be influenced by the possible variable surface condition of the material. A surface may have developed a patina, as in the case of copper and lead, or be in a weathered and decayed condition in the case of masonry. The surface condition will affect its response to graffiti removal procedures. For example, a stone surface may change from being strong and intact to decayed and friable within a few millimetres. This may affect the penetration of both the graffiti materials and cleaning agents and may require different methodologies to be implemented on the same stone.

An important consideration will be the vulnerability of the surface to repeated graffiti attack. Regular removal of the graffiti, whether by water-based or solvent-based systems, will significantly increase the risk of damage to the surface through the repeated physical actions of remover agitation, brushing and washing. There may also be a cumulative build-up of solvents in porous masonry materials that are not removed by the water-washing processes. In such circumstances, repeated cleaning may not be good conservation practice and alternative approaches should be considered.

Chemical graffiti removers are normally preferred to physical systems for dealing with the normal graffiti materials, as they are considered less damaging and less expensive. Flow diagram, Figure 1, outlines the procedures to be followed when chemical removal of graffiti is proposed. This should be read in conjunction with Table 7 that identifies a range of graffiti marker types and a sequence of steps that may be employed using chemical removal systems.

5.3.4 Equipment and tools for chemical removal graffiti

The following tools and equipment are typical of those required for the removal of graffiti from sensitive surfaces. Illustration 26 is a display of some of the equipment that might be employed by a conservator. The nature of this equipment is not appropriate for large-scale graffiti removal operations and does not represent the equipment that would be employed by a commercial cleaning contractor. The list is only a general guide as the nature of the equipment required may vary from one incidence of graffiti to another. However, when dealing with fragile historic surfaces, hard or abrasive brushes and scrapers should be avoided.

- a range of graffiti removal products and solvents that are suitable for the graffiti marker types and substrate materials
- soft nylon bristle brushes of various shapes and sizes
- nylon scrapers
- hand sprayers
- fibre pencils (for gentle agitation of cleaning gels)
- scrim cloth
- masking tape
- cotton wool and cotton buds
- sponge
- glass measuring jar
- magnifying glass/lens
- record notebook or clipboard
- camera.

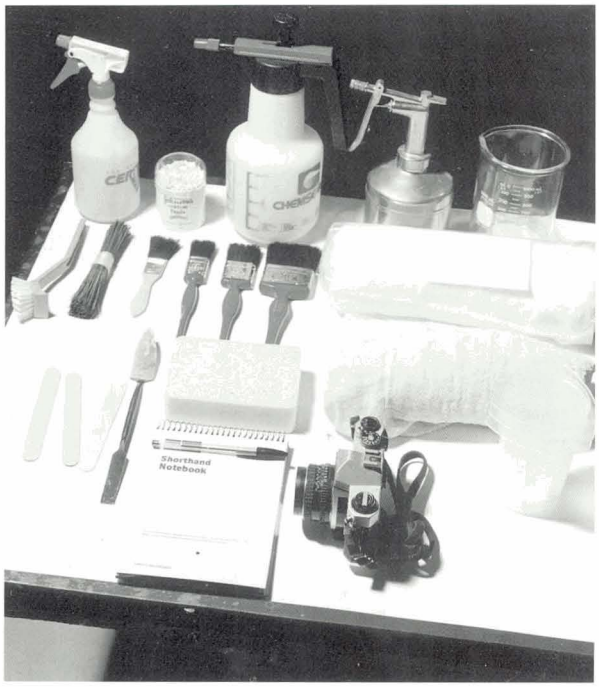


Illustration 26. A display of the range of equipment required for graffiti removal from historic surfaces.

5.4 Physical Graffiti Removal Methods

Mechanical methods of graffiti removal are commonly used. All systems work by abrading the surface to remove the graffiti coating. However, on rough porous surfaces such as sandstone where the graffiti dyes and pigments have been absorbed into the material, an abrasive system will only succeed in complete removal of the graffiti by a process of surface erosion that involves grain loss. Clearly, such systems should only be used where there is no risk of damage to the historic surface and the repeated use of abrasive systems on the same surface must be avoided.

There are numerous mechanical systems available most of which have been developed for purposes other than graffiti removal. Systems that include high-pressure water washing, grinding the surface with abrasive discs and blasting with hard abrasive grits should never be used on historic surfaces. All current proprietary systems make use of compressed air and an abrasive grit, either as a dry abrasive system or as a wet abrasive system. For graffiti removal on sensitive surfaces, a mechanical system must use low pressure (circa 30-40 psi) and minimally abrasive grit. Any system that does not meet these criteria must not be used.

Typical low-pressure systems make use of a range of soft grits such as calcium carbonate, sodium bicarbonate, aluminium oxide, ground shells of walnut and coconut, urethane sponge impregnated with tiny particles of plastic chip, aluminium oxide and the like are representative of the choice available. Suppliers and manufacturers promote these systems for graffiti removal but, as a general rule, they must only be used on sensitive surfaces after all other methods have been proved unsuccessful and only after thorough testing.

However, a micro-abrasive technique using a fine pencil nozzle and an abrasive powder such as aluminium oxide powder has been successfully used to remove relatively small-scale graffiti from delicate stone surfaces. Illustration 27 is an example of this system being used on a historic sandstone surface. This system must be carried out with great care to avoid damage to the surface and is therefore a slow and expensive method. It should be used only by a professional conservator, after testing on an inconspicuous area to assess the likely outcome of the cleaning. For porous masonry and other permeable surfaces, it is unlikely that complete removal of the graffiti will be achieved.

5.5 Laser Cleaning

The laser cleaning technique has been developed to the extent that it is now a reasonably well established system for cleaning museum artifacts, although not yet fully accepted as a cleaning system for buildings. McStay at the Robert Gordon University, Aberdeen has investigated lasers for cleaning soiling from buildings on behalf of Historic Scotland and Cooper (1997), at the National Museums and Galleries on Merseyside, has developed laser cleaning for works of art. As far as laser cleaning of buildings is concerned it is still the case that, whilst offering considerable promise as a non-damaging method for removing graffiti, laser technology cannot as yet compete in terms of cost with more conventional chemical methods.

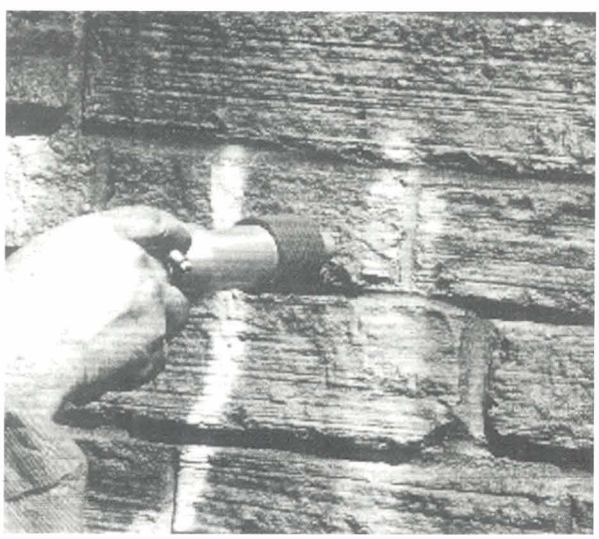


Illustration 27. Micro-air abrasive system in use on an historic stone surface. Note: Removal of graffiti also removes soiling leaving the outline of the graffiti. The low-pressure micro-air abrasive system has the potential to cause some abrasion of the stone.

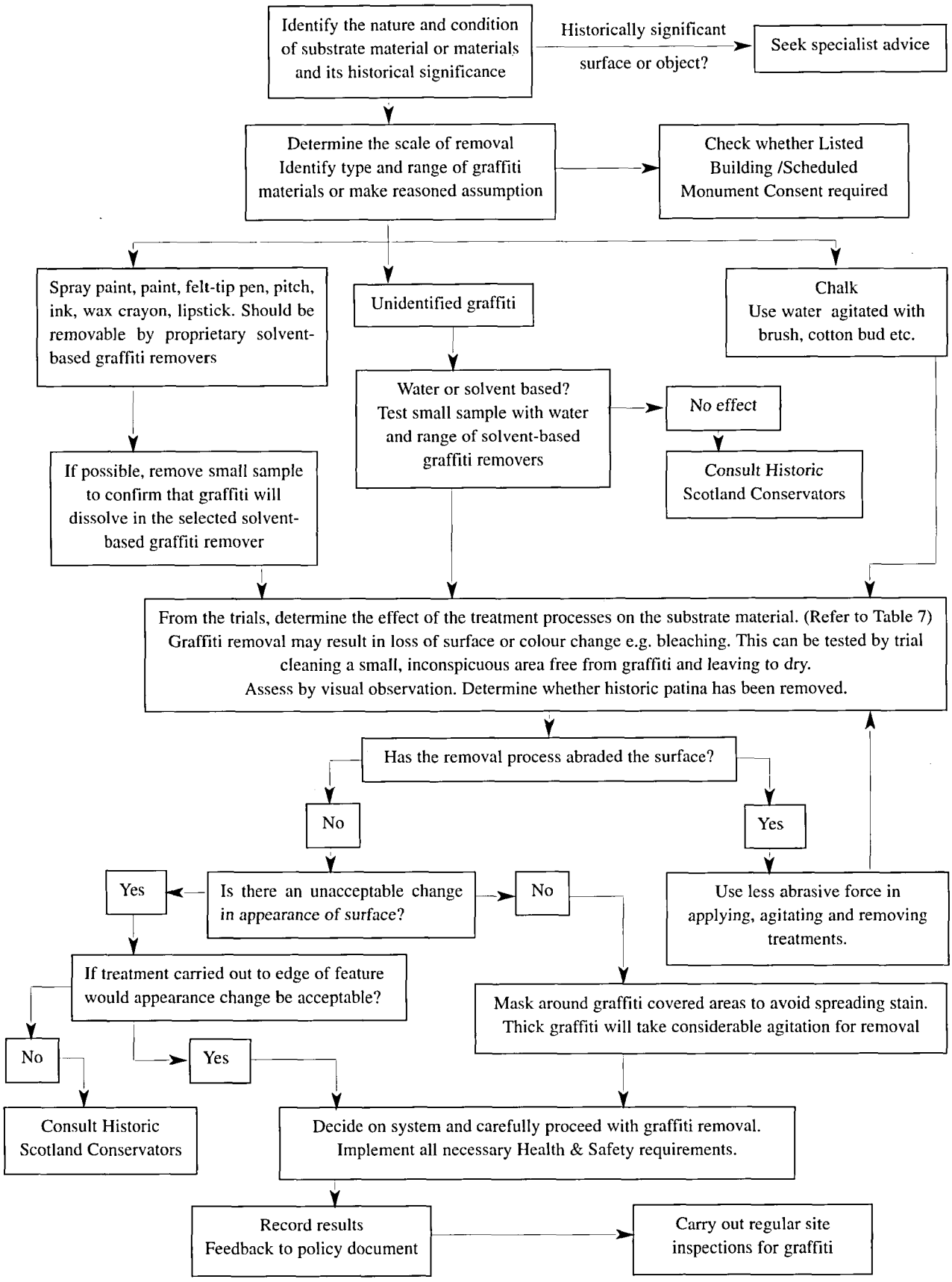


Figure 1. Flow diagram for procedures to be followed in chemical removal of graffiti. The diagram should be read from the top. Note, in certain circumstances Listed Building Consent or Scheduled Monument Consent may be required. Small-scale trial cleaning should always be carried out prior to full-scale treatment.

Action	Graffiti Marker						Comments
	Unidentified Graffiti	Felt-tip/Ball point	Paint	Lipstick	Wax Crayon	Sticky Labels	
Water	✓	✓	✓			✓	On a porous/permeable substrate, use of water only may cause dye etc. to soak more deeply into material. Use to identify felt-tip marker type.
Water + non-ionic detergent	✓		✓		✓		Gentle scrubbing with soft nylon bristle brush. Use non-ionic detergent on porous masonry. May cause dyes to soak more deeply into porous materials.
Low-pressure steam + pencil sized nozzle						✓	Precise removal can be achieved without damage to substrate.
Warmed vegetable oil				✓			Apply with clean white cloth to absorb wax and pigment. In the case of porous stone substrates, may cause discoloration and possible blocking of the pore structure.
Oil or wax solvent				✓			
Petroleum-based solvent		✓				✓	On non-porous surfaces only. Gentle scraping of sticky label.
Proprietary graffiti remover (water-soluble)	✓	✓	✓				Generally less aggressive than solvent-based removers. Requires dry substrate.
Paint remover (typically methylene chloride)	✓		✓				Not suitable on paint substrate. Gentle agitation with soft nylon brush. Water-rinsable.
Proprietary graffiti remover (solvent-based gel or poultice)	✓	✓	✓	✓	✓	✓	Ensure health and safety precautions are observed. Some materials hazardous. Gentle agitation of gels with soft nylon brush.
Bleach		✓			✓		Used only when other means unsuccessful. May bleach substrate material. Not recommended for porous stone. Testing on graffiti free substrate essential before use.
Low pressure water rinse	✓	✓	✓	✓	✓	✓	Use after all of the above methods.
Low pressure abrasive (e.g. micro-abrasive)	✓		✓				For porous masonry. Use only when all other methods have been unsuccessful. Carried out by specialist.

Notes

1. The sequence of activities should commence from the top of the table, starting with the least potentially damaging method.
2. Cleaning must stop if the action is causing damage to the substrate.
3. The above selections are for guidance only. All removal methods should be tested prior to full-scale cleaning.

Table 7. Summary of steps to remove graffiti marks. Adapted from CIRIA Special Publication 71.

The laser system that is most commonly used for conservation work is the Q-switched Nd:YAG laser, which provides short pulses of near infrared radiation. By using a short pulse length, heat is prevented from being conducted beneath the soiling or graffiti layer and into the surface of the material. Cooper identifies the main advantages of laser cleaning as follows:

- It is possible to remove layers of soiling without removing any original surface. The technique is sensitive enough to preserve surface relief; original tool markings can be uncovered and delicate patina left intact. However, it is unclear how effective this technique will be in dealing with, for example, graffiti pen dye that has penetrated into porous stone (author's note). Since laser energy is delivered in the form of light, there is no physical contact with the surface thus permitting work on fragile surfaces.
- Because the diameter of the laser beam can be accurately controlled, the same tool can be used for both extremely fine and relatively large-scale work.
- The conservator has instant control over the cleaning action as the cleaning action is immediately halted once the laser is switched off.
- Lasers have been used successfully to remove soiling from a wide range of materials including marble, limestone, sandstone, terracotta, alabaster, plaster, aluminium, bone, ivory and vellum.

At the current state of development, it is possible for laser cleaning to cause damage to stone in the following ways; if the laser energy/power density used is too large (McStay 1998, personal communication):

- The colour may be bleached from the stone. For example, red sandstone and red granite can become white.
- The wrong laser wavelength can also cause bleaching.
- Very high energy densities can produce holes in the stone surface and produce glass-like regions.

In addition, whilst producing small quantities of waste material, the heating action of the laser may cause toxic or irritant fumes to be emitted from the soiling material.

Work in the United States, on the laser removal of graffiti from highway signs, shows promising results and combining laser ablation with chemical removal systems may offer an effective technique.

5.6 Trial Cleaning

Once the substrate material and the graffiti marker types have been identified, or reasoned assumptions made, it will be necessary to conduct trial cleaning to establish the most appropriate cleaning method or methods to be adopted.

Test cleaning should incorporate the following features:

- It should be conducted on a small inconspicuous, but representative, area of graffiti. If the graffiti marker type is known, it may be possible to recreate the graffiti on a scrap piece of material to avoid damage to the historic substrate.
- All marker types should be subject to test cleans using the proposed methods of removal.
- All materials and techniques used should replicate exactly the full-scale cleaning operation, using the same equipment and water-pressures where appropriate and taking care to apply the same amount of surface agitation, repeat treatments, brush types, sizes and stiffness.
- The trial should be conducted on a sample that is representative of historic patina, including the presence of atmospheric soiling and biological growths. Removing the graffiti from such surfaces will result in an outline of the graffiti remaining. The effect on the historic patina must therefore be assessed.
- Adverse weather conditions may affect the outcome of the trial, which should be carried out only under conditions that would be applicable to the full-scale cleaning operation.
- Surfaces should be dry.
- All steps taken and procedures and materials used during the trial should be accurately recorded, together with the assessment of the outcome of the trial, noting any alteration to the substrate as a result of graffiti removal. This should include a photographic record.
- The point at which cleaning should stop must be determined so that the extent and intensity of any remaining graffiti dyes and paints can be agreed and accepted by all parties involved.
- The trial cleaning and the assessment of the results should involve the person who will be responsible for conducting the main graffiti removal operation.

5.6.1 Example of trial cleaning

In this example, the graffiti was an acrylic emulsion paint that was gently removed using the following steps:

1. Apply thin coating of methylene chloride gel (Nitromors) and leave for approximately 20 minutes.

2. Agitate with a soft nylon brush supplemented with water spray.

3. Wash-off with water using a hand spray at low pressure (30psi).

4. Dry-off with a sponge.

5. Repeat process using a thicker gel film.

6. Repeat the process with two further gel applications and water rinsing. At this point, any further application of paint remover would have caused grain loss at the surface.

Illustration 28. The first application of paint stripper gel to the graffiti. Note the weathered surface of the sandstone.

Illustration 29. Gentle agitation of gel and dissolved graffiti paint with a nylon brush.

Illustration 30. The graffiti after the first complete cycle of treatment.

5.7 Anti-Graffiti Coatings

One of the most significant problems associated with graffiti removal is the need to remove graffiti from surfaces that are subjected to repeated attack. Under these circumstances, the repeated removal of graffiti using even the gentlest methods will cause damage to the surface of the material. Where site conditions are such that it is impossible to prevent attacks from taking place, the best means of protecting the surface may be the application of a barrier coating, or anti-graffiti coating, that will prevent the penetration of paints and dyes into the surface. This will make the subsequent removal of the graffiti much less damaging to the surface.

The problem of absorption of graffiti dyes and paints into porous masonry materials has already been identified. Anti-graffiti coatings are therefore designed to prevent the penetration of these materials into the substrate and to facilitate their easy removal by preventing a firm bond between the graffiti and the substrate. The coating will work either by:

- blocking the pores,
- causing temporary blocking through softening and swelling of the barrier coating in the presence of moisture,
- lining the pores with a water repellent coating or
- retarding the drying of the graffiti material.

Coating the porous substrate with a barrier film may appear to offer an ideal solution to the graffiti problem but there are a number of important issues to be addressed before selecting a barrier system. The important issues with respect to historic surfaces are:

1. The coating must be permeable to water vapour. It must allow the masonry to 'breath' to prevent the build-up of moisture within the substrate material and therefore increase the rate of surface decay.

2. There must be no change to the appearance of the substrate material. Many coatings give the surface a sheen, which makes it appear wet and darker in colour. The appearance of coated and uncoated areas must be the same when the material is wet.

3. The coating should remain stable as it ages. Some coatings, which are initially clear, become cloudy or yellow as they age, through exposure to ultra-violet radiation.

4. The coating should attract soiling to the same extent as untreated areas and should weather in an even way.

5. During its planned life, the coating should not degrade on exposure to the weather and thus fail either to release the graffiti or become detached from the substrate.

6. The graffiti marking should be easily released from the substrate material and the coating should be effective against all types of graffiti markers.

7. The process must be reversible so that the coating can be completely removed should this become necessary. Coatings are classified as either 'permanent' or 'temporary'. A permanent coating will remain intact after each graffiti-cleaning episode. A temporary coating will be removed along with the graffiti because it will tend to be dissolved in the graffiti removing solvent.

8. The coating must be non-toxic and non-irritating to animals and plants once it has been applied.

9. In graffiti-prone areas, regular reapplication of the coating may be necessary. Such reapplication should not have a cumulative adverse effect on the surface through, for example, reduced water-vapour permeability or change in appearance. Unfortunately, a change to the water-vapour permeability is not immediately obvious and thorough testing will be necessary before any reapplication is carried out.

There are two main categories of anti-graffiti coatings available; clear (transparent) and pigmented. They are normally applied by airless spray or by brush.

In common with all other graffiti treatment work, no anti-graffiti coatings should be applied without first conducting trials on an inconspicuous area of the material to be treated.

5.7.1 Clear coatings

Clear coatings are colourless and transparent and are used where it is required to retain the original appearance of the substrate material. They are available with a gloss, semi-gloss or matt finish and care must be exercised to select a system that does not produce an unnatural 'sheen' to the historic surface. This will be especially noticeable when only part of a feature or wall has been coated.

Transparent coatings are available in two principal forms, permanent and temporary (or sacrificial).

Permanent coatings are usually moisture curing, two pack polyurethane-based systems or are silane based. Polyurethane coatings may be film forming and can result in pore blocking and reduced moisture evaporation rates in porous masonry. Silane based coatings are non-film forming and work by lining the pores rather than by forming a pore blocking film. Permanent coatings will degrade over time but will normally be able to withstand several cycles of graffiti removal operations without a significant reduction in their effectiveness. Some manufacturers claim graffiti resistance of up to five years. Permanent coatings are more resistant to the solvents used in graffiti removers, although reapplication will usually be required after several cleanings.

When dealing with a historic masonry surface, the use of a permanent anti-graffiti coating may not accord with good conservation practice because of the potential to reduce the water-vapour permeability of the masonry and the possibility of change to the appearance of the surface. Permanent coatings should therefore not be applied to historic masonry surfaces without rigorous, long-term testing to ensure that the surface is not changed by the application.

Temporary or sacrificial coatings are being promoted as suitable for use on porous masonry substrates. They are designed to be easily removed, or partly removed, along with the graffiti and are therefore reversible. Often, only pressure water washing is needed to effect their removal but even quite low-pressure water washing may damage a fragile surface.

Current sacrificial systems are based on water-based vegetable polysaccharides, water-based silicone free wax emulsions or solvent-based silicone/wax coatings. These systems are vapour permeable and reversible. As polysaccharide is a form of vegetable starch, it is biodegradable and environmentally safe. There are few health and safety problems associated with the water-based systems. These systems produce a more natural finish to the substrate than permanent coatings. However, wax-based systems can develop a gloss if they are rubbed. An advantage of a water-based system is that it can be reapplied to the surface immediately after the graffiti has been removed, whilst the surface is still wet.

To remove graffiti, the protective water-based coating is activated with hot water (60°c –90°c) and converted into a gelatinous substance, which is then peeled away using hot water under pressure.

There is little to recommend the use of permanent coatings on porous historic masonry surfaces because of their potential to cause unacceptable changes to the surface. Temporary coatings, despite the concerns outlined above, may be the only solution to dealing with the graffiti problem in some situations and may be worth considering. Water-based polysaccharide coatings have been used successfully on a number of historic buildings and monuments in Europe and the United States.

5.7.2 Pigmented coatings

The pigmented coatings are, in effect, tough and durable paints and are used to cover existing graffiti and to facilitate the removal of graffiti applied to the coating. They can be considered as a substitute for normal paints. Pigmented coatings are typically applied in the form of a multi-coat system, in the same way as normal paints; consisting of primer, undercoat and finish. Because they modify the appearance of the surface, pigmented coatings are not recommended for unpainted historic surfaces. There may be, however, a case for their use on dense, hard, non-porous surfaces such as metals that require to be painted for normal maintenance reasons.

5.8 Summary of Stages in Graffiti Removal Process

This summary relates to the whole process, from the time that an attack has been discovered to post cleaning monitoring.

Stage	Action
1. Recording	Photographs should be taken along with brief notes describing all relevant site details.
2. Identification	Identify the type of graffiti marker or markers.
	Identify the substrate and its condition.
3. Treatment type	Select an effective system of removal based upon accurate identification.
	Ensure that the removal system is compatible with the substrate.
4. Test cleaning	Carry out a small test patch and record the effectiveness of the treatment, along with any adverse effects.
	Prepare a photographic record.
5. Treatment	Based on test cleaning results, select the appropriate treatment method or methods and proceed with full-scale graffiti removal.
6. Completion	Prepare a final record, noting the treatment methods actually used and the outcome of the removal process, whether successful or otherwise.
	Prepare a final photographic record. An example of a graffiti record chart is shown in Appendix B.
7. Monitoring	Conduct regular inspections to check for any further graffiti incidents.

6 SURFACE ASSESSMENT BEFORE AND AFTER CLEANING

An assessment of the surface condition of a historic material is a vital component of any graffiti treatment operation (refer to Appendix B). As has been previously identified, the type and condition of the substrate must be established before any work commences. It is important that an accurate record of the existing condition is made so that the effects of both the trial cleaning and the main cleaning operation can be established. The condition of the surface will also have a significant influence on the strategy to be adopted in dealing with the graffiti problem. The focus of this section is on assessing the condition of natural stone as this represents the most frequently attacked historic surface in Scotland. It is also the most complex surface. However, the majority of the elements in any assessment will be applicable to all surfaces.

6.1 Features to be Assessed

A record of the surface may include the following elements.

6.1.1 General appearance

Colour photographs of the graffiti marked surface should be taken before and after cleaning. These should include photographs taken both normal to the surface and at an oblique angle. This latter view can be useful for recording roughness, surface scaling and depth of any surface loss.

An examination of the surface using a magnifying glass. A magnification of 10x is usually adequate to identify the main surface features. Figures 2 and 3 are sketches, before and after cleaning, based on information gathered from such an on-site examination of graffiti. In Figure 2 the dissolved paint and solvent have penetrated into the pore spaces below the surface and will remain in the stone resulting in a slight 'ghosting' effect. Residues of paint are also visible within the spaces between the grains.

In Figure 3, more aggressive cleaning to remove the paint from between the quartz grains would cause damage by removing grains from the surface. This level of graffiti removal may be the acceptable level in many cases.

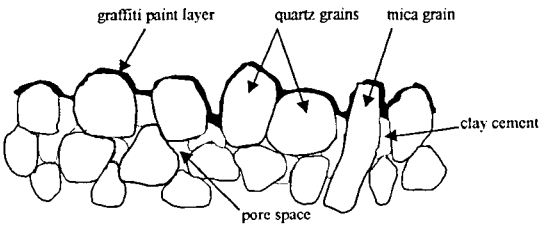


Figure 2. Diagrammatic representation of cross section of sandstone surface showing graffiti (paint) on the surface.

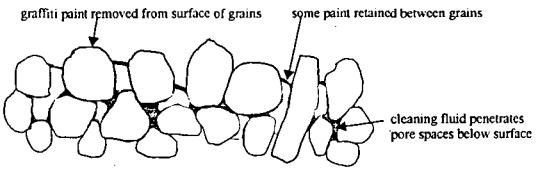


Figure 3. Diagrammatic representation of sandstone surface after gentle cleaning.

6.1.2 Colour

During and after the graffiti removal operation, it is important to monitor the colour of the substrate, as a change in the colour of the dry surface will be an indication of some alteration of the substrate. This is particularly true for sandstone, where bleaching of the surface is common. When dealing with removal of a single graffito from a stone, and the whole stone is not being cleaned, a change in colour of the treated part of the stone is easily compared with the colour of the untreated part of the stone. Unfortunately, colour change is not easily discernible whilst the stone is wet. It is therefore advisable during the trials to allow the stone to dry out between stages, to enable an accurate colour comparison to be made.

For most graffiti removal operations, a visual examination will normally be sufficient to detect any colour change. For more precise colour measurement, a hand held chromameter can be used to determine a numerical value for the colour components of a surface.

6.1.3 Surface patina

Record the nature of the patina on the surface. In the case of stone, this may be particulate soiling, biological growths (algae and lichen are most common) and natural staining (especially iron staining) of the surface because of fluid movement within the surface zone. Cleaning of the graffiti without reference to other surface phenomena can result in the 'image' of the graffiti remaining on the surface. Graffiti cleaning may result in loss of iron from a sandstone surface, giving the stone a 'bleached' appearance. As far as possible the historic patina should be preserved.

6.1.4 Salts

Record the presence of any surface salt deposits (efflorescence) and any surface loss that may be due to salts within the surface zone (cryptoflorescence). Alkaline based poultices and gels, particularly those containing sodium hydroxide may encourage the formation of florescences in stone.

6.1.5 Porosity

Assess the surface permeability or porosity. It is usually the case that the more porous the surface, the greater is the potential for the absorption and retention of cleaning solvents, and dyes and paints in their solvents, within the porous material. A weathered or decayed surface can react differently to a non-weathered surface and may have a stronger absorption.

A crude indication of the absorption of a surface may be obtained by assessing how quickly the material absorbs a drop of water. The time taken for a stone to dry out after the application of a solvent can also be a useful indicator of moisture movement characteristics. In experimental work conducted by the Building Research Establishment for Historic Scotland in 1997, it was found that a red Locharbriggs sandstone was a stronger inhibitor of solvent penetration than either a white Newbigging sandstone or a granite. The Locharbriggs sandstone also took ten times longer to dry out after solvents were applied. The porosity of both sandstone types is approximately the same, around 25%. The absorption and evaporation characteristics are therefore not simply a function of total porosity. The size of the pore spaces present will be an influential factor.

A more accurate method of comparing surface absorbencies is by measuring the rate of absorption of water into the stone from a graduated measuring tube, known as a Rilem tube. If a small sample of the porous masonry can be obtained, a very accurate measurement of effective pore volume and pore size distribution of interconnected pore space may be made by the use of mercury porosimetry. However, the use of such sophisticated laboratory-based equipment is unlikely to be necessary in most situations. If the sandstone type is known, it may be possible to obtain information on the porosity of the stone from existing records.

6.1.6 Surface roughness

Measurement of surface roughness before and after cleaning may be a useful means of determining whether surface loss has taken place. A number of sophisticated, laboratory-based instruments are available to measure, with a high degree of accuracy, the surface roughness characteristics of a material. Generally, they can only measure surfaces that are relatively smooth. For most normal graffiti removal operations, the expense involved in using such equipment will not be justified by the usefulness of the data obtained. A simple examination, using sight and touch, by an experienced conservator will normally be sufficient to assess any change in surface roughness. During the graffiti removal process, surface roughness should be regularly checked for any change by comparing the roughness of the stone under the graffiti with that of the surface immediately adjacent to the area being cleaned.

7 PREVENTIVE STRATEGIES

In Section 2, the need for a clearly defined policy in tackling the graffiti problem was identified, particularly for sites where graffiti attack is a recurring issue and where the historic surfaces are vulnerable to the effects of graffiti treatment processes. In such circumstances, preservation of the historic surfaces will demand that alternative strategies be set in place either to prevent further attack or to reduce the incidence of attack. In addition, where the cleaning process would produce unacceptable damage to the surface, consideration may be given to screening-off or otherwise obscuring the vulnerable location. In dealing with the graffiti problem, a combination of detection through regular inspections, deterrence through the use of alternative strategies and removal will provide a co-ordinated response to the problem. It is unlikely that detection and removal alone will provide adequate means of dealing with the problem.

It is important to graffitists that the marks made are visible. It is also the case that most of the sites selected by graffitists on which to display their marks tend to be readily accessible. In a survey of historic sites in Scotland, it was found that, with only a small number of exceptions, most graffiti attacks were carried out on readily accessible surfaces. However, there were situations where walls or other barriers had to be scaled to gain access to the site, usually at times when the site was closed to the public. If the graffitist is denied easy access to a vulnerable surface, this will tend to act as a discouragement to further attack but may move the problem to another location on the same site if an overall strategy for the site is not in place.Whilst careful treatment of graffiti by suitably experienced persons will remain the primary means of dealing with the problem, the adoption of preventive or supplementary strategies may be effective in deterring further incidents. Preventive strategies fall into two broad categories, physical strategies and social/educational strategies.

7.1 Physical Strategies

These involve the erection of physical barriers to prevent access by the graffitist to either the site as a whole, or to the vulnerable surfaces, or devices to improve the surveillance of the site. The strategy is likely to include design and planning of areas that do not form part of the historic fabric.

7.1.1 Site audit

The first requirement in the implementation of physical measures is to conduct an audit of the site, to establish the areas of the site that are subjected to repeated attack and how and when access to the site is gained. The extent of the audit will depend on the location, size and layout of the site.

The factors to be incorporated into a site audit may include:

1. A plan of the site showing the locations of surfaces subjected to repeated attack, access routes to the vulnerable locations when the site is both open and closed, public lavatories, visitor centre, car parks, custodian's office or residence and other inhabited buildings on the site. The plan should also show those areas of the site which are known meeting points for the local youth. If appropriate, the location of other graffiti-prone sites in the vicinity may be noted on a large-scale plan of the area. This latter point may be important, as the historic site cannot be divorced from the problems of the area in which it is located. The vandalism problems of the surrounding area will, as a rule, not stop at the site boundary.

2. Each location where graffiti has been applied should be indicated on the site plan. Reference codes may be used to indicate the severity of attack and the nature of the graffiti markers used.

3. A record of the materials on which graffiti is applied, including photographs and a detailed description of the surface condition. This may form the basis of a continuing record for any subsequent graffiti attacks and the treatments that have been carried out on the materials.

4. The location and extent of any areas that have been treated with anti-graffiti coatings, together with details of the treatment, if known.

5. Names and addresses of all persons or contractors who have carried out graffiti removal work on the site and dates when the work was carried out.

6. The nature, location and condition of any existing anti-vandalism measures and installations. There is little point, for example, in protecting a site with a fence and allowing the fence to become broken-down.

7. The general condition of the site. This should include an assessment of site maintenance. A well-maintained site will act as a deterrent to the graffitist and may prevent or reduce the severity of an attack.

7.1.2 Site protection measures

As each historic site is different, no one set of site protection measures will be suitable for all situations. Each site must be individually assessed, bearing in mind the extent of the graffiti problem, the cultural value of the site and the cost of providing effective protection. The cost of improved protection should be set against any reduction in costs of graffiti treatment measures as a result of the improved protection.

Typical site protection measures may include:

Floodlighting

The locations on a site that are more vulnerable to severe graffiti attack are those where the graffitist is hidden from public view whilst carrying out the attack. The installation of floodlighting or improved lighting, to illuminate the dark corners may act as a deterrent. Floodlighting fixtures can be visually intrusive but may be made less so by using fittings recessed into the surrounding ground surface. Where the surrounding surfaces are historic, it may be necessary to use freestanding floodlighting masts to avoid fixtures on historic surfaces.

Historic buildings in city centres can offer opportunities for graffiti activity. Corners of buildings remote from the public gaze are likely targets. Improved visibility and lighting may act as a deterrent in these locations.

Surveillance systems

Closed circuit television (CCTV) is commonly used for surveillance purposes and may find use as an anti-graffiti measure on some sites, particularly when used in combination with other measures. Video cameras sited in strategic locations, combined with clear signs throughout the site that cameras are in use, can act as an effective deterrent.

There are, however, some obvious problems with such installations on historic sites. The cameras need to be securely fixed in inaccessible places and this may not be compatible with historic fabric. The pictures also need to be transmitted to a central video-recording suite; the siting of which may be a problem on an open, unmanned site. The use of 'dummy' cameras may be sufficient to act as a deterrent in some situations.

Illustration 31: City centre church.

Illustration 32: City centre church. Graffiti on sandstone. Note spray paint on mesh window screen.

Security personnel

The obvious presence of security personnel, or the well-publicised information that security patrols exist and that vandals will be prosecuted, can also be an effective deterrent. Patrols may be carried out by the organisation's own staff (custodians, rangers etc.), private security guards or police. However, the cost of this form of surveillance will be high, as it must extend over a twenty-four hour period and is unlikely to be justified on small sites. However, if the security of a historic building can be linked into a wider security system covering the surrounding area and involving a

number of building owners, costs may become more acceptable.

Physical barriers

These may form the primary physical systems on a site and can take a number of forms; providing that these are compatible with the historic fabric and do not detract from the cultural value:

- Extending the height of existing walls on or around the monument or historic building may close off an access route to the vulnerable site.
- Installing doors or gates into openings in the historic fabric to prevent access into the interior of otherwise open monuments. A door may provide a more acceptable surface for the graffitist to work on and may thus reduce the extent of graffiti on the historic surfaces. Also, the door may be cleaned or repainted at regular intervals, or after a severe attack.
- Erecting barriers or shields in front of vulnerable areas. This might take the form of a clear acrylic or polycarbonate sheet either fixed to the wall or to a freestanding frame adjacent to the wall. If such an installation can be combined with an information display, a dual purpose is served. However, the impact of such fixtures on historic fabric may not be acceptable in some circumstances. It is possible that the screens may themselves become disfigured by graffiti to a greater extent than the original wall surface. Screens, however, are easily cleaned and the clear sheets can be replaced when necessary.

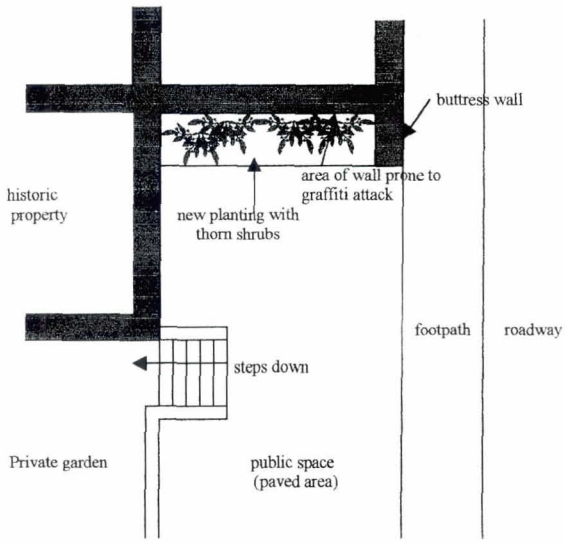
Illustration 33: Plant-box used to hide graffiti and prevent access to the surface.

Illustration 34: Historic house. The harled recess is vulnerable to graffiti attack.

Hard and soft landscaping

Good design of both hard and soft landscaping can form an important feature of any anti-graffiti strategy. Landscaping features can be used to prevent access to vulnerable surfaces and can obscure areas of graffiti from public view. For soft landscaping, the use of fast-growing thorn bushes (e.g. Berberis thunbergii and hawthorn) are particularly suitable if they are compatible with the historic situation. Illustration 33 is an example of the use of a large plant-box being used to obscure existing grafffiti and prevent access to a surface that had been the subject of repeated attacks, to the extent that repeated cleaning had damaged the granite surface. Note that the plywood box has now become a target for graffiti but can be regularly repainted.

A further example of the potential for landscape design to deter graffiti attack is shown in Illustration 34 and Figure 4. In this case, instead of the existing hard paving being taken into the recess (which has been the target of graffiti in the past) a plant bed, containing



Sketch plan not to scale

Figure 4: Plan view of public space with new planting to deter graffiti attack.

bushes and plants that are difficult to penetrate, could be positioned against the wall, to make access to the recessed area much more difficult.

Location of new fixtures

Many listed buildings are used for commercial purposes in city centre locations. Over time, the use of the building may change, or the manner in which the business is conducted may alter with the introduction of new technology. The positioning of an installation on the outside of the building, or in close proximity to the building, which acts as a collecting point for the public has the potential to increase graffiti application to the building fabric. Some examples of such fixtures, which encourage people to make heavy use of a particular location, especially at night, are:

- Positioning of bus stops or taxi ranks adjacent to an important building façade or monument. (Illustration 35)
- Automatic teller machines, especially when these are set into a recess in a wall thus shielding the user from public view.
- Public telephone boxes.

Under these circumstances, the positioning of the installation requires careful consideration. Unfortunately, it is often the case that the potential for increased graffiti is not considered when siting a new fixture, and the damage caused to vulnerable stone as a consequence is overlooked. Local authority planning departments have a role to play in this regard and may want to give consideration to the impact of the installation on city centre conservation. Often, however, an alternative position for, or repositioning of the installation is not possible and consideration may have to be given to the use of anti-graffiti coatings or shields.

The church building in Illustration 35 is frequently attacked by graffiti, mainly because of the location of the bus stop, which is within a few metres of the sandstone wall. By repositioning the bus stop adjacent to the railings, much of the problem will be avoided. The need for collaboration between the church authorities, the local authority and the bus companies will therefore be necessary.

7.2 Educational and Social Strategies

A historic building or monument is an important feature of the community in which it is located. It is part of the history of that community but, unfortunately, its presence tends to be a matter of complete indifference to many of the people who apply the graffiti. This may be because they are not aware of its significance and it is perceived to be just another surface, owned by some remote authority, upon which they can leave their marks. Community involvement and education may therefore have an important part to play in an anti-graffiti strategy. In many instances, applying graffiti may be seen as a symptom of boredom when it is perceived that there is nothing better to do.

There are a number of initiatives that may be considered:

1. Incorporating the historic building into a neighbourhood or business watch scheme. This will also encourage greater involvement with the local community, local police and other security agencies.

2. Collaborating with the schools and community education centres in the vicinity to build into the curriculum learning packs and presentations relating to the historic building. Visits to the site would also form an important part of the educational process. This would help to raise awareness of the importance of the building to the community, help the children and adults to feel an involvement with the building from an early age and to foster a feeling of pride in it. Children are often a good source of information regarding the identity of the graffitists. Such information may come out in a general discussion on the problems caused by graffiti on historic surfaces.

3. Offer training to convicted graffitists, perhaps as part of government training initiatives, to develop the understanding and skills necessary to participate in graffiti removal and other cleaning operations. This would help to raise awareness of the issue amongst the peer group.

4. Ensure that the historic building is actually part of the local community, and that it is not perceived as the preserve of a few people who have no connection with the community. Discussions with the local community, local councillors and youth groups may elicit information as to the best means of incorporating the building into the activities of the local community, whilst still preserving its cultural value and historic fabric.

5. Anti-litter campaigns have now increased priority with many local authorities. Collaboration with the local authority to include anti-graffiti publicity as part of the campaign would be helpful. The publicity, as far as historic and sensitive surfaces are concerned, could highlight the nature of the problems posed by graffiti applied to such surfaces.

6. In many instances, the local authorities have an essential role to play. Local authorities may own many of the important city centre buildings that are regularly attacked and they also have a responsibility for the

quality of the environment of the city or town centre. Commercial premises in city centres in Scotland are often important stone buildings and many are also subjected to frequent graffiti attack. Individual property owners may not have the knowledge necessary to deal with graffiti on their building and may simply commission a cleaning contractor to undertake the graffiti removal work, perhaps causing damage to the material. In such circumstances, local authorities may want to consider a city centre wide initiative, to advise building owners on the nature of the problem and to implement a co-ordinated, area-wide approach to both graffiti removal and preventive measures.

Illustration 35. Location of bus stop encourages graffiti on adjacent sandstone wall.

8 COST AND CONTRACTUAL CONSIDERATIONS

8.1 Cost Considerations

The cost of anti-graffiti measures is a factor to be taken into account in the graffiti policy. When dealing with historic or other sensitive surfaces, the costs of graffiti removal are likely to be underestimated and may prove to be significant, due to the fact that the graffiti removal procedures that are normally used on more utilitarian surfaces may cause damage to the historic fabric. Authoritative data on the costs of dealing with graffiti on historic surfaces is not available, mainly because of the unpredictable and sensitive nature of the substrates in question and the need for highly skilled and experienced personnel to carry out the work. Often the work may need to be either carried out, or at least supervised, by a conservator and this cost must be included.

Costs may be considered under two categories, direct and indirect.

8.1.1 Direct costs

Direct costs are the costs associated with the physical removal of the graffiti and treatment of the surface with anti-graffiti coatings. Of these costs, labour and supervision will be the single largest component. The most important consideration is the selection of the treatment process that will achieve the necessary level of graffiti removal without damage to the surface. A comparison of the costs of materials for the various treatments, to select the cheapest, should not be an influential factor. The costs associated with the selected treatment must therefore become the budgeted costs and work should not proceed unless these costs can be borne. The temptation to adopt the cheapest, and usually the quickest, method must be resisted if this will be to the detriment of the historic fabric.

Factors to be considered in determining direct costs will include:

1. Shelf life of materials. It should be remembered that materials have a finite shelf life. In dealing with a graffiti incident, the quantity of materials used is likely to be relatively small. Bulk buying of one type of graffiti remover to reduce material costs should be avoided. It is better to maintain a small stock of a range of products that have proved successful on the marker types and substrates likely to be encountered. Alternatively, materials may be purchased to deal with a particular incident.

2. The cost of materials and their coverage rate, in terms of square metres per litre, varies considerably. It must also be recognised that more than one application may well be required. For example, some anti-graffiti coatings are applied as a three-coat system.

3. The efficacy of the products used should also be considered. As with coverage rates, the effectiveness of a treatment will vary considerably between products used on a particular substrate. The lowest cost material may therefore not provide the best value.

4. The nature of the substrate, in terms of surface roughness and absorption, will have a significant influence on the quantity of materials used and on the time required to execute careful treatment of the graffiti. Excess film thickness will also contribute to the loss factor for applied materials. With some systems, the loss factor may be as high as 50% on absorbent substrates.

5. The need for access scaffolding.

6. The cost of trial cleaning. In a situation where the substrate is of significant cultural value or is in a fragile condition, the costs associated with determining the most appropriate treatment may form a large component of the total direct costs.

7. The cost of any specialist services that may be necessary, such as laboratory testing and other scientific investigations.

8. Protection of adjoining surfaces and prevention of chemical contamination of plant and animal life.

9. Safe collection and disposal of wash-off water to prevent damage or contamination of other historic surfaces in the area.

10. Health and safety equipment and precautions for operatives and the general public.

11. The need to provide power to the site. Many historic sites do not have an electricity supply and an electric generator will therefore be necessary, in some instances.

8.1.2 Indirect costs

These are considered to cover the costs of all alternative measures, including social, educational and physical strategies. Under this heading, the effects of not removing graffiti should be included as part of the cost-benefit analysis. Many of the benefits will be intangible, such as the potential for increased graffiti and other forms of vandalism should graffiti removal not be carried out, resulting in a reduced amenity of the site. Conversely, a decision not to clean an isolated graffiti incident may be to the long-term benefit of the historic substrate. The costs associated with the installation of physical measures, of the type outlined in section 7, are relatively easily determined. However, it is much more difficult, if not impossible, to determine accurately the cost savings that may be achieved by their installation.

Cost sharing of anti-graffiti measures with other organisations should be investigated where this is possible. A sharing of costs may be possible for educational initiatives in local schools, advertising campaigns, litter collection, control of fly-posting, improved lighting, security patrols and neighbourhood watch schemes.

A graffiti daubed and vandalised site may act as a discouragement to visitors and thus there may be an associated financial loss.

8.2 Selecting a Contractor

If graffiti treatment is to be carried out by a contractor, selecting a suitable contractor is of paramount importance. The factors that will influence the selection are:

1. The knowledge and experience of the contractor in the treatment of graffiti on historic surfaces. The contractor must be able to show that he has successfully removed graffiti from similar substrates.

2. All staff, operatives and supervisors, must be able to demonstrate the appropriate level of skill and understanding necessary to work on historic surfaces. This may be determined during preliminary trials, in addition to recognised certification of the individual operatives.

3. It is recommended that a list of approved contractors should be prepared. No contractor, who has not been previously approved, should be employed to work on historic surfaces.

4. A satisfactory statement that explains how health and safety requirements will be implemented and how vulnerable fabric, plants and animals (if appropriate) will be protected.

5. The contractor selected for graffiti removal should also be responsible for the application of any anti-graffiti coatings.

9 HEALTH AND SAFETY ISSUES

9.1 Hazard Information

Many of the solvents, proprietary graffiti removal treatments and anti-graffiti coatings are hazardous to health. All substances in this category are classified under the Chemicals (Hazard Information and Packaging for Supply) Regulations 1994 and 1996 (CHIP) which require suppliers to provide sufficient information to ensure that the hazards are correctly identified. The regulations also require dangerous chemicals to be suitably labelled, with the appropriate danger symbol displayed, together with relevant risk and safety phrases on the label.

If substances are classified as dangerous, then material safety data sheets, together with the labels on containers of products, provide a most important source of information for users undertaking risk assessments as required under the Control of Substances Hazardous to Health Regulations (COSHH).

The COSHH Regulations define in general and specific terms how employers are expected to safely manage the use of potentially harmful substances. For workers who expect to handle a variety of toxic substances there are a number of guidelines laid out in the Health and Safety Executive COSHH publications Approved Codes of Practice and Guidance Leaflets. The COSHH Regulations apply to substances hazardous to health or mixtures of substances classified as dangerous to health under the CHIP regulations. There are two types of occupational exposure limit for hazardous substances; occupational exposure standards (OESs) and maximum exposure limits (MELs), (e.g. carcinogens, mutagens or teratogens). Guidance Note EH40 from the Health and Safety Executive, which is updated annually, lists the occupational exposure limits which should be used in determining the adequacy of control of exposure by inhalation, as required by the COSHH Regulations.

The Regulations require employers to make an assessment of all work that is liable to expose any employee and other persons to a substance hazardous to health. Most chemical and physical methods of graffiti removal and anti-graffiti coatings on masonry surfaces require to be assessed as they involve the use of hazardous liquids, dusts, fumes or vapours depending on the method selected. However, some coatings, such as those based on vegetable polysaccharides, are completely safe, solvent-free and require no special protective clothing.

Managing hazardous substances and complying with the requirements of the COSHH Regulations requires:

1. Identification of the hazardous substance involved.

2. Assessment of the risk to health arising from the work and identification of the precautions necessary.

3. The introduction of appropriate measures to prevent or control the risk.

4. Checks to ensure that control measures are used and that equipment is properly maintained and procedures observed.

5. Where necessary, exposure to be monitored to ensure that methods and control measures work.

6. Employees to be informed, instructed and trained in the risks and precautions to be taken.

Assessment means evaluating the risks to health and then deciding on a course of action needed to remove or reduce the risks, with the details recorded in writing. The responsibility for assessment should be allocated to a competent person who is adequately trained, with access to appropriate levels of advice and professional support as required.

Persons managing the site or contract have a responsibility to ensure that contractors and others have adequate information to plan safely their work. There is also a responsibility to ensure that they have carried out their COSHH assessments, that they are adequate, and have in place a management system for checking on the suitability of the assessments for the work being carried out and to ensure that precautions and controls are being implemented.

9.2 Safety Equipment

The treatment of graffiti will require the operatives to be supplied with personal protective equipment that is suitable for the identified hazards. For most graffiti removal and anti-graffiti coating work, the following list defines the minimum equipment required. The manufacturer's Safety Data Sheet for each product should be consulted.

- One-piece water and solvent proof boilersuit.
- Respiratory protective equipment suitable for the solvents being used.
- Eye protection.
- Gloves suitable for use with the chemicals being handled.
- Clean or sterile water for use in case of splashes or contact with the eyes.
- Some chemicals may also require washing with soap and, in case of swallowing, the administration of activated medical charcoal.
- First aid kit.
- Waste disposal sacks.

9.3 Protection of the Public and the Environment

Adequate measures are required to be in place to protect the public and the environment. The scale of the graffiti treatment operation will have a big influence on the nature of the protection measures required. Some typical measures are given below:

- Barriers to keep the public a safe distance from the work, to prevent contact with splashes from chemical cleaning materials and dust inhalation.
- Prior notification to the local authority when scaffolding is to be erected on public footpaths.
- Safe collection and disposal of run-off materials to prevent entry to drains and sewers, and to prevent damage to any vulnerable planting.

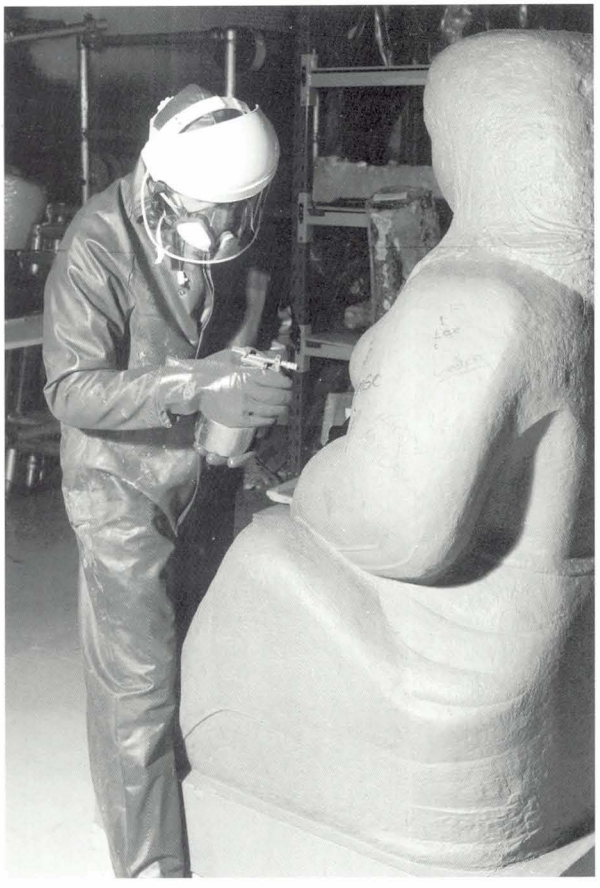


Illustration 36: Fully protected operative removing graffiti from a carved figure.

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APPENDIX A

Graffiti Removal Products and Anti-Graffiti Coatings

Notes

1. The list of products identified in this Appendix is for guidance and information only. The list is not intended to be definitive or exhaustive but is merely indicative of the range of products available at the date of this Technical Advice Note.

2. Historic Scotland does not accept any responsibility for the information contained in this Appendix and the appearance of a manufacturer or product in the list is neither an approval nor endorsement of the manufacturer or product. Persons proposing to use a particular product should take steps to satisfy themselves that the product is suitable for the intended use.

3. Manufacturers change product names and active ingredients from time to time and manufacturers should be contacted for their latest information.

4. The use of N.D. indicates that the relevant data was not available when the Appendix was prepared.

5. Information contained in this list has been abstracted from manufacturers' published product information.

GRAFFITI REMOVAL PRODUCTS

Supplier/ Manufacturer	Product and General Description	Principal Active Ingredient/s'	Substrates	Additional Comments from Manufacturer's Literature
Arrow Chemicals Ltd	Graffiti remover (Aerosol) Viscous aerosol	1-methoxy-2-propanol N-methyl-2-pyrrolidone Nonionic surfacant	Most surfaces	Removes inks, paints, felt-tip markings
Chemsearch	Wipeout Graffiti remover and cleaner	1,2-dichlorobenzene 1,4-dichlorobenzene Xylene	Porous & smooth surfaces	Removes most paints, lipstick, crayon and inks. PH =13.0
	ZOFF Aerosol Aerosol cleaner	Sodium nitrate Fatty alcohol ethoxylate Nonyl phenol ethoxylate Xylene	Non-porous	Removes inks, crayons, lipstick, grease, sticky labels, marker pens, many spray paints. PH=9.0
Crowner Industrial Hygiene Company	Graffiti remover Gel spray	N-methyl-2-pyrollidone n-butane	All surfaces	All forms, including felt-tip marker and aerosol paint.
Dacrylate Ltd	Marclean G.P. Brush applied gel general purpose graffiti remover	N.D.	Sealed surfaces but may remove graffiti from unsealed brick and stone	Removes sprayed graffiti, felt marker etc. Ghosting possible on unsealed sub-strates.
Dimex Ltd	Vandalex graffiti remover Aerosol gel spray	N.D. Not solvent based	Brick, stone, plastic, paint	Removes paint, felt-tip, crayon, ball pen
	Vanquish Spray	N.D.	Porous surfaces, metal, tiles	Use on aerosol, gloss, polyurethane or epoxy paints.
Janchem Ltd	Graffiti Remover Available as Gel spray	N.D. Solvent based	Gel – delicate surfaces Liquid- non-porous surfaces	Removes paint, ink, crayon from hard non-porous surfaces
3M United Kingdom PLC	Graffiti stain remover Liquid spray	N.D.	Plastics, paint, concrete, brick	Removes aerosol paints, felt-pen ink, emulsion paint, lipstick & crayon. Three products for different sub-strates. (GR3 for bricks etc, tiles, metals)
Modern Maintenance Products International Ltd	Tribol QGR Aerosol spray	Dichloromethane 4-Methlpentan-2-one 1-methoxy propan-2-ol-Acetone	All surfaces	Removes paint, crayon, marker pen etc from hard surfaces.
Performance Chemicals Ltd	Multipurpose Graffiti Remover Gel Brush applied gel	N-Methyl Pyrrolidone	Hard non-porous e.g. Masonry (sic) aluminium	Removs felt-tip ink, aerosol spray paint, wax crayon
	PCS200 Brush applied gel	Methylene Chloride	Masonry, metals, wood	Removes paints, cellulose, enamel, polyurethane, modern acrylic
	Exterior Stubborn Graffiti Remover Brush applied gel	Methylene Chloride	Concrete, brick, metal , wood	Removes felt-tip ink, aerosol spray paint, lipstick, wax crayon
Performance Chemicals Ltd	Graffiti Gone Brush/spray applied liquid	N-Methyl Pyrrolidone	Hard non-porous e.g. masonry (sic), metals	Removes felt-tip pen ink, paint, wax crayons
	Graffiti Remover	N-Methyl-2- Pyrrolidone	Metal, masonry	Ink, paints, crayons
Remchem Ltd	Anti Graf General purpose graffiti remover	N.D.	N.D.	
	Orion Heavy duty graffiti remover	N.D.	Porous surfaces e.g. brick, stone, concrete	
Servo-Chem Ltd	AG3 Graffiti Remover N.D.	Solvent based	Most surfaces	
	Graffiti Wipes Graffiti remover liquid impregnated cloth	Solvent based	Smooth surfaces	Removes pen ink, spray paint
Strippers	Graffiti-Stripper G-102 Two pack system, brush or spray (not nylon brush)	Non-phenolic solvent based includes Methylene Dichloride	Brick, stone, concrete	Removes aerosol paints, paint, felt-tip ink.
Tensid UK PLC	Graffiti Clean 300/400 Brush-on gel	N.D.	Portland stone, marble, granite, Concrete, tiles	300 more gentle than 400
	Graffiti Ghost Brush applied	N.D.	All masonry except limestone & marble	Removes ghosting after initial cleaning
	Graffiti Ghost Poultice Poultice, site mixed	N.D. Alkaline based	All masonry	For deep seated ghosting.
Flirok UK Ltd	Specialist micro-abrasive machinery	Micro abrasive Granulets range, using calcite with fine graining, dry or with water	Most surfaces less glass and plastic	Removes most graffiti from range of surfaces

GRAFFITI REMOVAL PRODUCTS

Supplier/ Manufacturer	Product and General Description	Principal Active Ingredient/s	Substrates	Additional Comments from Manufacturer's Literature
Stewart Wales, Somerville Ltd	GR1 Graffiti Remover Brush applied	N.D.	Absorbent and non-absorbent surfaces	For aerosol paints but not gloss/matt/emulsion paints.
	GR2 Graffiti Remover Brush applied	N.D.	Non-absorbent surfaces	For marker pens and aerosol paints but not gloss/matt paints
Surface Protection Systems Limited	TR20 Graffiti Remover Airless spray or brush applied	N-Methyl-2-Pyrrolidone Di Basic Ester, Organic acid	Porous surfaces	Bio-degradable
Unicorn Chemicals Ltd	Supa-graff Aerosol application	1-Methoxy-2-Propanol Propan-2-ol	Non-porous surfaces	Removes inks, lipsticks, crayon, grease. Ball-point inks, felt-tip, cellulose, non-cellulose paints
	Zapp Paint Stripper Aerosol application	Dichloromethane Methanol	Wood, concrete, masonry, metals	Mainly a paint stripper. Removes graffiti from masonry surfaces.
T & R Williamson Ltd	Toocan E F Graffiti Remover Liquid, environmentally friendly	N-Methyl-2-Pyrrolidone P-Mentha-1,8(9)-Diene	N.D.	
	Toocan Mild Graffiti Remover No 2. Mild gel	1-Methoxy-2-Propanol Propan-1-Ol	N.D.	
	Toocan Graffiti Remover No3 Strong gel	1-Methoxy-2-Propanol N-Methyl-2-Pyrrolidone	N.D.	

Anti-Graffiti Coatings

Supplier/ Manufacturer	Product and General Description	Principal Active Ingredient/s	Substrates	Additional Comments from Manufacturer's Literature
All Remove (Scotland)	PSS20 Protective Surface System. Airless spray, aqueous solution	Vegetable polysaccharides Neutral cleaner Sodium bisulphate	Suitable for porous substrates	Solvent free. Reversible
Dacrylate Paints Ltd	Margard SP Clear Moisture-curing polyurethane coating, brush applied	Polyurethane	Concrete, brickwork, renders, timber, tiles	Graffiti resistance for 5 years.Gloss, semi-gloss or matt finish. Coarse or weathered substrates, two coats of sealer advisable.
Degurra A.G.	Protectosil Antigraffiti Spray applied sacrificial coating	Alkylalkoxysilane + wax	Stone, brick, concrete, plaster, render	Water solvent. Removed by hot water at 80-90oC. Water vapour permeable. Requires sound surface, free from soiling. Also acts as water repellent. Substrate colour may be intensified.
Rechem Ltd	Reguard 2000 Clear permanent coating	Water based	Brick, stone, concrete	Microporous
Tensid UK PLC	Grafi Coat 1 Water-based silicone free wax emulsion	Micro-waxes Anionics/non-ionics with additives	Porous masonry	Sacrificial system. Permeable. pH 7, Applied on wet or dry surfaces.
Stewart Wales, Somerville Ltd	AGC 2001 Brush or spray applied	Micro-waxes Anionics-ionics with additives	Porous masonry	Sacrificial, reversible. Extra Strong used for porous surfaces.
Surface Protection Systems Limited	TP500 Water based, bio-degradable. Spray applied	Wax Dispersion	Hard, porous surfaces	Protects against spray/brush/roller paint. Protects against airborne pollution and dampness for minimum of 4 years.
T & R Williamson Ltd	GS1 3 Coat clear Matt Finish . Brush or spray	Two pack polyurethane. Xylene, Mixture of isomers Ethylbenzene 2,6-Dimethylheptan-4-one	Porous substrates e.g. stone, concrete, brick	Likely to produce finished 'sheen' to masonry. Permanent coating.

APPENDIX B

GRAFFITI RECORD CHART: PART 1

1 Name or address of site/property

2. Listed Building/Scheduled Monument YES ☐ NO ☐ **3. Date of incident** ☐

4. Previous graffiti incidents at the site YES ☐ NO ☐

5. Location of graffiti (describe accurately, use sketches if necessary) **6. Photograph/s** YES ☐ NO ☐

7. Substrate material or materials (enter the appropriate scale for surface roughness and condition of the substrate)

Material	Porous (Yes/No)	Colour	Historic patina (Yes/No)	Surface roughness [1]	Salts (yes/No)	Previous graffiti removal	(Yes/No)	Condition[2]	Other comments
1.									
2.									
3.									

8. Graffiti type (tick all appropriate boxes)

Aerosol spray paint	☐	Brush applied paint	☐	Felt-tip marker	☐
Correcting fluid	☐	Crayon	☐	Lipstick	☐
Chalk	☐			Surface scratches/gouges	☐
Other	☐	(please describe).....			

9. Extent of attack

Severe	☐	(graffiti extends over 1 metre length)
Moderately severe	☐	(0.5-1m **and/or** extends over more than one material, feature or element)
Moderate	☐	(0.1-0.5m and confined to a single material, feature, or element)
Slight	☐	(< 0.1m and confined to a single material, feature or element)

---

1 **Surface roughness**: VR=very rough (eg harling), R=rough (eg sandstone, course brick), S=smooth (eg polished granite), VS=very smooth (eg polished metal, glass)

2 **Condition:** 1=sound/intact, 2=minor erosion, 3=moderate erosion, 4=severe erosion

GRAFFITI RECORD CHART: PART 2

TRIAL REMOVAL/TREATMENT RECORD

10. Trial Treatment and Testing

Trial treatment conducted YES ☐ NO ☐

If YES, Name of person supervising trial_____

Name of person carrying out trial (if different)_____

11. Description of method/s and results of trials

Method	Results								Other observations (e.g. ghosting)
	Graffiti removal %				Substrate change				
	1	2	3	4	N	S	M	E	
1.									
2.									
3.									
4.									

Notes

i. Graffiti removal %: 1 = 100%, 2 = 50-99%, 3 = 10-49%, 4 = <10%

ii. Substrate change: N = none, S = slight, M = moderate, E = extensive

12. Is the overall result of trial satisfactory? YES ☐ NO ☐

13. Details of specification and procedures to be adopted in main treatment operation

Signature of supervising agent_____Date_____

GRAFFITI RECORD CHART: PART 3

MAIN TREATMENT STAGE

14. Name of contractor/person carrying out treatment_____ **15. Date**_____

16. Was treatment carried out according to specification in Part 2? YES ☐ NO ☐

If NO go to 18.

17. Outcome of main graffiti treatment

Satisfactory YES ☐ NO ☐

If NO, give reasons. If YES go to 20.

18. Reason for change in specification

19. Outcome of treatment using revised specification

Satisfactory YES ☐ NO ☐

If NO, give reasons

20. Record of final condition (attach a photographic record of final surface condition)

Graffiti removal
- ☐ 100%
- ☐ 50-99%
- ☐ 10-49%
- ☐ less than 10%

Residual ghosting YES ☐ NO ☐

Substrate change
- ☐ None
- ☐ Slight
- ☐ Moderate
- ☐ Extensive

Details of change

21. Any other comments

Signature of supervising agent_____ Date_____

APPENDIX C

USEFUL ADDRESSES

Health and Safety Commission
Rose Court
2 Southwark Bridge
London
SE1 9HS
Tel: 0171 717 6000

Health and Safety Executive
Rose Court
2 Southwark Bridge
London
SE1 9HS
Tel: 0171 717 6000

Historic Scotland Conservation Centre
South Gyle
7 South Gyle Crescent
Edinburgh
EH12 9EB
Tel: 0131 334 6367
Fax: 0131 334 6810

National Graffiti and Vandalism Association
Secretary
Dr Maurice Whitford
22 Haydn Park Road
London
W12 9AG

Scottish Conservation Bureau
Historic Scotland
Longmore House
Salisbury Place
Edinburgh
EH9 1SH
Tel: 0131 668 8668
Fax: 0131 668 8669

Society for the Protection of Ancient Buildings
37 Spital Square
London
E1 6DY
Tel: 0171 377 1644

Society for the Protection of Ancient Buildings in Scotland
The Glasite Meeting House
33 Barony Street
Edinburgh
EH3 6NX
Tel: 0131 557 1551

London Underground Ltd
Building Control Group
30 The South Collonade
Canary Wharf
London
E14 5EU
Tel: 0171 308 4344

The Stone Federation of Great Britain
18 Mansfield Street
London
W1M 9FG
Tel: 0171 580 5404
Fax: 0171 636 5984

Stone Federation of Great Britain Scottish Branch
PO Box 28011
Edinburgh
EH16 6WN
Tel: 0131 467 1998
Fax: 0131 621 7089

Tidy Britain Group
Elizabeth House
The Pier
Wigan
WN3 4EX
Tel: 01942 824 620
Fax: 01942 824778