Enamel is graffiti-prohibitive

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Graffiti resounds throughout the land. This article is to give an overview about the topic itself. What exactly is Graffiti? How is it defined? What kind of damages are caused by graffiti? Who are the sprayers? What motivation and what risk do they have? Which possibilities exist to remove graffiti and what about prevention? Where can one find interesting projects on enamel realized?

Materials are considered to be graffiti-prohibitive if graffiti can be removed easily. Graffiti has become well-known during the Student Revolt of 1968. It developed in the US (New York) and originated from the so-called "tags", the personal marks of individuals, which can be compared to a sign or signature. Public or private buildings as well as transport facilities get more and more blemished by illustrations, scribbling and initials, also known as characters, styles and tags. Graffiti can either be sprayed using varnish paint or written with a type of felt pen or craved on surfaces. The latter is called "scratching". Only two percent of all graffiti "works" are considered to be artistic. According to estimations e.g. the number of graffiti sprayers in the city of Berlin amounts 14,000. Thus, one can imagine that, as a result, the number of unpleasant taints is considerably high. Depending on the type of surface, removal of graffiti can be immensely expensive. The sum paid annually by the companies for public transport in Berlin amounts up to € 18 million. Throughout Germany graffiti damages are estimated to run up to € 150 million, damages worldwide are considered to be approx. € 55 billion. Yet, painters, fabricants of spraying color benefit from graffiti.

The reproduction of the famous little Mexican from Mordillo, seen in Straßbura, is an example of

Now the question is: who is liable for the damages? The rule is clear: the owner has to pay for the removal. Costs can be written off against tax, leading to a loss of tax income for the government. Some municipal cleaning organizations offer service contracts for graffiti removal. € 5 is the yearly amount for maintenance resp. cleaning of one square meter per year. A great number of members of anti-graffiti associations come from the painting business. Lobbies aim at financial support by the government. The age range of the graffiti sprayers is well known: 95-99% are male teenagers between 14 and 19 years. When it comes to the motivations for graffiti vandalism, a considerable number of those teenagers seek for attention, acceptance and estimation, while thrill seeking, too, is an important motivating factor. The thrill of illegality makes graffiti even more attractive for sprayers. In crowded areas, graffiti has developed as kind of youth culture. Frequently, politically motivated graffiti is found, the majority of them coming from the polar opposites, the right-wing radicalism and the left-wing anarchism. Very often, these groups lack opinion forums within the parliamentary system. Last but not least, we also find the group of sprayers that use graffiti as provocation or as a mean to let off steam. In view of these motivations, the sense of legally provided graffiti surfaces remains uncertain. Many times, young people make their first graffiti-experiences on publicly organized graffiti events and acquire a taste for it. As a quintessence, one can observe that the first spray-can was paid by municipality.

Example of stencil graffiti

What are the risks for the sprayer? In general, courts are bound to keep costs for the accused as low as possible. Thus, costs for cleaning (means) exceeding the amount of € 15 per square meter, are generally not accepted. In the discussion with "Flughafen Frankfurt Main AG" (FAG) in the year 1982 (Runway West), a remarkable sentence was pronounced. The person having been arrested for wall-painting, was acquitted since the wall had been torn down when the process started. This verdict signifies a precedent for all cases dealing with damaging ruins or abandoned buildings, where one can no longer speak of damage to property. Therefore, the risk of getting in trouble because of spraying those buildings is very low. The owner is still obliged to proof depreciation/loss of intended use. Pedagogues claim that from the nineteen fifties on adults again and again had to ponder with juvenile subcultures (youngsters, rockers, hippies, punks, skins and others). Juvenile subcultures had always been provoking and infringing rules of the adult world. Some even compare graffiti to cavemen painting assigning graffiti a 40,000-year-old tradition.

The Alibi-Train is a typical example of graffiti "infestation" of means of transport.

At this point, the thought comes up that one tries to search for a technical solution for a social problem, that has not been solved so far. At any event, the owner is obliged to keep buildings clean. In the city of Hamburg, the construction authority can arrange cleaning actions at owner's expenses.

The following means for graffiti removal exist:

- washing-off (semi-permanent systems and permanent systems)
- removal of protective films (temporary systems)
- painting the graffiti
- dry-ice blasting
- high-pressure water jets
- sandblasting

The effect of dry-ice blasting can be compared with using high pressure jets or sandblasting. The problem with dry-ice blasting is the resulting embrittlement of the varnish layer. Moreover, the different thermal expansion causes tensions between varnish and ground material. Apart from this, dry-ice blasting is similar to high-pressure water jets and sand blasting.

Meanwhile, a RAL -quality assurance association for graffiti removal techniques has been founded. Often, great deals of damages are caused by the owners themselves using inappropriate cleaning means. Concerning the cleaning of sprayed surfaces, one has to be very careful keeping in mind the different kinds of material of walls: concrete is different from metal sheets, aluminium or enameled surfaces.

Some of the above-mentioned possibilities base on anti-graffiti systems. Their effectiveness consists in preventing the penetration of pigments (e. g. into the wall), which facilitates the graffiti-removal considerably. Semi-permanent protection systems usually combine a base coat that still remains after the graffiti removal (modified siloxanes or acrylates) and a protective coating that has to be re-applied after each removal (fluorcopolymers). Typical temporary systems are biopolymers (wet ground: polysaccharides, starch/cellulose) (dry ground: waxes, acrylates/copolymerisates) and protective films.

As a conclusion, the following graffiti-preventives can be mentioned:

- planted walls
- enameled panels
- artistic graffiti
- graffiti protection systems
- prohibition of spray cans
- prompt removal (24h)

Graffiti protection systems are not always trouble-free. Especially permanent systems (i.e., systems lasting 3-5 years) may seal the surface in such way that it is almost gas-proof. Frequently, however, gas diffusion out of the wall is indispensable (new buildings etc.). A congestion of water vapor may cause large surface blistering on the wall. Temporary systems often do not ensure sufficient financial security to the applicant and, furthermore, hold the problem that with hot water blasting, color particles can easily be pressed into the pores. If this is the case, an entire graffiti-removal becomes very laborious. Walls that have been cleaned within 24 hours are avoided by sprayers. The desired long-lasting effect and the "fame" are not achieved – the spraying pleasure gets expensive and frustrating.

Enamel is recommendable as (permanent) graffiti protection system since a characteristic of enamel consists in the fact that the varnish does not stick-on enameled surfaces. Other surfaces do not possess this property and have to be acquired through extensive and expensive works. Glass and enameled surfaces have this property by nature. Elastic varnishes are able to stick on glass and enamel (e.g. Window Colors) but can be taken off easily like a film. In this case, the varnish sticks on the surface only by adhesion (no capillaries – contact angle ~90°). If the varnish cannot spread on the substrate surface, no intermolecular interchanges and therefore no adhesion can develop. This can be shown easily by the following experiment:

This figurative graffiti example comes from Rome.

We observe a drip on the substrate surface: if a small drip remains on the surface without diverging, this is a consequence of poor wetability. Only poor adhesion can be expected. Then we spread the cover material manually on the surface. If the liquid converges again to drips, it is likely that the relation between surface tension and viscosity of the liquid is unfavorable for the covering; likewise, only poor adhesion can be expected. Rough surfaces go along with a surface enlargement and have statistically more bonding points. Cave like structures lead to interlockings. Removal is only possible through a cohesion fracture in the substrate or coating.

For a more quantitative consideration, the penetration depth (d) of the liquid is an important measure. It is easily understandable that this is advantaged by larger capillaries (radius = r) and a longer residence time (t). The wetability can be obtained by the cosinus of the contact angles (cos θ). Moreover, high surface tension (σ) and low viscosity (η) of the liquid are as well favourable for a great penetration depth. This is expressed in the Washburn equation:

$$d = 2{,}24 \cdot \sqrt{\sigma/\eta \cdot (r \cdot \cos\theta) \cdot t}$$

Graffiti can be removed easily from enameled surfaces by either using appropriate solvents (as e.g. acetone or acetic acid ethyl ester) or by effecting a cohesion fracture in the coating caused by a mild scouring detergent. This has the advantage that one does not have to take care of absorption and disposal of the used solvents. There are already a large number of projects realized or being realized with architectural enamel – as e.g. the following two samples. At New York's JFK-Airport one of the most effective terminals of the US has been build: in terminal 4 operate more than 50 airlines, building costs: some $ 1.2 bn. The second example is the windscreen project at the Sheepshead Bay, which is used by 8,000 passengers every day: twelve decorative and informative anti-graffiti and vandalism-resistant, enameled, double-faced boards will serve as windbreakers.

At the PEI we learn that enameled panel is the material of the future for architecture – especially recommendable for application in underground and bus stations, tunnels and bridges. Enameled signs resist gas emissions and graffiti and are the most durable material. Many signs are already more than 50 years old. Enamel offers innovative qualities that should be in great demand at the moment. In the US, the potential has already been recognized. For architectural purposes, enamel frequently is a simple and decorative solution, but since architects are hardly instructed as to this fact, they often do not think of enamel as architectural solution. Concerning signs and signboards, the weight of enameled signs (and panels) is frequently criticized. For this reason, aluminium often is preferred since it is also sufficiently resistant to decomposition. But as aluminium is an expensive material, it becomes more and more a target for scrap thieves. Planners should consider this, too. The above mentioned organic anti-graffiti systems have, of course, their advantages, since e. g. historic buildings are to be protected from graffiti-vandalism and require a transparent (invisible) system.