Appendix 2: Surface Treatments – Use & Alternatives

1 Summary
Surface treatments, like surface dressing and micro asphalt, are sometimes viewed negatively by the public, who unfairly (but understandably) compare them unfavourably to conventional resurfacing.

In practice, the different treatment types are used at different stages of a road’s life and complement each other over a whole lifecycle.

Used correctly in this ‘mixed lifecycle’ approach, surface treatments offer a range of benefits which would not be achieved by using resurfacing alone.

1.1 Economy: Save HCC millions per year
Surface treatments are cheaper than resurfacing and using surface treatments as part of our maintenance programme allows us to maintain and improve the condition of our network efficiently. It would cost the County Council millions of pounds more every year to achieve the same results with resurfacing alone.

1.2 Efficiency: Reduce the number of days of disruption
Surface treatments are quick to apply, so we can be in and out quickly, keeping the disruption to a minimum and reducing the impact on the travelling public.

1.3 Environment: Lower carbon cost of treatments and Reduced carbon emissions due to better roads
Surface treatments have a much lower carbon footprint than conventional resurfacing, so they are a much greener way of maintaining our roads.

In addition, by using preventative maintenance like surface treatments when and where appropriate, we keep the road in a good condition for a greater proportion of its lifecycle. This means the roads are, on average, less bumpy than they would otherwise be, reducing the carbon generated by vehicle traffic and keeping down operator costs.
2 Surface Treatments – in more detail

2.1 Road surface treatments (surface dressing and micro asphalt) form a key part of our strategy for maintaining our roads and careful use of these treatments over the last decade has played an important role in improving the condition and restoring the resilience of our road network.

2.2 Despite this, these treatments are often unpopular with the public because, when first laid, they tend to look untidy; the loose stones that are a normal part of the processes contribute significantly to this, as does the fact that the white lines can’t usually be repainted for several weeks until the new surface has bedded in and the loose stones swept up. All of this can create the impression of a poor quality job.

2.3 So why use them? We only use them on roads that are suitable – our mantra is ‘right treatment at the right time’ and both timing and treatment selection are important but, where a surface treatment is a viable option, it can give the County Council benefits in terms of economy, efficiency and environment.

3 Economy

3.1 Surface treatments are significantly cheaper than full resurfacing and, used as part of a ‘lifecycle’ approach, they can extend the life of a road surface for many years for a fraction of the cost of replacing it.

3.2 Example 1 - Simple Resurfacing: Assume have a new road; the surface lasts 20 years, after which we resurface conventionally at a cost of £22/m².

   Annual cost = £1.10 per sq. metre (£22 divided by 20 years of life)

3.3 Example 2 – Mixed Lifecycle: Assume we have a new road; after around 20 years we apply a surface dressing to extend its life at a cost of £4/m², we repeat this treatment after 30 years. After 40 years it needs a further treatment and we decide that a resurfacing rather than further surface treatment is the appropriate treatment based on a technical assessment at a cost of £22/m². So, over 40 years, we have used two surface dressings at £4/m² each and one resurfacing at £22/m².

   Annual cost = £0.75 per sq. metre (£30 (£4 + £4 + £22) divided by 40 years of life)

3.4 Hertfordshire has around 30 million square metres of road; applying the above examples to that, the ‘simple resurfacing’ strategy would require a budget of £33m per annum whereas the ‘mixed lifecycle’ strategy would
need a budget of £22.5m p.a. Or, to put it another way, in this (very much simplified) example, shifting from a mixed lifecycle approach to a simple resurfacing approach would mean an increase in budget of 47% or a reduction in the scope of the programme that would mean we would be unlikely to be able to continue to hold or improve the condition of our roads.

4 Efficiency

4.1 Surface treatments are very fast to apply; we can surface dress in a single day an area of road that would take 20 shifts to resurface conventionally. Even taking into account the need to return to complete the aftercare work such as sweeping and road marking, there is still much less overall disruption to road users.

4.2 We don’t select surface treatments because they’re quicker but, on a busy network like Hertfordshire’s, speed of application can be a valuable added benefit.

5 Environment

5.1 Surface treatments have a significantly lower carbon footprint than conventional resurfacing where the old surface is removed and replaced. Although resurfacing is necessary at some stages of a road’s lifecycle, it generates a lot of waste (the old road surface) that needs to be removed for reprocessing or safe disposal and requires a lot of new stone which frequently needs to be newly-quarried in order to ensure quality. The production of asphalt at hundreds of degrees centigrade is energy intensive and removing the waste and delivering the new material involves a lot of lorry movements.

5.2 By contrast, surface treatments produce very little waste, since the old surface stays in situ and, because the new layer added is thin, a lot less new material needs to be produced, transported and laid. In addition, some processes like micro surfacing are laid at ambient temperature meaning the energy used in producing the material is much less than for conventional hot asphalt.

5.3 Consequently, including surface treatments in the lifecycle of our roads helps extend the life of the (carbon-intensive) road surface layers by laying a lower-carbon preventative treatment over the top. This means that the lifecycle carbon cost per year of maintaining that road is lower.
5.4 Besides the direct ‘carbon cost’ of the treatments, the preventative maintenance approach of the ‘mixed lifecycle’ has benefits to the wider economy and environment.

5.5 A recent study in the *International Journal of Sustainable Transportation*\(^1\) found that:

“Keeping road pavement\(^2\) in good shape saves money and energy and reduces greenhouse gas emissions, more than offsetting pollution generated during road construction.

*The researchers found that extending the life of pavement\(^2\) through preventive maintenance can reduce greenhouse gases by up to 2 percent; transportation agencies can cut spending by 10 percent to 30 percent; and drivers can save about 2 percent to 5 percent in fuel consumption, tire wear, vehicle repair and maintenance costs because of smoother surfaces.*”

5.6 In effect the study concludes that, because the preventative nature of the ‘mixed lifecycle’ emphasises intervention before the road gets into a poor condition so the road spends more of its life in a relatively good condition and less in a poor condition. Due to this, the roads are, on average, less bumpy which means vehicles operate more efficiently, accounting for the carbon reduction from lower fuel usage and lower operating costs. The research also endorses the conclusion (under ‘Economy’ above) that the cost to transport authorities of maintaining their road assets can be significantly reduced by adopting this preventative approach (something we have championed for years in Hertfordshire.

6 **Surface Treatment Types**

6.1 Surface dressing and micro asphalt (or micro surfacing) are the two main surface treatments used on carriageways within Hertfordshire. Both apply a new surface over the existing one; both restore texture and grip to some degree and both seal the old surface to keep out water and extend its life. The third main alternative is a conventional resurfacing but this is very much more expensive than either surface dressing or micro asphalt and can’t therefore be considered a like-for-like option.

6.2 It is beyond the scope of this paper to cover the technical aspects of these treatments in detail but an overview is presented here to assist understanding.

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\(^2\) In this technical context, the term ‘pavement’ is used to refer to any large area with a hardened surface – in this case a road.
6.3 Although surface dressing (SD) and micro asphalt (MA) achieve similar objectives, they do so in different ways.

6.4 MA has slightly more structure to it (the material is a bit thicker) and so it is more resistant to the kind of scuffing action caused by vehicles tyres as they park or make turning manoeuvres – both of which are more common in an urban environment. Due to the thickness of the material, MA adds some thickness to the road (typically 15-20mm); this means it can help to even out dips and bumps but also means it is more likely to raise the crown of the road which can cause unwanted problems with the profile.

6.5 SD is both typically slightly cheaper than MA and also generally has a longer life than MA so offers better overall value for money. SD adds very little thickness to the road surface so it does not change the profile; consequently it is not so useful for evening out minor dips but it also avoids raising the crown of the road.

6.6 Taking these factors into account, as a general rule, WCS engineers will tend to specify SD in more rural locations and MA in more urban ones. However, there are exceptions, considered on a case-by-case basis, which can include:

- Urban roads with a low number of parking or turning movements (some urban A roads and dual carriageways fall into this category)
- Urban roads where the shape of the road (e.g. a high existing camber or lack of existing kerb face) makes adding additional thickness to the road undesirable

6.7 Engineers will also take into account the defects that are present and need treating (for instance a road where there are no dips to remove but the surface is very polished might be a stronger candidate for surface dressing)

6.8 Both SD and MA tend to look untidy when first laid, with loose stones lying on the surface; this means they can tend to create a negative first impression with residents but, once the surfaces have bedded in, been swept and the road markings replaced, both types of treatment quickly revert to looking like a normal road surface.

7 Alternative Options

7.1 Both SD and MA can be considered as alternatives to the other under certain circumstances, as discussed in section 6 above.

7.2 Conventional resurfacing can also be used as an alternative to surface treatments under most circumstances although it is more appropriate to think of both surface treatments and conventional resurfacing as suitable interventions for different stages of the lifecycle of a road surface. The complete replacement of surface treatments with conventional surfacing
would have significant negative impacts in terms of economy, efficiency and environmental impact, as discussed in sections 2, 3 and 4 respectively.

7.3 Other surface treatments: There are many different proprietary surface treatments on the market, most of which are variations on SD or MA. The asset management team keep new and existing products under review and work with industry bodies and other local authorities to assess the potential benefits, drawbacks and applicability of new products. There are too many different products to consider individually here but some worth particular mention include:

7.3.1 ‘Lock Chip’ - A standard surface dressing which has an additional level of binder sprayed over it a few days after laying. This seals the surface, makes it look much more like a conventional asphalt, greatly reduces the amount of loose stone and allows the road markings to be replaced more quickly, shortening the aftercare period. A recent trial in Hertfordshire showed limited benefits but we will be trialling this process further during 2020 using a different specification for the additional binder layer. The process has the potential (if it matches the claims) to address some of the public perception issues that SD suffers from. However, it is more expensive, requires an extra site visit/road closure (for the extra spray) and does not offer extended life or other technical benefits beyond a normal dressing. However, if the trials are successful and demonstrate that the claimed benefits can be delivered reliably and the additional cost and disruption kept within reasonable limits, it may be beneficial to use on more sites in the future.

7.3.2 Fibre-reinforced treatments – Both SD and MA are available with glass-fibre reinforcement added to the mix. This tends to be used on sites where there is a need to control fine cracking or to add extra strength to the surface treatment. We already use these on selected sites where there are technical benefits although, visually, there is little to differentiate them from the standard versions of the products.

7.3.3 Asphalt Preservatives – Several companies offer asphalt preservative products, usually in the form of a bitumen spray that is applied to the surface of the road to ‘rejuvenate’ the binder in the existing asphalt and extend its life. The preservative spray has the side-effect of turning the road surface black (so it looks new). After treatment, the surface is usually lightly dusted with grit to restore the texture although a lot less lose material is used for this dusting than is typically present after surface dressing or micro asphalt. The process is very cheap but needs to be done very early in the life of a new road surface – sometimes as early as a couple of years after laying – and to be repeated frequently, typically on a five-year cycle throughout its life, in order to deliver the promised benefits. Because of sheer number and frequency of treatments, it is less economical than other surface treatments over a normal lifecycle so, although we did extensive trials about ten years ago, we have not used this treatment as part of our regular maintenance cycles. We do, however, continue to look closely at this sector of the market as it could offer useful benefits if a suitable product emerges.