In the latest in our series of articles from the Road Surface Treatments Association (RSTA), chief executive Howard Robinson examines the area of high friction surfacing.

High friction surfacing (HFS) has a long history of proven use in saving lives by imparting the highest level of skid resistance onto a road surface and is available as hot applied or cold applied systems. Cold applied HFS systems are similar to surface dressing in that they involve the even application of a tough polymeric liquid binder onto the prepared road surface followed by the application of calcined bauxite aggregate. The hot applied systems involve the application of a hot pre-mixed material consisting of binder and calcined bauxite.

The concept was first investigated in the USA during the 1950s using epoxy resin binders and was first known as anti-skid surfacing. In the UK, the first evaluation trials were conducted in 1967 for the Greater London Council. The study over a period of 12 months demonstrated a 50% reduction in skid related accidents and casualties on roads treated with high friction surfacing.

The use of high friction surfacing was fairly limited in the 1970s due to its relative high cost and limited highway budgets. Applications grew steadily in the 1980s when highway engineers could balance the cost of high friction surfacing against a broader savings strategy. Effectively, budgets were allocated for accident investigation and prevention, demonstrating returns on the investment in high friction surfacing at accident black spots compared with the savings in casualty reduction.

The growth of high friction surfacing accelerated in the late 1980s and early 1990s, largely in parallel with the traffic calming act and the development of alternative resin processes to the original epoxy resin systems. The current UK market is around two million square metres per annum.

How does HFS work?
The high level of skid resistance is imparted by the calcined bauxite aggregate used in HFS systems. Calcined bauxite is a manufactured aggregate with exceptional resistance to abrasion caused by vehicle tyres combined with a very high resistance to polishing - polished stone value (PSV) of 70+.

Calcined bauxite micro-texture results in reduced contact points with vehicle tyres creating high contact pressure points and improved hydraulic conductivity which are critical for high skid resistance (Parry,TRL,1996).

When to use high friction surfacing
On sites where there is high risk of accidents resulting from collisions between vehicles or between vehicles and pedestrians (e.g. on approaches to pelican crossings, junctions and crossings).

Cost effectiveness
Tragic loss of life or serious injury has an immeasurable cost to the accident victims, their families and friends.

Financially, there are major cost consequences for emergency services, local and national governments. It is estimated that one fatality on a non-motorway road costs £1.4m and on a motorway £1.7m.

The table (right) is courtesy of RoSPA (Royal Society for the Prevention of Accidents) and shows how HFS reduced accidents by 57% measured on 34 schemes and delivered a first year rate of return of 352%.

Which roads can be treated with high friction surfacing?
All classes of road, from single track, unclassified roads to high speed urban routes, trunk roads and motorways can and have been successfully treated.

High friction surfacings can be specified in accordance with The Specification for Highway Works Clause 924.

RSTA ADEPT code of practice for high friction surfacing
Published in 2011 and peer reviewed and endorsed by the Association of Directors for Environment Economy Planning and Transportation (ADEPT).
Analysis of schemes (<£100,000) by category

**Key:** FYRR = First Year Rate of Return (100% = 1 year)

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of schemes</th>
<th>Av. Cost £</th>
<th>Reduction in Accidents %</th>
<th>FYRR %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-skid</td>
<td>34</td>
<td>8,620</td>
<td>57</td>
<td>352</td>
</tr>
<tr>
<td>Area Traffic Calming</td>
<td>14</td>
<td>46,093</td>
<td>57</td>
<td>216</td>
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<tr>
<td>Controlled Crossing</td>
<td>73</td>
<td>15,916</td>
<td>31</td>
<td>89</td>
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<tr>
<td>Markings</td>
<td>43</td>
<td>2,020</td>
<td>34</td>
<td>957</td>
</tr>
<tr>
<td>Markings &amp; Signs</td>
<td>63</td>
<td>2,537</td>
<td>41</td>
<td>820</td>
</tr>
<tr>
<td>Refuges</td>
<td>65</td>
<td>10,387</td>
<td>37</td>
<td>259</td>
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<tr>
<td>Package Schemes</td>
<td>97</td>
<td>22,099</td>
<td>42</td>
<td>171</td>
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<tr>
<td>Signal Improvements</td>
<td>16</td>
<td>17,095</td>
<td>22</td>
<td>155</td>
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<tr>
<td>Speed Limits</td>
<td>6</td>
<td>1,117</td>
<td>33</td>
<td>1,035</td>
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<tr>
<td>Traffic Calming Horizontal</td>
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<td>22,606</td>
<td>46</td>
<td>125</td>
</tr>
<tr>
<td>Traffic Calming Vertical</td>
<td>58</td>
<td>23,333</td>
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<td>198</td>
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<td>Warning Signs</td>
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<td>553</td>
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<td>Speed Cameras</td>
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<td>Junction Improvements</td>
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<td>18,513</td>
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<td>New Traffic Signals</td>
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<td>40,717</td>
<td>67</td>
<td>153</td>
</tr>
<tr>
<td>Mini Roundabout</td>
<td>18</td>
<td>14,769</td>
<td>49</td>
<td>134</td>
</tr>
<tr>
<td>Yellow bar markings to slip roads</td>
<td>1,000</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Yellow bar markings to roundabouts</td>
<td>1,000</td>
<td></td>
<td>50</td>
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</tr>
</tbody>
</table>

The document is reviewed annually by the RSTA-ADEPT working party to ensure it remains rigorous, accurate and up to date to serve the needs of local authorities. It is freely available on the RSTA website [www.rsta-uk.org/publications.htm](http://www.rsta-uk.org/publications.htm)

This code of practice has been written by the Road Surface Treatments Association and ADEPT to assist procurers and installers to obtain a high quality durable surface treatment. It represents best practice for the selection and application of high friction surfacing systems to maximise their performance and durability.

To obtain the best results it is necessary to give careful consideration to a wide range of details and to plan and design the work carefully and to use only HAPAS approved installers. HAPAS categories systems as type 1, 2 and 3, where type-1 has attained the highest performance level. All comply with Clause 924 of the Specification for Highways Works, part of the manual of contract documents for highway works.

The type of application in which the materials are applied and the prevailing ambient conditions at the time of installation are also important to ensure long term durability of the product.

The purpose of this code is to identify the important aspects of the process, and to refer to other documents relating to good applications of high friction surfacing and so give practical guidance on achieving high quality.

The code discusses how to determine suitable sites for treatment and considers the different types of HFS systems in terms of composition, manufacture and installation. Specification issues are covered in some detail and it highlights the clients responsibilities towards achieving a successful outcome. It goes into some detail regarding planning and coordination, health and safety aspects, planning the execution of the works, traffic management and good surface preparation which is regarded as being a key factor affecting durability.

The document contains a new specification for calcined bauxite aggregates and provides a framework for the contractor to offer a five year guarantee providing the code of practice is followed to the letter. Guidance is also provided on how soon freshly laid asphalt surfacings can be treated depending on the choice of HFS system.

Training the workforce is also a major topic covered in the document. It is imperative that local authorities ensure their contractors have properly trained and qualified operatives with an NVQ level 2 in HFS and an appropriate CSCS card to ensure good workmanship which has a major impact on durability. There is also a checklist for contractors before, during and after the works and a glossary of terms.

### Some important benefits and features

- Designed to enhance the skid resistance of trafficked surfaces
- A high strength veneer surfacing, typically 3-5mm thick
- HFS systems properly specified and installed on a well prepared substrate have been shown to provide the highest level of skid resistance over a 10 year service life
- Should only be applied onto sound substrates that have been well prepared and are in fair to good condition

Environmental considerations

- Accident levels will be reduced by importing the highest attainable skid resistance
- The rapid speed of the process means that disruption to road users, local businesses and emergency services is minimised.

Life expectancy

- Careful attention to material selection and installation has provided service lifetimes of typically five to 10 years
- Cold applied HFS systems have an average service life of eight years and hot applied four years (Ref: RSTA/ADEPT code of practice for high friction surfacings)
- Calcined bauxite has proven to be extremely durable and able to withstand high braking and shearing forces over many years.

Summary

- High friction surfacing is an established, proven process for saving lives by imparting the highest level of skid resistance onto any road surface
- It is an extremely cost effective solution when compared to the value prevention by avoiding collision related fatalities
- Installed by specialist companies and organisations
- Requires well trained operatives and specialist plant
- Suitable for all vehicular traffic
- Adaptable to cycleways or pedestrian surfaces
- Commonly referred to as anti-skid surfacing.