

Nynas

Environmental concern, greater traffic volumes and increasing axle loadings have all contributed to the call for a new generation of high performance bitumen binders.

Changing demands bring new solution

Polymer modified bitumen binders have come strongly into vogue since the late 1990s, when traditional road surfacing materials were proving unable to cope with modern traffic demands. Higher traffic volumes, increased vehicle weights and axle loadings and the sheer weight of increasing traffic added up to greater numbers of failures due to permanent deformation. At the same time, the end user – the driver – was becoming aware of traffic generated noise pollution and a greater need to preserve the environment.

Thin surface course materials have been a major response of the asphalt industry to these problems and have come to dominate UK road surfacing, displacing Hot Rolled Asphalt as the road operator's material of first choice. One key to the success of a thin surfacing system is the binder, which has brought polymer modified binders to the fore along with a new emphasis on engineered products from the bitumen suppliers.

In recent years the asphalt industry has responded enthusiastically and successfully to the demands of

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Steve Harris

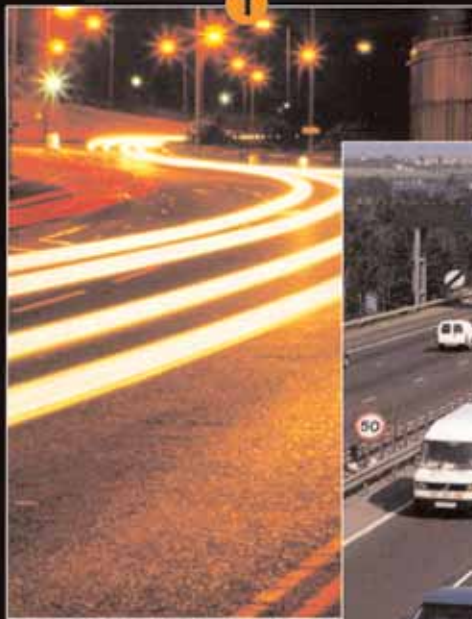
end users for a wider range of options for road surfacings. Asphalt has progressed from black art to a new status as an engineered material, and an innovative, quality and value for money oriented specialism has come of age. Behind the scenes bitumen producers have been active in helping the industry promote a more analytical approach to material development, evaluation and specification.

Advances which they have made in binder science have introduced a whole new range of analytical tools for testing and binder characterisation. Steve Harris, Senior Asphalt Engineer for the European Technical Support Group of Nynas Bitumen's Product Technology Division, says: “Softening point and penetration values used to be about the only measurements which were used to gauge performance, and whereas they do provide some comfort when recipe based specifications are being followed, in an age when end performance characteristics are increasingly adopted a more engineering approach is needed. We are now introducing more fundamental evaluation tools that allow us to assess properties such as complex shear modulus, cohesive strength and ageing resistance.”

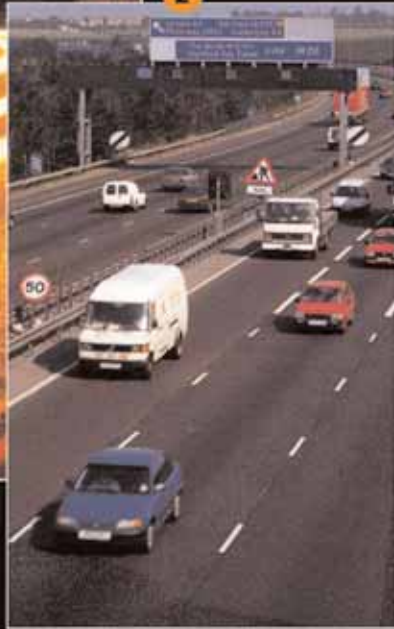
Nynas launched a new range of modified binders three years ago called Nypol, which epitomises the new approach to binder science. Nypol TS was developed specifically for thin surfacings, and now the technology which underpinned its development is being exploited to benefit other surfacing applications such as SMA and high modulus bases.

Nypol TS is regarded at Nynas as a ‘smart’ binder, one which has been engineered to exhibit thixotropic or shear thinning properties throughout the production and surfacing temperature range. As shear is increased – ie during mixing – the viscosity reduces, easing the mixing process while minimising the need for elevating temperatures which can alter the binders’ properties.

While in transit the viscosity increases over and above the viscosity changes which would be



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1. **Nynas' Nypol binder range is specially designed to create an asphalt surface that can withstand the higher traffic volumes and increased vehicle weights experienced by many roads.**
2. **NYPOL was used on a heavily trafficked section of the M25 in Kent to produce a high performance asphalt which resists reflective cracking.**
3. **Nypol has been engineered so that it can be adapted and used as easily in a porous mixture as in a stone mastic asphalt thin surfacing material without compromising performance.**
4. **Thicker binder films can help minimise the impact of environmental effects and improve durability.**

A KEY REQUIREMENT for a thin surfacing binder is that it promotes a thick binder film around the aggregate. These materials are highly textured and have a large surface area which is continually exposed to an aggressive environment. Water, oxygen, UV light, de-icing salts, oil and detritus can all affect the integrity of the end product.

Thicker binder films can help minimise these effects and improve durability. The use of polymers improves the cohesive strength of the binder, the internal cohesion of the mixture and the adhesion of the aggregate/binder mixture. Reduction in temperature susceptibility and the creation of an homogeneous polymer/bitumen structure improves the binder film's ability to resist the tensile stresses and strains that are induced by traffic loading over a wide range of loading frequencies, speed and ambient temperatures.

The introduction of a modifier to a bitumen alters the characteristics of the base binder. These changes are most easily identified by a change in binder viscosity. But simply increasing viscosity is not necessarily the answer. Ease of mixing and compaction need to be considered. Simply elevating mixing temperatures to compensate is not always practical. 'Softer' base binders and some modifiers can be damaged by excessive temperature. A balance needs to be struck so that the risk of excessive oxidation and, for some mixtures, binder drainage is minimised.

Nypol technology represents a significant breakthrough in overcoming these problems. It has a unique thixotropic behaviour which ensures that the binder is easy to mix at conventional temperatures. During storage and transportation the viscosity rises, reducing drainage. As the binder passes through the paver the viscosity again falls, allowing easy compaction.



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expected with temperature reduction, allowing thicker binder films without the risk of binder drainage. The paving operation introduces more energy, resulting in reduced binder viscosity and improved workability. Harris says: "End performance being the ultimate goal, Nypol TS will enhance mixture cohesion, resistance to ageing and strain characteristics. That makes it all round a smart binder."

of thin surfacing systems of fundamentally different type, on roads from the heavily trafficked south of England to more extreme cold weather areas in Scotland. Harris concluded: "Thin surfacing systems, along with performance testing and analytical pavement design, have significantly broadened the asphalt industry's offer of engineered solutions to its client's needs."

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Nypol TS has been used successfully in a number