Pavement durability – Shell’s alternative options explored

The life expectancy of highway pavements could be increased using binder technology that incorporates sulphur as well as bitumen, according to Shell tests.

Use of sulphur as an ingredient in road construction came to prominence in the 1970s when shortages of oil led to restrictions in the availability of bitumen. “When applied correctly the use of sulphur often led to well built roads,” says Shell Bitumen’s Global Thiopave Technology Manager David Strickland. “But problems associated with storage, mixing sulphur at higher temperatures and an odour given off by the sulphur-asphalt mixture led to the technique’s demise.”

Fast forward four decades and the company has resurrected the idea of applying sulphur to base and binder courses in road construction. It has launched a technology known as Shell Thiopave which replaces up to a quarter of the bitumen content in an asphalt mix with sulphur.

Shell Bitumen asked TRL to conduct an independent review of Shell Thiopave to test the findings. Results from the TRL study show that adding sulphur has the potential to increase the longevity of asphalt and can help to reduce the whole life cost of a pavement. The positive results of this study led Shell to look at new applications on account of its impressive mechanical performance. For example, it can help strengthen a carriageway on sites which are trafficked by very heavy construction plant, weighing over 1000 tonnes.

“Using sulphur within an asphalt mixture can lead to more durable pavements,” continues Mr Strickland. “It can increase the stiffness of the material and reduces the risk of rutting. We have designed Shell Thiopave to be mixed at slightly lower temperatures, thereby reducing emissions. And we incorporate special additives to significantly reduce odours that used to be associated with using sulphur. We have made great strides forward to improve the technology since sulphur was used in asphalt during the 1970s.”

Sulphur introduced to Shell Thiopave comes in a pellet form and is added in the asphalt production process at a warm temperature of 130°C. Incorporation of Shell Thiopave into the asphalt mixture can also help make bitumen go further. “While Shell Thiopave can enhance a road’s performance if laid to the same thickness as a conventional asphalt pavement, it can also...

New approaches embraced by Shell

Highway construction activity has changed considerably in the UK over the last 15 years, with road maintenance and the need to improve existing carriageway condition becoming headline news. Increased traffic, a greater number of heavy goods vehicles on the road and climatic variations are severely testing road infrastructure and have led to one clear observation: conventional bitumen does not always meet the needs of modern roads.

Shell Bitumen is now working closer than ever to help customers spend their money wisely on asphalt solutions while taking in to consideration environmental and sustainability commitments. “Shell has adapted by developing innovative and long lasting materials that meet the customer’s requirements,” says Shell Bitumen’s Lee O’Nions.

Other examples of Shell’s innovative solutions for reducing energy consumption and emissions include the low temperature asphalt process Shell WAM Foam and the Shell S-Grade binder range.

With Shell WAM Foam, lower production and laying temperatures are achieved by combining soft and hard bitumen grades. The soft bitumen is mixed with the aggregate to pre-coat it and then the hard bitumen is introduced into the mixture as a foam. The Shell WAM Foam Process results in an asphalt mixture with good workability at lower temperatures and properties at least equivalent to those of ‘hot mix’ asphalt. Recent trials have been carried out to incorporate the use of higher levels of recycled asphalt.

Shell S-Grade binders can also be used for lower temperature applications, helping to reduce asphalt manufacturing temperatures by 20-30°C and energy consumption by up to 9 kWh per tonne of produced asphalt. Their advanced viscosity technology is also designed to help accelerate productivity, allowing roads to be opened to traffic sooner and cause less traffic disruption to the public.

Shell WAM Foam is laid at lower temperatures
be laid thinner to give a similar performance,” Mr Strickland says.

Shell Bitumen has carried out a number of demonstration projects of Shell Thiopave in the UK as well as in North America, India and China. “We are very excited by the technology and I am sure that our customers not only around the world but in Britain too will come to see the benefits of using sulphur in roads.”

While Shell Thiopave is a relatively new development by Shell Bitumen, plenty of the company’s products sold today have been around for many years. Among them is the Shell Cariphalte range of polymer modified binders which were introduced to market in the 1970s and have been used extensively in road construction applications since the 1980s. Shell Bitumen has designed the Shell Cariphalte range to provide solutions for all types of roads.

Shell Cariphalte technology, the product of 40 years’ expertise and continual development, has earned Shell an international reputation.

One of the most high profile uses of Shell Cariphalte has been its application on the M25 London orbital motorway, where it was chosen to improve the rutting resistance of hot rolled asphalt. The material has been down on sections of the motorway since its opening in 1986 and a fresh application of Shell Cariphalte has recently been used on a section of the M25 near Potters Bar currently being widened by the Connect Plus consortium on behalf of the Highways Agency.

“Shell Cariphalte has performed very well on the motorway over the last 25 years and the same material has been used on the current scheme to widen the M25,” says Shell Bitumen’s UK Technical Manager Lee O’Nions. “The performance of the Shell Cariphalte range of polymer modified binders is the result of decades of experience as a leading supplier.”

Another long serving Shell Bitumen product with proven performance is Shell Mexphalte C which was first used 25 years ago and has been used in various asphalt applications ranging from decorative lightly trafficked areas to high durability bus lanes. An innovative application is its use in tunnels and there have been more than 15 tunnels where the material has been laid in continental Europe since the early 1990s. “When used in road tunnels, a light coloured asphalt can help to improve visibility as well as potentially reduce lighting costs and associated emissions,” Mr O’Nions says. “The material reflects light so well that levels of illumination within tunnels could potentially be reduced.”

The Markusberg Tunnel in Luxembourg is an example where power requirement for lighting was reduced by 40% (about 400,000 kWh per year savings). This innovation has also recently been tested on highway A35 near Hengelo in the Netherlands, by Dura Vermeer Construction and Public Works, where the light coloured asphalt has been designed to improve road safety and reduce public lighting requirements. Shell Bitumen and Tarmac are working closely to bring this innovation to the UK market.