

ASPHALT SUSTAINABILITY: IT'S ALL IN THE CHEMISTRY

PUMA BITUMEN HAS RECENTLY INTRODUCED THE ANOVA® PRODUCT LINE OF BIO-BASED ASPHALT ADDITIVES FROM CARGILL TO CUSTOMERS IN AUSTRALIA. PUMA BITUMEN'S GLOBAL TECHNICAL MANAGER ERIK DENNEMAN AND CARGILL'S GLOBAL TECHNICAL MANAGER HASSAN TABATABAEE EXPLAIN HOW THE PRODUCTS CONTRIBUTE TO ASPHALT SUSTAINABILITY.

The asphalt industry's incentive to reduce greenhouse gas emissions has increased since the 1990s due to growing concerns about global warming. This has stimulated the introduction of warm mix asphalt and related technologies which serve the purpose of reducing greenhouse gas emissions by reducing the mixing and compaction temperatures of asphalt mix.

Incorporating liquid warm mix additives into the binder is a common process in warm mix asphalt production with far-reaching benefits, from lower energy demand and emissions during asphalt production, increased allowable haul distances and increased workability and compaction during construction.

But, of all the benefits that warm mix additives offer to the asphalt mix, Puma Bitumen's Global Technical Manager Erik Denneman says their impact on asphalt

durability by minimising bitumen ageing is often overlooked – but one that offers most sustainability outcomes.

To elaborate this further, he offers a short overview of how asphalt binders age with time.

"Asphalt binders are made of organic molecules, and they age when they react with oxygen from the environment. Most of this ageing happens during the production, transport and the laying process because it occurs at elevated temperatures," he says.

"We know that under hot mix conditions, the majority of the ageing process takes place during the manufacturing, transport and placement phase. So, in effect, a large part of the oxidation life of the binder is consumed by the time the bitumen is used in the field."

Therefore, he explains that using warm mix asphalt instead of hot mix asphalt does not just reduce emissions and

energy consumption during production and construction, it also leads to more durable roads, with longer maintenance requirements, significantly lowering the roads' carbon footprint because the asphalt mix can be produced and compacted at reduced temperatures. This is quite possibly the most important contribution of warm mix asphalt to improving sustainability of the product, he says.

ANOVA: STABLE AND BIO-BASED

Working closely with Cargill, the global manufacturer of Anova asphalt products, Puma Bitumen recently introduced the Anova warm mix additive and the Anova asphalt rejuvenator to the market.

Denneman says before choosing Cargill's Anova product line, Puma Bitumen did extensive research to find proven asphalt products with demonstrated performance history.

"We were looking for a warm mix additive that was completely safe from a health and safety perspective and that is how we ended up with the Cargill product," says Denneman.

"Cargill's Anova product line has a significant track record, especially in the US, where it has been approved for use in 20 states. So, we did not have to reinvent the wheel, all we had to show was that it worked with the bitumen and rock sources we use here in Australia."

Denneman says the fact that the Anova warm mix additive is made with bio-based oils means it is non-toxic and non-corrosive.

"Puma Bitumen, as a company, always has sustainability front of mind and we aspire to play a leadership role in this space. One of the benefits of the Anova warm mix additive is that it's a vegetable derived product, so it is non-hazardous. As far as operational health and safety is concerned, it ticks all the boxes," says Denneman.

"We also undertook extensive laboratory testing, including compaction testing, to demonstrate that the temperature reduction achieved with Anova was at least on par with that obtained using wax or amine based warm mix additives. We performed a range of binder tests to show that Anova did not negatively affect the performance of the paving grade bitumen or polymer modified bitumen (PMB)," he adds.

Further, Denneman says the Anova warm mix additive is also very cost competitive.

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"The dosage rate of the Anova warm mix additive is comparable with that of amine based warm mix additives, that is around 0.3 to 0.4 per cent of the binder content. Comparatively, wax-based additives are typically used at higher dosage rates, which makes them more expensive than Anova."

Puma Bitumen also offers a special service to its customers, which is to provide binders pre-dosed with Anova additives at Puma Bitumen terminals, eliminating the need to handle warm mix additives at the asphalt plant.

"Normally, customers have to add the warm mix additive themselves, which can be cumbersome," says Denneman. "By giving them the option to select binder pre-dosed with Anova at Puma terminals, we give them the peace of mind that the bitumen properties are controlled and provide the best performance."

Puma Bitumen started first demonstrations with the Anova warm mix additive in September 2020 at its plant in Victoria, with the product now offered across all of Puma Bitumen's terminals Australia-wide.

HOW CARGILL DEVELOPED AND TESTED ANOVA

Hassan Tabatabaee, Global Technical Manager – Asphalt Solutions at Cargill explains how Cargill developed and demonstrated performance of the Anova product line.

"As a company with over 150-years of manufacturing experience, Cargill is a pioneer in finding ways to sustainably use agricultural products to create unique chemistries for industrial applications," says Tabatabaee, who has a PhD in pavement materials.

"The Anova product line was born out of that concept and as we started experimenting with different types of bio-based materials, we initially launched a rheology modifier and then further expanded the product line to include recycling agents or rejuvenators, warm mix additives, cold mix additives, anti-

stripping agents, and emulsifiers, growing Anova into a broader portfolio over the past seven years."

With the Anova warm mix additive, Tabatabaee says the product goes beyond conventional mixes when it comes to safety and cost-efficiency.

"Within the industry, having a product with a clean safety datasheet is certainly very important. Being a bio-based, non-toxic and non-corrosive formulation means the Anova warm mix additive really stands out from some of the more traditionally used warm mix additives.

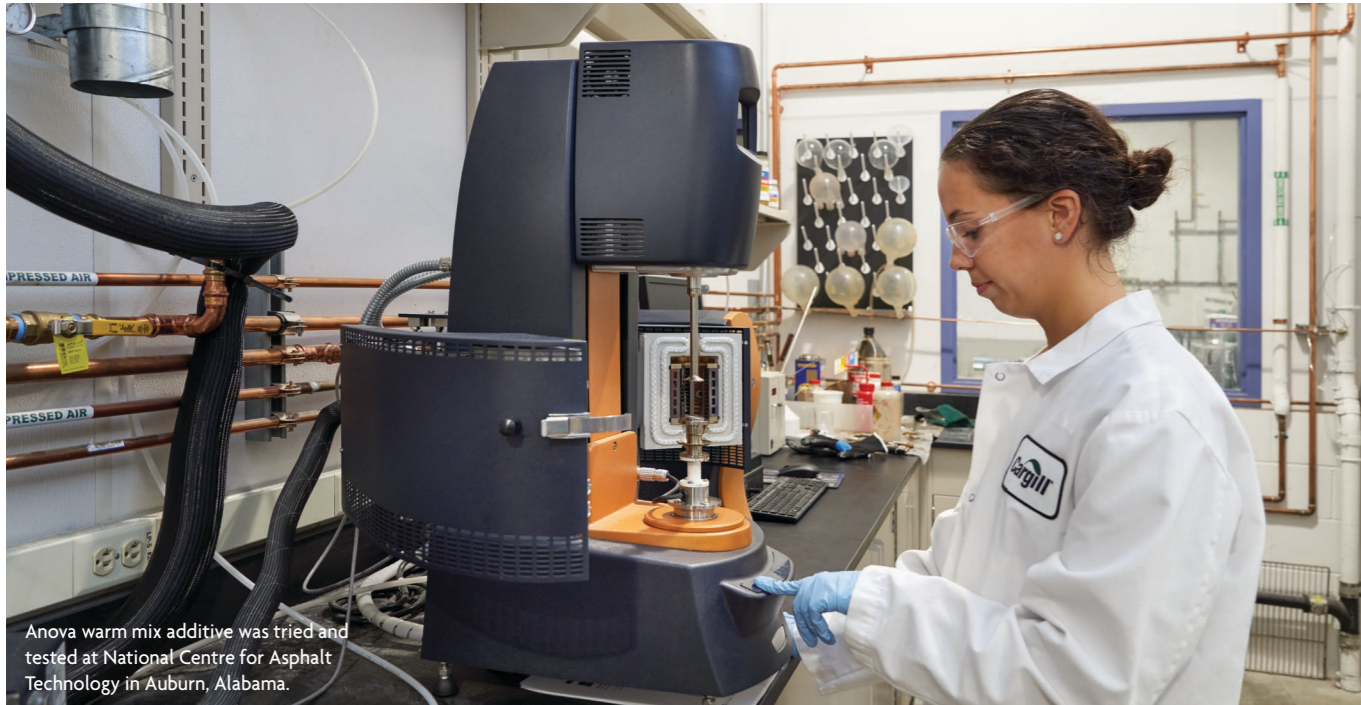
On top of that, it's also very cost-effective as it can reduce the asphalt's compaction temperature with very low dosage," he says.

The Anova asphalt rejuvenator, Tabatabaee says, is an easy-to-use, stable liquid additive that offers great flexibility to asphalt terminals. The Cargill Anova asphalt rejuvenator allows for using up to 100 per cent of recycled asphalt pavement (RAP) in hot mix asphalt, while also aiding in compaction.

"What makes the Anova asphalt rejuvenator product unique in the industry is the extent of its demonstrated history, not just in the US, but globally," says Tabatabaee.

"When this product was first brought to the market around six years ago, we started trialling it with varying percentages of recycled contact across the east coast of the United States. East coast regions like New York City and New Jersey have a very high population density and are therefore very conscious about managing their material stockpiles, especially of recyclable materials like reclaimed asphalt pavement (RAP). Since they have excess RAP available, we were able to use the rejuvenator for 50, 60 per cent or even higher recycled content and we got great results in terms of performance.

"Almost concurrently, we also started trials in the Netherlands, which is very flat and has little access to local aggregates, so resource management is again very critical. We started looking at 70 per cent



Anova warm mix additive was tried and tested at National Centre for Asphalt Technology in Auburn, Alabama.

recycled content and very quickly went up to 100 per cent. Within a couple of years, we were doing millions of tonnes of pavement with high recycled content in North America and in Western Europe using Anova rejuvenator.”

Independent testing at test track facilities in North America complimented the trials, he says.

“In order to have independent demonstration of the results, we worked with two leading test track facilities in North America, the National Centre for Asphalt Technology (NCAT) in Auburn, Alabama, and the Minnesota Research facility (MnROAD) in Otsego, Minnesota. These facilities work very closely with each other in terms of studying real-world pavements and trafficking, but with independent monitoring of the conditions, one in hot climate and one in cold, wet climate.

“We put down sections with high recycled content, about 45 per cent, in both regions and about three years later they have gone through a full cycle at both facilities. We have now surpassed 10 million loading cycles on the NCAT test track, which is pretty much the life cycle of a very busy freeway. There has been zero cracking reported so far, which is some very powerful data coming from these nationally recognised centres,” he adds.

The ageing stability is also critical where

high percentage of recycled asphalt is used in the mix. Here, Tabatabaee says the Anova asphalt rejuvenator stands head and shoulders above its competitors.

“The other part, which was really a big aspect of our product development, was putting a unique emphasis on ageing stability. It was important for us that our product not just helps on day one, but that pavements with high recycled content have a long, healthy life on par, if not longer, than what you would expect from a pavement with low recycled content. That unique ageing resistance is a big aspect of how we position the value of the Anova asphalt rejuvenator product with customers.”

CHEMISTRY BETWEEN THE TWO BRANDS

Both Tabatabaee and Denneman agree that the chemistry and synergy shared between Cargill and Puma Bitumen is the secret to the two companies’ successful partnership.

“Our partnership with Puma Bitumen has been quite gratifying and unique,” says Tabatabaee.

“Both our companies have a broad approach to how we serve the pavement market. Puma Bitumen has been very innovative and open about how they bring value to their customers. They are also always very transparent, both with their customers and with partners like us. That’s

something that we as a company value a lot,” he adds.

With Cargill’s brand strategy focussed on helping the world thrive, Tabatabaee says sustainability is at the core of the company’s products.

“Sustainability has been a core value to the Cargill business, not just because it’s become trendy, but because it is in the company’s culture. With Cargill’s tagline around ‘thriving’ communities, we certainly understand the need for a healthy environment and sustainable resource management. Cargill knows that, across industries, manufacturers are looking for smarter ways to formulate their products to improve performance and/or gain cost efficiencies.

“We develop our bioindustrial solutions to meet our customers’ needs in a responsible, sustainable manner by using renewable feedstocks, while also contributing to farmer prosperity and improving farmer livelihood. Puma Bitumen, as a global company, shares those values with us and it has been an important angle in our relationship.”

Denneman says Puma Bitumen’s existing product portfolio and the mix it brings to the market is a good indicator of the company’s position on sustainable pavements.

“Our range of high performance, storage stable PMBs, which are very well known for their quality and consistency, help to

create more durable pavements. We also offer consistent EME2 binders that allow construction of thinner pavements, further assisting with pavement sustainability.

“More recently, Puma Bitumen has also introduced GB5 base course mix, which is an alternative to EME2, allowing the use of even less bitumen in pavements. On the recycling side, we have a range of waste tyre derived crumb rubber binders ranging from the normal spray sealing grades to more specialty binders and our latest OLEXOCRUMB® hybrid binder which contains both tyre derived rubber and styrene-butadiene- styrene (SBS).”

The latest addition to the family follows the same sustainability strategy, Denneman says.

“The research and development part of Puma’s business is squarely focussed on bringing more sustainable products to the market.

“Puma Energy has committed to carbon neutrality by 2030 and we want to help our customers achieve the same. Cargill’s Anova asphalt solutions fit that objective like a glove.”



Aerial shot of Puma Bitumen low temperature bitumen technology applied on a council road.

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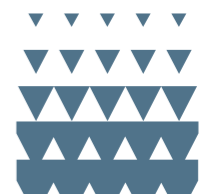
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