TURNING SUGARCANE WASTE INTO STRONGER AND GREENER ASPHALT IN BRAZIL

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In 2025, the Highwaytoday magazine published an article stating that Brazilian researchers at the State University of Maringá (UEM) have discovered that sugarcane bagasse ash, the residue left after sugarcane is processed for sugar and ethanol, can replace a key ingredient in asphalt. The result is a pavement that they claim is stronger, longer-lasting, and significantly more eco-friendly.

This plant-powered asphalt not only repurposes agricultural waste; it also promises to reduce the carbon footprint of road construction while boosting performance. Brazil, the world's largest sugarcane producer, generates millions of tons of bagasse waste each year. By blending this normally discarded material into the asphalt mix, Brazil is tackling two problems at once: disposing of industrial waste responsibly and upgrading the quality of its roads. Early highway trials are yielding impressive results, suggesting that this new asphalt could transform how the world builds roads, infusing each mile with a dose of sustainability without compromising strength or cost.

In sugar production, one major leftover is bagasse, the fibrous pulp from cane stalks after the juice is extracted. Brazil's sugar industry produces an astonishing amount of this by-product. For example, over 548 million tonnes of sugarcane were processed in the 2022/23 harvest, yielding roughly 3 million tonnes of ash after the bagasse was burned. Traditionally, this sugarcane bagasse ash has been treated as waste, often sent to landfills or spread back onto fields with little utility.

In a typical asphalt mix, stone dust (mineral filler) is one of the ingredients that helps bind the aggregate and bitumen together. The idea emerging from Brazil's State University of Maringá (UEM) was to swap out a portion of that stone dust for sugarcane bagasse ash, which is fine-grained and silica-rich, making it somewhat similar to existing mineral fillers. By replacing the conventional filler with about 5% sugarcane bagasse ash, the researchers created an asphalt mix that met all technical requirements and exceeded some of them.

Initial results from Brazil's sugarcane-asphalt experiment are extremely encouraging. The modified asphalt has proven to be tougher than the traditional recipe. Laboratory tests showed about a 40% increase in overall asphalt strength and a notable gain in tensile strength when sugarcane ash was introduced. In practical terms, that means roads could withstand heavier loads and harsher conditions without cracking or deforming. Field trials echoed the lab findings: pavement sections with the bagasse ash mixture exhibited higher resilience and significantly improved resistance to rutting (permanent deformation) under repeated heavy truck traffic. One key test recorded a 73% increase in the material's resistance to flow

(deformation) and around 28% less permanent deformation compared to conventional asphalt, indicating a much slower rate of wear and tear. For motorists and road engineers, these numbers herald pavement that can stay smoother and safer for longer, even under Brazil's notorious sun and pounding freight trucks.

By substituting waste ash for mined mineral filler, the new asphalt significantly reduces the need to quarry fresh stone and sand, which in turn diminishes carbon emissions and environmental impact. Producing and transporting traditional aggregates is energy-intensive; using agricultural ash that's already available cuts down on that carbon cost. Additionally, every tonne of sugarcane waste redirected into pavement is a tonne saved from potential open dumping.

On the economic side, using sugarcane ash is proving to be a savvy move. Stone dust must be quarried or crushed and delivered to asphalt plants. Bagasse ash, by contrast, is abundant and cheap, especially in a sugarcane-rich nation. By plugging this "free" recycled material into the mix, construction costs can be trimmed without sacrificing quality. The researchers report that the partial replacement of mineral filler with cane ash lowered overall asphalt production costs while actually boosting performance. More recycling means the price of paving a road could drop and for budget-conscious road authorities and contractors, that adds an extra incentive beyond the environmental kudos. Essentially, Brazil's experiment suggests that it is possible to build a better road for less money and with less environmental guilt, a compelling case for widespread adoption.

Behind this innovation is Vinícius Milhan Hipólito, a civil engineer and researcher who led the project as part of his graduate work at UEM. He's also an executive at Conasa Infraestrutura, a company responsible for managing over 1,500 km of Brazilian highways, which gave him a foot in both academia and industry. The research was published by Vinícius Milhan Hipólito in Scientific Reports, a high-profile international scientific journal, which immediately put a global spotlight on what might have otherwise been a local curiosity.

This bold idea has moved rapidly from the lab to the laydown. In Paraná state, an experimental stretch of the BR-158 highway between Campo Mourão and Maringá, a key artery for agricultural transport became the proving ground for sugarcane-based asphalt. According to the research team, what began as an academic hypothesis is now quite literally part of the road network, carrying trucks and cars daily. This real-world test was crucial for proving that the new mix could be produced with existing equipment and would hold up under real traffic. The verdict so far has been resoundingly positive – the sugarcane asphalt performed even better on the ground than anticipated, confirming that the lab gains translate to practical durability.

Brazil's sugarcane asphalt is a textbook case of synergy between agriculture and infrastructure. Few countries are better poised to benefit from this than Brazil, which produces about 40% of the world's sugarcane and in 2020 crushed over 757 million tonnes of cane. Turning a share of that bounty's by-products into pavement creates a bridge between two traditionally separate sectors. On one side, the sugarcane industry gains a valuable outlet for its waste. Rather than dumping the ash or applying it to fields (a practice with dubious benefit), mills could send it to asphalt producers, closing the loop through a circular economy approach. On the other side, the construction sector gets access to a new sustainable material stream that improves roads without relying solely on dwindling natural resources.

This innovation reduces emissions, improves durability, and offers a cost-effective solution for eco-friendly infrastructure. For construction professionals and engineers, this development opens up new possibilities.

It’s an invitation to rethink materials and to consider local waste products as potential resources for projects. For investors and policymakers, it’s a reminder that innovation in infrastructure can deliver both economic and environmental returns. And for society at large, it’s a feel-good narrative: cleaner, better roads achieved by linking two of the country’s proudest sectors, construction and agriculture, in a virtuous loop.

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