

# Geosynthetics pioneer upcycling of plastic waste



*Field implementation of a composite geosynthetic made from upcycled plastic in Buchanan County in 2023*



*Field implementation of wicking geotextile made from upcycled plastic in Buchanan County in 2024*

## PROBLEM

The global production of plastic waste has doubled over the past two decades, but only a small fraction of it is effectively recycled. A novel recycling technique gaining attention recently involves converting plastic waste into construction materials. A promising application of this technique is the production of geosynthetics, engineered products that are commonly employed in road construction to stabilize weak subgrades. In an ongoing project, researchers at Iowa State University's Institute for Transportation are seeking to both reduce plastic pollution and improve the structural integrity of roads using geosynthetics made from upcycled plastics.

## PROJECT DESCRIPTION

To assess the effectiveness of upcycled plastic-based geosynthetics, the research team selected two products: (1) a novel composite geosynthetic composed of an upcycled polypropylene geogrid bonded to a nonwoven geotextile and (2) a wicking geotextile containing 10% to 15% upcycled plastic.

Unpaved roadway test sections stabilized with the materials were constructed in Buchanan County, Iowa, in 2023 and 2024 and subjected to traffic loads ranging from trucks to heavy agricultural equipment. Field tests demonstrated a significant reduction in major pavement distresses in the sections stabilized with upcycled plastic-based geosynthetics, suggesting that these materials can enhance road durability while also addressing plastic waste concerns. The research team will continue to monitor and evaluate these test sections to assess long-term performance.

## IMPACTS

This research has the potential to reshape the future of road construction, addressing transportation infrastructure

challenges and making construction more resource-efficient and cost-effective. The successful implementation of upcycled plastic-based geosynthetics will not only help reduce landfill waste but also provide an innovative, cost-effective solution for strengthening the base layers of unpaved roads.

In addition to demonstrating durability benefits, the new composite geosynthetic and wicking geotextile made from upcycled plastic allow for a reduction in road thickness, which reduces material costs. The enhanced stability and longevity of road surfaces resulting from this technology can also reduce the frequency and cost of road maintenance, leading to long-term economic benefits. Moreover, upcycled plastic-based geosynthetics offer an alternative to traditional geosynthetics by transforming plastic waste into usable materials and reducing dependence on virgin resources.

Efforts to disseminate and expand upon this research are already underway. An open house event held in Buchanan County in September 2023 highlighted research on base stabilization using upcycled plastic-based geosynthetics and introduced the Iowa paving community to the concepts involved. The research team is also conducting an ongoing project focused on the use of plastic materials in asphalt and concrete pavements.



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