NEBRASKA
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DEPARTMENT OF TRANSPORTATION

RESEARCH SUMMARY

Using recycled plastic as an additive in asphalt mixtures could improve pavement durability and provide environmental benefits.

Incorporating Plastic Waste in Asphalt Pavements

Every year, more than 30 million tons of plastic waste are generated in the United States, much of it ending up in landfills. At the same time, the asphalt industry has a long history of successfully incorporating recycled materials to improve performance and reduce its environmental impact. In July 2023, Nebraska Department of Transportation (NDOT) funded a research project, The Use of Recycled Plastic in Asphalt Pavements: Feasibility Study. In the summer of 2025, South Sioux City, Neb., with financial support from the Nebraska Environmental Trust, paved a 4,000-foot segment of Foundry Road, Neb., to evaluate the use of recycled plastic in asphalt mixtures to improve pavement durability. That project ended January 31, 2026, and currently a new project is monitoring the long-term performance of these improvements.

THE CHALLENGE

Approximately 75% of waste plastic ends up in landfills, where it contributes to soil and water pollution. Finding practical, large-scale reuse opportunities is a growing global priority, and asphalt pavement presents a potential solution. For many years, the asphalt industry has incorporated recycled materials such as rubber tires, glass and asphalt shingles into its mixes. More recently, waste plastics have emerged as a potential additive that could improve the performance of asphalt pavements while reducing the volume of material sent to landfills.

Although plastics and asphalt binders are derived from petroleum, suggesting compatibility, incorporating waste plastic into asphalt mixtures presents technical challenges. Because plastics vary widely in polymer type, composition and melting point—and some contain additives that could affect performance or raise environmental concerns—careful material selection and testing are critical to confirm the resulting asphalt mixture meets performance standards.

From an engineering standpoint, any new material must meet established pavement performance criteria, including rutting and cracking resistance, moisture susceptibility and long-term durability.

"This practice improves pavement performance while repurposing waste plastics and reducing maintenance and construction costs."

— Jamilla Teixeira University of Nebraska–Lincoln

An additional consideration is NDOT's extensive use of reclaimed asphalt pavement (RAP). If plastics are introduced into new pavements, NDOT must verify that the resulting asphalt can continue to be recycled in the future without compromising RAP quality. This multiphase feasibility study evaluated the use of recycled plastic in asphalt mixtures.

THE RESEARCH

Researchers partnered with a local recycling company to obtain a variety of plastic samples. Based on the results of a literature review and laboratory evaluation, they identified polyethylene and polypropylene as the most promising candidates because the melting temperatures of these materials are compatible with conventional asphalt mixing temperatures.

Established laboratory performance test methods were used to evaluate how plastic type, melting behavior and particle shape—flakes versus pellets—influenced the performance of the asphalt mixtures, including moisture resistance, rutting and short-term aging. Additionally, the team worked with industry partners to confirm that the plastic waste material could be incorporated using existing plant equipment without requiring new processing infrastructure.

THE RESULTS

Laboratory results indicated that low-density polyethylene performed well as an additive in asphalt mixtures, particularly in improving rutting resistance at higher temperatures.

In early testing, flake-shaped plastic particles dispersed more uniformly in the mix than larger pellets, which were more difficult to distribute evenly. However, refining the size of pellets could improve future performance while also reducing shipping and handling costs.

In the summer of 2025, South Sioux City, with financial support from the Nebraska Environmental Trust, paved a 4,000-foot segment of Foundry Road using an asphalt mixture incorporating the equivalent of approximately 2 million recycled plastic bags and 25% recycled asphalt pavement.

NDOT funded Phase II, which will start in July 2026, to evaluate and monitor the long-term performance of this road segment. The research will evaluate durability across seasonal variations, potential environmental impacts and recyclability to ensure that pavements containing plastic can still be effectively reused as RAP.

THE BENEFITS FOR NEBRASKA

If long-term performance meets expectations, incorporating recycled plastic into asphalt mixtures could provide multiple benefits for Nebraska. Environmentally, this practice offers a large-scale pathway for reusing locally generated plastic waste, supporting state recycling strategies and reducing landfill demand. From an infrastructure perspective, improved rutting resistance and potentially extended service life could reduce maintenance needs, conserve natural resources and lower costs across the pavement life cycle.

ABOUT THIS PROJECT

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Final Report

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NDOT Research
ndot.research@nebraska.gov

PRINCIPAL INVESTIGATOR

Jamilla Teixeira, Ph.D.
Assistant Professor
University of Nebraska–Lincoln