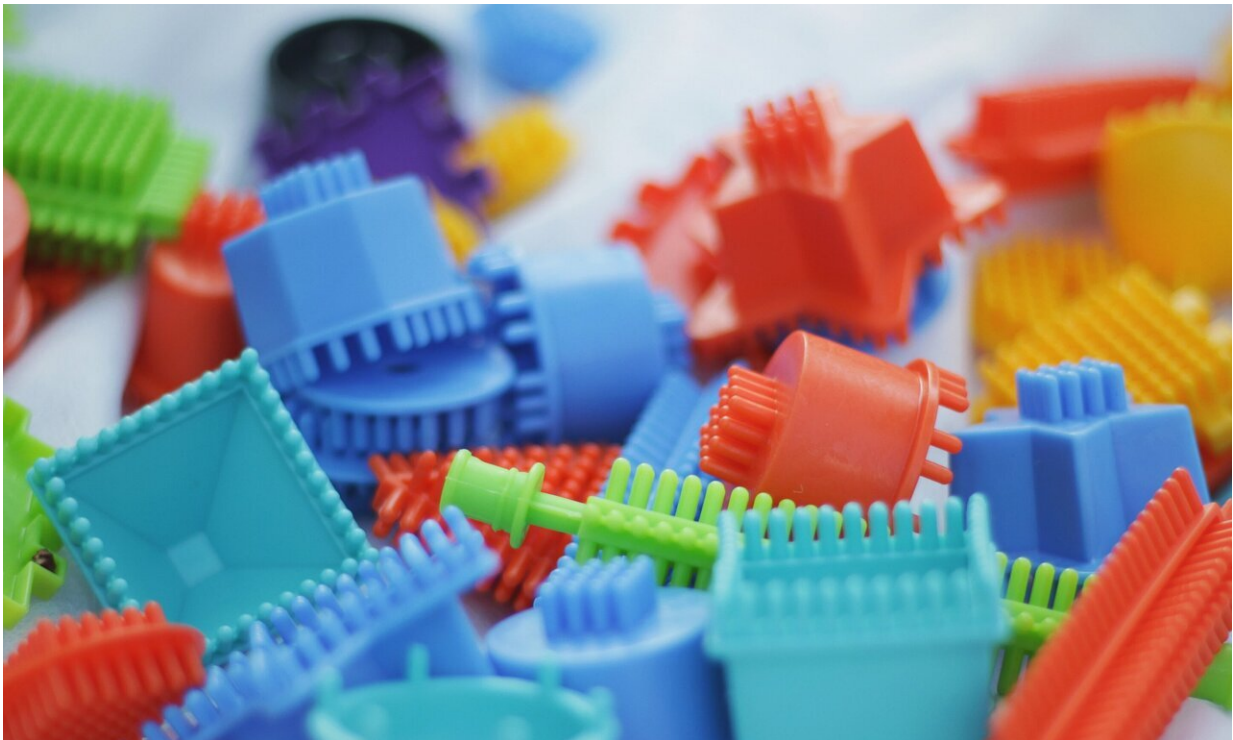


Q&A: Can we use plastic waste to build roads, buildings, and more?

July 18 2023, by Rob Jordan



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Stanford engineers Michael Lepech and Zhiye Li have a unique vision of the future: buildings and roads made from plastic waste.

In a new white paper commissioned by the National Academies of Sciences, Engineering, and Medicine (NASEM), Lepech and Li study

the current status, challenges, and needs of recycling plastics in a [circular economy](#), and examine the long-term durability and [environmental costs](#) of doing so for use in infrastructure.

Using a mix of computer modeling, scientific research, experimental and field data, as well as interviews with recycling industry stakeholders, Lepech and Li analyze [case studies](#) using plastic waste for façade panels in the San Francisco Museum of Modern Art and pavement in a California Department of Transportation road project. Among other results, their findings indicate that recycled glass fiber reinforced polymer composite—a tensile plastic commonly used in car, boat, and plane parts—is a promising material for reuse in buildings.

NASEM will publish the white paper as an appendix to its annual report to Congress, the U.S. Department of Transportation, and the U.S. Environmental Protection Agency, and may use it as the basis of recommendations to policymakers.

Below, Lepech, a professor of civil and environmental engineering, and Li, a postdoctoral scholar in civil and [environmental engineering](#), discuss obstacles, opportunities, and other aspects of transforming or upcycling plastic waste into valuable materials.

What are some of the biggest obstacles for repurposing plastic waste into infrastructure applications?

Lepech: One of the challenges that we and others identified through this work is the difficult economics and logistics of managing plastic waste streams from municipal solid waste. Plastic waste material flow is highly variable. Its mass can change from month to month, as can the type of plastic—lots of different packaging, for example.

What about the big opportunities?

Lepech: The recycling of entire buildings made of polymer composites at the end of their useful lives could be a game changer. That's because the amount of material, along with its likely uniform composition, would make recycling it into another infrastructure application significantly easier.

Li: Our paper gives a few recommendations: Improve waste sorting, encourage and support plastic upcycling innovation, set up a performance database of certain plastic blends, and establish predictable models for these materials' durability under different use conditions.

What lessons does upcycling of plastic waste for infrastructure hold for other circular economy efforts?

Li: Upcycling of recycled plastics in infrastructure sets an example of creating value by creating demand. The [recycled plastic blended construction material](#) needs to achieve certain performance requirements and maintain lower environmental impacts than conventional construction materials. Our paper shows that for a use case that has a longer lifespan—such as certain blended plastic composite building panels or asphalt pavement, the needed quality and sustainability requirements are more achievable.

Upcycling plastic waste has obvious environmental advantages. What are the business/profit advantages?

Lepech: Among the many potential advantages, firms that are part of a circular economy value chain may see regulatory advantages, such as

extended protection of an explicit or implicit license to operate or greater flexibility with regulatory agencies. There are obvious operational efficiencies possible when not relying upon virgin fossil resources.

From the standpoint of risk management, there could be reduced potential for environmental emergencies, such as oil spills, and reduced insurance premiums. There is certainly opportunity for growth by targeting markets that value environmentally friendly or sustainable products. Finally, firms can achieve increased clarity in strategic direction when they align value chains with corporate mission, especially in the case of environmentally conscious firms.

Beyond buildings and roadways, what are some major potential applications for upcycling plastic waste?

Li: Upcycling plastic waste in infrastructure has attracted increasing interest because it creates something of high value for which there is large potential demand. Beyond buildings, there are many applications for reusing plastic, but not many that would use as much [plastic waste](#) or last as long. For example, packaging consumes more than 60% of global recycled plastic, but has a short lifespan. Some automotive parts can be made with recycled plastic, but they require relatively little plastic to produce.

More information: White paper: [Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities](#)

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