Turning Junk Mail Into Concrete

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Students Kim, Shana and Emily set papercrete blocks as part of a workshop at Coconino Community College. **(Joe Costion)**

Students of the **University of Arizona** (UA) are putting newspaper to work in outhouses--and it's not, ahem, for wiping up. They're using newsprint--along with some water and a small quantity of sand, lime, clay, fly ash, or Portland cement--in a concoction called **papercrete** to construct outhouses, as well as things like concrete benches and residential dwellings. Papercrete, known by alternative names such as fibrous concrete, padobe, and fidobe, is a low-carbon construction material, and though it's not yet extensively used on university and college campuses, students are exploring its uses for a variety of purposes.

Diane Austin, associate professor and associate research anthropologist in the UA's Bureau of Applied Research in Anthropology, has been pushing her students to use greener building materials. Working with her students and a network of local partners in border communities of southern Arizona and northern Sonora, she has been testing the feasibility of papercrete for a variety of applications. "Our project is designed to find an alternative form of construction for low income households that are building their own homes," she explains. "It must be cost-effective, rely on locally available materials and local skills, be insect and fire resistant, and be durable."

We already know that **traditional concrete** is energy-intensive, accounting for **2.4 percent** of total global industrial- and energy-related carbon dioxide emissions, and papercrete goes a long way to solving this problem. "There are many formulations. The simplest is water, paper, and Portland cement whipped up in a food processor. Try it yourself, it's easy." explains Vincent Pawlowski, a Prescott College alumnus and former student of Austin's. A typical papercrete formula uses four to five percent Portland cement as a binding agent that helps set the shape of the papercrete.

However, according to Pawlowski, "Most people will find alternatives, like lime and clay or podzalan volcanic ash materials instead of Portland cement. Others are using coal fly ash, or natural alternatives like pumus or semi-natural alternatives like pearlite (another kind of volcanic ash that's heated like popcorn and pops to become very light and a great insulator)."

"Papercrete has great potential as a low-carbon building material," says

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Pawlowski. "Even when adding Portland cement to the mix the carbon footprint isn't as bad as some people think it would be because the CO^2 that is produced when creating Portland cement (when it's baked) goes back into it when you add water."

Yet the climate benefits of papercrete go well beyond eschewing Portland cement.. Papercrete, which has been used for decades in a variety of building applications, has many **climate benefits**. The sequestration of carbon is perhaps the most significant since papercrete is composed of 50-80 percent waste paper (low-grade newsprint as well as higher-end magazines, cardboard, and junk mail). Papercrete is also a good insulator, which helps reduce the energy needed to heat or cool a building.

The carbon footprint of a building is also impacted by its lifespan. "The longer the lifespan, the lower the carbon footprint," explains Shane Keller, who has previously instructed students at the **Campus Center for Appropriate Technology** through Humboldt State University on the use of papercrete. "This bodes well for papercrete since its lifespan is very long (just how long remains to be determined by time). It doesn't rot, insects do not consume it and it doesn't catch flame. Buildings made of it should last for many hundreds of years. As with any building, the structural design, roof system and maintenance over time will play a significant role in its lifespan."

The mixing process used to make papercrete is purportedly less energy-intensive than traditional concrete as well. And since in many cases locally-sourced sand, clay, and lime can be used, transportation fuel for moving materials is also minimized, further shrinking its carbon footprint.

These are issues being explored by **Coconino Community College** in Flagstaff, AZ, as part of associate degrees in alternative energy and sustainable green building. The one-credit papercrete workshop taught during the innovative and alternative building techniques course gives students hands-on experience working with the material as well as theoretical knowledge about how it can be applied.

In Action

Working with local experts and novices, UA students use their newfound knowledge of papercrete in collaborations with low-income communities seeking ways to build sturdy structures at minimum cost and with little environmental damage and lower operating costs. Some student groups have gone into local science classrooms to teach K-12 students about the material, and there are also two houses constructed of papercrete in Nogales, Sonora, several benches constructed by students for their schoolyard habitats in Nogales, Arizona, and two CalEarth domes at Avalon Farms in Tumacacori that are covered with papercrete.

As Joe Costion, Coconino **Construction Technology Management** department chair puts it, "Papercrete teaches students to look at the possibility of building with materials from the waste streams of society to create a viable structure." As students begin to understand that there is no more "away" for waste, they come to appreciate refuse as a resource. "Waste paper is a tremendously underutilized resource, the aim of teaching papercrete then is to change our perspective about the daily materials we use and discard."

Papercrete can be used to construct homes and office buildings and though it can't be utilized in wet climates (it takes too long to dry and doesn't hold up well in the presence of constant moisture), papercrete structures are low maintenance and last for many, many years. According to Pawlowski, "The folks at **Mason GreenStar** think that it could be used in North America, at least in the Southwest where insulation is critical and the dampness isn't a problem."

To date, only about 100 North American homes are using this material and other than the odd outhouse, it has yet to be used on college campuses. It is still very much a material for amateurs. But that isn't slowing down students' interest in the material. "Papercrete has repeatedly brought out the creative energy of students," says Costion. "Better yet, the tinkerers and shade-tree mechanics are absolutely intrigued by this material. It's cheap and lightweight, so it inspires and provokes people as owners and builders."

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