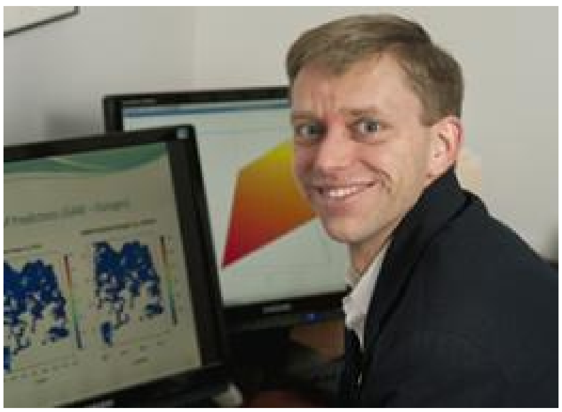
In Disaster-Prone Areas, Construction Needs a New Approach

March 23 2009



Seth Guikema's research focuses on how to develop sustainable and resilient infrastructure. He is a Johns Hopkins assistant professor of geography and environmental engineering. Photo by Will Kirk/Johns Hopkins University

In regions that have been devastated by hurricanes and other natural disasters, public officials should pursue a new direction in infrastructure projects, one that focuses on more durable designs and a greater sensitivity to the surrounding environment, a Johns Hopkins researcher says.

Seth D. Guikema, writing in the journal *Science*, says builders of infrastructure in disaster-prone areas have traditionally put together projects that weigh lower up-front construction costs against the potential price of repairing or replacing these structures when a natural disaster occurs. In an opinion piece published in the journal's March 6 edition, Guikema argues that many of their decisions have hinged on assumptions that do not draw on new ways to produce buildings and bridges that can better withstand nature's wrath and reduce environmental damage.

"For example, we have an extensive record of hurricane impacts and can design structures to withstand those impacts in many cases," writes Guikema, an assistant professor of geography and environmental engineering. "Despite advances in our knowledge of structural design for hurricane-prone areas, economic damage to buildings from major hurricanes in the United States has remained largely steady over the past four decades when adjusted for population growth and inflation."

What is needed, Guikema says, is a new approach that takes into account the long-term survival of a structure and its interaction with the surrounding habitat. Designers should think not only about the potential release of hazardous materials when a hurricane hits, he says. They also should consider using nearby terrain such as restored marshes and barrier islands to help minimize storm-related damage.

Guikema's research focuses on how to develop sustainable and resilient infrastructure, which he defines in his essay as "the networks that transport people and goods, distribute energy, and maintain communications and the buildings in which people live, work and play."

At a time when the United States is preparing to spend huge sums to repair and rebuild major infrastructure, the Whiting School of Engineering researcher aimed his recent essay at the public policy-makers who adopt building codes and approve such construction projects. "I want them to think about impacts over a longer period of time and affecting a larger spatial area," he says. "It would require a change in thinking about what we build and how we build it."

One thing that might be reconsidered is the one-size-fits-all approach to building codes. In his essay, Guikema envisions two neighboring structurally similar low-rise industrial buildings. One is used for manufacturing inexpensive, environmentally benign products; the other is used to make expensive computer chips, using hazardous materials. If a severe hurricane struck both buildings, the damage and environmental cleanup would be far more costly in the second building. "Standardized design codes do not directly account for these differences," the researcher writes.

In his previous post as an assistant professor of civil engineering at Texas A&M University, Guikema examined damaged Gulf Coast infrastructure in the aftermath of hurricanes Katrina and Rita. Traditional guidelines call for most infrastructure to be designed to withstand the stresses imposed by a hurricane that would occur, on average, every 50 years. But when climate change and new design techniques are considered, Guikema says, "I think a lot of building codes may be outmoded."

He is pleased to see some early signs of fresh approaches to construction design in disaster-prone areas. His essay points to new homes being built "with a modified, elevated foundation, materials that are stronger and more resistant to mold, hurricane straps and improved building envelope sealing, moisture management and insulation." Such steps can reduce energy costs and make the dwelling more resistant to storm forces, while maintaining a traditional architectural design. Less traditional designs, including dome-shaped houses, can also stand up well to powerful hurricane winds, he says, but are being built on a very limited basis.

"The optimal design," Guikema writes in his essay, "is one that considers the full impacts of infrastructure on the surrounding environment and community and the influence of the surrounding environment on the built facility."

His Science article, "Infrastructure Design Issues in Disaster-Prone Regions," can be viewed online here.

With funding from the National Science Foundation, the U.S. Department of Energy and non-government sources, Guikema is currently researching ways to predict how hurricanes and other natural disasters will impact large electrical power grids, communications systems, housing and other forms of infrastructure.

Provided by Johns Hopkins University (news : web)

Citation: In Disaster-Prone Areas, Construction Needs a New Approach (2009, March 23) retrieved 7 August 2024 from https://phys.org/news/2009-03-disaster-prone-areas-approach.html