

POLICY:**Transportation planners ponder costs and benefits of stormproofing**

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Driverless snowplows. Massive tidal barriers. New floodgates to protect subway stations. These are some of the ideas transportation planners are dreaming up to protect America's infrastructure from the onslaught of climate change.

More than a year after Superstorm Sandy hit the Eastern Seaboard, killing nearly 300 people and inflicting \$50 billion in losses including damaged infrastructure in New York, New Jersey and New England, policymakers are still grappling with how to make sure roads, tunnels and bridges hold up in the next big storm.

An icecycle? A brave Boston commuter tries his luck in snow-slowed traffic earlier this week.



Photo by Carolyn Bick, courtesy of Boston University News Service.

"Just as 9/11 changed the way we thought about terrorism and terrorist threats, Sandy created a new thinking about how we deal with natural disasters," said Bethann Rooney, manager of port security at the Port Authority of New York and New Jersey.

This month's blizzards that canceled thousands of flights; shut down the federal government in Washington, D.C.; canceled school for children across the upper half of the U.S.; and delayed trains on Amtrak, Washington's Metro and New York

City's subway underscored the concerns about better preparedness.

The buzzword in transportation circles is now "resiliency." It means ports, roads, bridges and railroads should be made to better withstand more frequent extreme weather episodes. Changes to the climate such as higher sea levels, more precipitation, stronger storms and heat waves are now taken as a given.

Some are critical of that term, believing that it is a new message for an old problem and that it admits defeat.

The thinking seems to be "we've just got to patch up what we've got and leave it up to individual businesses and hospitals and transportation networks to do the best they can," said Malcolm Bowman, professor of oceanography at the State University of New York, Stony Brook, who's advocating for storm surge barriers to protect New York City from being flooded again by wind-driven tides.

"That's not good enough. Our political leaders should be saying, 'Look, this Sandy was so terrible that we should never let this happen again.'"

Cost of doing nothing is rising

While experts can't directly tie individual storms to climate change, there is little debate among scientists that global warming is helping increase the frequency and severity of such storms.

When transportation networks more frequently go down because of weather or other events, the economic impact can be huge because people can't get to work, businesses can't operate properly and goods or supplies can't get shipped on time.

Rooney of the Port Authority told a recent gathering of transportation experts in D.C. that "it looked like Armageddon" when she toured the New York port after Sandy: Cargo was strewn all over, dozens of shipping containers were floating in the water, and of the 16,000 cars on the docks, 14,000 were destroyed, including some \$100,000-plus Fisker cars.



"With regards to the water ... we used all of the [Federal Emergency Management Agency] predictive maps to guide our preparation, and they were grossly inadequate."

A report commissioned by New York Gov. Andrew Cuomo (D) urged the state to waterproof low-lying infrastructure like rail and road tunnels, airports, and wastewater treatment plants. It said long-term solutions like storm surge barriers and more natural defenses like wetland restoration should be considered to protect New York Harbor.

In 2007, then-New York City Mayor Michael Bloomberg started an initiative called PlaNYC that brought together local government agencies to make the city greener and adapt to both a changing climate and a growing population.

Old 'normal' was more benign

Global warming may not immediately bring the term "heavy snow" to mind. But Michigan, a state through which an estimated \$520 billion of freight is moved every year, has actually seen more snow in some parts due to the Great Lakes that surround the state.

Lake-effect snow is produced when cold air interacts with the warmer lake waters that evaporate into the air as moisture. Because the temperatures in the lakes have been getting higher, there is a greater difference between that air and the lake moisture, potentially leading to more snow.

"In years past, we used to get a freeze-over of the lakes and that would pretty much end the lake-effect snow," said Gregory Johnson, chief operations officer of the Michigan Department of Transportation. "[But] with the warmer lake temperatures that we're seeing, we're not getting the ice cover," and that may be causing more and heavier snows.

Photo by Jim Larrison, courtesy of [Flickr](#).

Workers at Chicago's O'Hare International Airport de-ice a departing airliner.

That leaves lots of snow on the roads, delaying or stranding drivers, and causes flooding when spring rains and the winter melt occur. Johnson said in the future, driverless snowplow machines might be deployed to more quickly clear the snow.

The U.S. Department of Transportation has also been devoting some grant money to the topic. In late December, it announced \$3 billion to boost the resiliency of public transit systems affected by Sandy.

Some fixes are relatively easy. For example, elevating subway ventilation grates a couple of inches higher can prevent them from becoming drains for the whole city. Some people could use downtown bicycle fleets for evacuation if a city's subway system goes down.

New Orleans, a city with a system of levees and flood walls that is supposed to protect residents, represents what can go wrong when planning is insufficient, as in Hurricane Katrina.

Cases of enhanced vulnerability

"As the water broke through the levees and flood walls, once the drainage pumping stations stopped working for loss of power, it was a cereal bowl, it was a bathtub full of water, and the city had to actually be dewatered," said Deborah Keller, director of port development at the Port of New Orleans.

The transportation effects were myriad. Thousands of poor residents were trapped in the city because they didn't have cars and couldn't afford to leave when evacuation calls were issued. Heavy congestion on highways out of the city made traffic slow, and some people ran out of gas.

"You have highly vulnerable populations in the cities, especially overseas, but also in the U.S., you tend to have a much higher proportion of lower-income communities, and they become very vulnerable to these events," said Thomas Lewis, president of the Louis Berger Group, an infrastructure consulting firm.

On the key 5.8-mile rail bridge that Norfolk Southern runs over Lake Pontchartrain, almost 5 miles' worth of track washed away, landed in the lake and had to be fished out by eight cranes on barges.

What to do with building and transportation infrastructure in vulnerable areas is another concern.

"If I'm building something along the coasts, and I don't know if the sea-level rise or, more importantly, the storm surge could be 10 feet or 20 feet, how do I make an informed decision about that?" asked Steve Winkelman, director of transportation and adaptation programs at the Center for Clean Air Policy.

A combination of higher sea levels and storm surges from Sandy eroded and washed out parts of State Road A1A in Fort Lauderdale, Fla., forcing the city to spend \$8 million on emergency repairs while it works on a more permanent fix.

"Infrastructure climate change costs are obviously huge, [and] communities are really starting to pay attention," said Arleen O'Donnell, vice president of the environmental consulting firm Eastern Research Group.