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Transportation

Why climate change is about to make your bad commute worse

Traffic congestion in Bethesda, Md., during rush hour. (Sarah L. Voisin/The Washington Post)

By **Matt Alderton**

August 8, 2020 at 5:37 p.m. CDT

Something remarkable happened on American roadways during the early days of the coronavirus pandemic: In even the most congested cities, traffic started moving again. With Americans staying home, cars suddenly rolled over highways like water through a freshly unclogged pipe. By mid-April, traffic had fallen to just 52 percent of pre-pandemic levels, according to traffic research firm INRIX.

But the reprieve was short-lived. As states and cities reopened their economies, drivers restarted their vehicles. By late June, INRIX reported, travel nationwide had already reached pre-pandemic levels, and in many states traffic was actually exceeding those levels.

That's bad news for motorists, who lost an average of 99 hours to congestion in 2019 — two hours more than just two years prior.

Most motorists are familiar with many of the reasons for bad traffic: more cars on the road, unskilled drivers, construction, inadequate mass transit, crashes. Increasingly, however, there's at least one more culprit to consider: climate change.

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"America's transportation system is not set up to recover and regain functionality after a major disruption or disasters," said Paula Pagniez, director of the Climate and Resilience Hub at global risk management firm Willis Towers Watson. "Both chronic and acute changes in weather impact America's roads, bridges, tunnels and transit."

[U.S. traffic has rebounded to about 90 percent of pre-pandemic levels, analysts say]

In fact, weather already causes approximately 15 percent of congestion, according to the Federal Highway Administration. And with climate change escalating — scientists expect extreme weather events such as heat waves, snow storms, hurricanes and floods to increase in both frequency and intensity — gridlock will only grow. That is, unless governments change the way they plan, design and manage climate-sensitive infrastructure.

"We need to fundamentally reassess what our systems need to be able to deliver, and under what conditions," said Mikhail Chester, associate professor of civil, environmental and sustainable engineering at Arizona State University and co-leader of the Urban Resilience to Extremes Sustainability Research Network. "And those conditions, it looks like, are going to be changing faster and faster in the future."

The climate conundrum

So fundamental is climate's impact on critical infrastructure that it's codified in local, state and even federal regulations.

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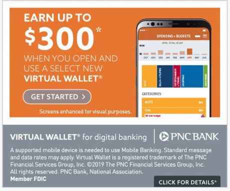
"Everything that is built around you is built with some consideration for how much environmental exposure it's going to be able to tolerate," Chester explained. "When it comes to roads, for example, the American Association of State Highway and Transportation Officials has guidelines that say asphalt should be engineered to withstand the hottest week on record during a certain historical period — say, 1970 and 2000. In Arizona, that might be 115 degrees, and in Chicago, it might be 105 degrees."

The problem is, thanks to climate change, past is no longer prologue. "We're not going to shut off CO2 emissions overnight, so the climate is going to continue changing. The question is, by how much and in which direction?" Chester said.

"Let's say you design a road in Chicago for the hottest week on record, which might be 105 degrees. Well, the hottest week going forward might be 108 degrees, or it could be 120 degrees," he said.



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Faced with uncertainty, civil engineers can do little but guess. And the wrong guess could be costly.

Consider, for example, "robust design." That's design "that will withstand all of the environmental conditions you might expect over the lifetime of a road," said Jayne Knott, a civil and environmental engineer who is principal and senior scientist at JFK Environmental Services.

[Michigan dam disaster an example of what could happen in other communities]

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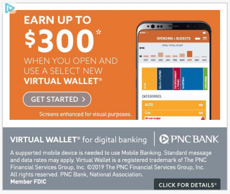
"The problem with that is, when you build a road that's good for all conditions, you end up with very thick asphalt," said Knott, who is also a research associate at the University of Massachusetts at Boston's School for the Environment. "When you consider paving an entire roadway, that extra asphalt costs big, big money. Plus, you're raising the road, so suddenly trucks don't fit under bridges. It's very complex."

If over-engineering hurts public coffers, under-engineering hurts public safety. When pavement falls victim to extreme temperatures or precipitation, for example, it fails. And when pavement fails — creating cracks, potholes and rutting — roads become hazardous.



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It's not just roads, either. Also vulnerable are railroads, whose tracks can buckle in extreme temperatures; power lines, which can sag and fall during heat waves and topple during windstorms; dams and sewers, which can flood and fail during extreme rains; and bridges, which expand and contract with the temperature in ways that can degrade their structural integrity.

And along with fiscal and physical fallout, there are economic consequences.

"We need infrastructure to move the goods and people that make the economy go," said Bob Perciasepe, president of the Center for Climate and Energy Solutions, adding that infrastructure failure can hamper employment, productivity, logistics and commerce.

Solutions: More funding, adaptive engineering

Even without the specter of climate change, U.S. infrastructure is in dire straits, according to the American Society of Civil Engineers, which gave the nation a D+ on its most recent "Infrastructure Report Card."

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"Climate change is an additional stressor on already taxed infrastructure," Chester said. The situation's silver lining, he added, is consensus: "Everyone is in agreement that we should do something about infrastructure."

[House Democrats unveil $500 billion transportation package with focus on buses, rail and the environment]

In fact, bipartisan legislation is awaiting action by Congress. The Transportation Infrastructure Act of 2019 would invest $4.9 billion over five years in a new resiliency program to protect roads and bridges from extreme weather and natural disasters. If passed, it would build upon the Fixing America's Surface Transportation Act of 2015, which requires state departments of transportation to incorporate resilience into long-term infrastructure planning, and the Disaster Recovery Reform Act of 2018, whose Building Resilient Infrastructure and Communities program funds infrastructure projects that proactively mitigate communities' disaster risks.

Federal funding is especially important in light of the coronavirus pandemic, according to Allie Kelly, executive director of the Ray C. Anderson Memorial Highway (the Ray) in Troup County, Ga.

[U.S. has 230,000 bridges that need major repairs or replacement, new report says]

“An added complication for us right now as we’re promoting smart, resilient infrastructure is the economic damage we’ll likely be working through for years, not months, as a result of covid,” Kelly said, adding that the funding mechanisms transportation departments rely on to build, operate and repair infrastructure are drying up because of the pandemic.

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“People don’t drive during economic downturns, so they don’t use as much gas. That means DOTs don’t have the gas-tax revenue that is their lifeblood,” she said.

Creativity and adaptability are also essential. Along its 18-mile stretch of Interstate 85, for example, the Ray tests new infrastructure solutions that deliver cost savings, performance improvements and climate resilience. Two that show particular promise are roadside vegetation and rubber-modified asphalt. The former fills vacant roadside land with perennial grains whose deep roots retain water and hold soil against storm water flooding. The latter, made with recycled tires, are rutting- and crack-resistant, which increases road durability and extends the life of the pavement by up to 30 percent or more.

[How carbon levels hit a record high even as emissions fell during coronavirus pandemic]

In some cases, answers lie in geography. “In the Southwest, they use different asphalt binders than in the Northeast,” Knott said. “As the climate warms, materials that are used right now down South might be appropriate for up North. We just have to be willing to make changes instead of sticking with what we’ve always used.”

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Chester agreed, suggesting that engineers respond to climate change by designing infrastructure for the short term, instead of the long term.

“The way we typically approach infrastructure is to assume stability, but it’s looking more and more like the world in the future is going to be unstable,” he said. “So instead of building rigid systems that are supposed to last 50 or 100 years, we might want to think about building systems that are reasonable for the next 10 or 20 years, then pivoting quickly as conditions change.”

Whatever solutions they bring to bear, the biggest need for communities to fortify their infrastructure against climate change is better data.

“If we know what the conditions are going to be, we have enough skill in the engineering field to be able to design for those. The weak link right now is that we don’t have the information we need to project what those future conditions will be,” said Perciasepe, of the Center for Climate and Energy Solutions. He cited the flood plain maps generated by the Federal Emergency Management Agency as an example. As recently as December 2016, a government audit found only 42 percent of the flood map miles in FEMA’s inventory were updated and valid.

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“We need additional investment to be able to get that data updated so it’s available for people to use when they’re doing climate vulnerability assessments,” Perciasepe said.

Sandy shines a light

Even as the nation falls behind, however, some cities are pulling ahead. Among them is New York, whose coastline was walloped by Hurricane Sandy in 2012. Two years later, Mayor Bill de Blasio (D) established the Mayor’s Office of Resiliency to lead climate adaptation across the city’s five boroughs.

“Hurricane Sandy was a pivotal moment in New York City’s climate action work,” said Jainey Bavishi, the office’s director. “We wanted to make sure we weren’t just recovering from Hurricane Sandy, but that we were building a city that’s more resilient to the chronic impacts of climate change that we know we are going to continue facing.”

[Extreme climate change has arrived in America]

Bavishi and a staff of approximately 30 are charged with executing a $20 billion resiliency strategy whose components include building coastal infrastructure to protect against sea-level rise and developing guidelines to help civil engineers leverage climate projections in their designs.

Because it must rely on external stakeholders to execute its work — including other city departments, regional agencies and the private sector — the office’s most important contribution might be leadership.

“Within the city, we very much are a thought leader, policy leader and multiagency convener. A major part of our role is bringing agencies together to introduce them to the challenge and figure out how we’re going to manage it together,” Bavishi said. “We’re basically leading an organizational change process from the ground up for the entire city government. It’s a massive effort.”

Large though it may be, experts insist that this kind of effort is critical.

“The nation can save $6 in future disaster costs for every $1 invested in hazard mitigation,” Pagniez said, citing data from the National Institute of Building Sciences. “Beyond a misuse of taxpayer dollars, the consequences of not acting include lives and livelihoods lost and assets damaged — sometimes beyond repair.”

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