

Study identifies top reasons for sewer line failure

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Concrete sewer pipes around the world are most likely to fail either because their concrete is not strong enough or because they can't handle the weight of trucks that drive over them, a new study indicates.

The study used a [statistical analysis](#) to show that those two factors were the most likely to trigger a problem among 16 common causes of sewer pipe failure they examined.

The study was published online earlier this year in the journal *Structure and Infrastructure Engineering*.

"There is a vast array of pipes underground that is working every day and if there is disruption - leakage or collapsing in a pipe, for example - not only will there be discomfort for the residents, but also economic, health and [environmental consequences](#)," said Abdollah Shafieezadeh, senior author on the study and an associate

professor of civil, environmental and geodetic engineering at The Ohio State University. "The losses can be significant."

And so can the cost of repairs and maintenance: In 2017, the American Society of Civil Engineers estimated the cost to fix and maintain the U.S. sewer system at \$150 billion.

For this study, researchers gathered data and analyzed buried sewer pipes, which, in the United States, are commonly made of concrete. Then, they identified the most likely causes of sewer pipe failure. Those causes included things like the density of soil surrounding sewer pipes, the elasticity and strength of the concrete materials and the weight of trucks that regularly drive over them.

They then built a [statistical model](#) that could evaluate the stress caused to the pipes by each variable individually and in combinations, and conducted several statistical analyses using the Ohio Supercomputer Center.

The analyses showed that, statistically, cracks that will eventually influence the structural integrity of sewer pipes are most likely to form when the concrete is made from weak components and not maintained properly, or when heavy trucks regularly drive on roads above the pipes. Cracks that influence structural integrity, the researchers say, are the first signs that a sewer pipe is on its way to collapse.

"It's a worldwide problem, and part of the issue is that, for many cities around the world, these sewer systems have been installed long ago, and the challenge now is to maintain these old systems," Shafieezadeh said.

Systems can be complex and expensive to maintain. Cities often have tens of thousands of miles of sewer pipes running beneath them. And, because they are underground, spotting issues is

not as simple as finding issues with above-ground infrastructure like roads or power lines, said Soroush Zamanian, a graduate research associate in civil, environmental and geodetic engineering at Ohio State and lead author of the paper.

"In 2017, the American Society of Civil Engineers gave the United States' overall sewer system a D+ rating," Zamanian said. "And that's part of why we are looking at this question and seeing if we could help predict where lines might fail."

The researchers said future studies should examine the way aging and corrosion of pipes affects the way in which system operators can repair them. And, they said, future studies could analyze other [pipe](#) configurations, or analyze more details about the types of soil that surround those pipes.

"The big picture is if we want to design sewer pipes for the future, or if we want to assess the current condition and predict future conditions of these pipes, one key element is to know the important factors contributing to their failures - and how do those factors play out in the real world," Zamanian said.

More information: Soroush Zamanian et al, Significant variables for leakage and collapse of buried concrete sewer pipes: a global sensitivity analysis via Bayesian additive regression trees and Sobol' indices, *Structure and Infrastructure Engineering* (2020). DOI: [10.1080/15732479.2020.1762674](https://doi.org/10.1080/15732479.2020.1762674)

Provided by The Ohio State University

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