carbin

CSHub MIT CONCRETE SUSTAINABILITY HUB

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Crowdsourcing Pavement Data with Carbin

Confronting an Infrastructure Crisis

The United States has over 8.5 million lane miles of roads—the largest road network of any nation. But according to the American Society of Civil Engineers, 20% of it is in poor condition.

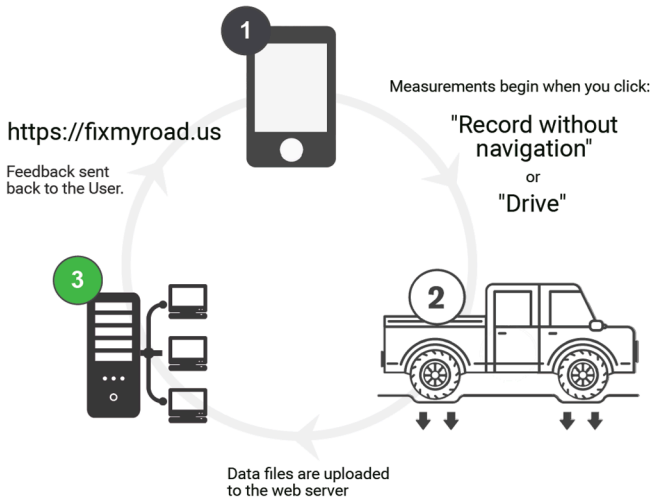
This influences not just the road network's safety, but also its environmental impact. On California's highways, MIT Concrete Sustainability Hub (CSHub) research found that pavement quality caused vehicles to consume an extra 1 billion gallons of fuel over 5 years. The quality of pavements has an even stronger effect in cities. There, it can contribute to around 15% of a vehicle's fuel consumption.

To improve roads and reduce emissions, CSHub researchers have developed the Carbin app. Using just a smartphone, Carbin measures pavement quality and its effect on fuel consumption while directing users to their destination. The anonymous data users collect can then inform road repairs around the world.

Measuring Road Quality and Vehicle Emissions

The key to Carbin is an instrument that most carry in their pockets—an accelerometer. Found in virtually all smartphones, accelerometers gauge position to, for example, orient a phone's screen. Carbin instead uses a phone's accelerometer to measure pavement quality from within a moving vehicle.

The data Carbin collects actually look like a heartbeat in an EKG: As the car drives, bumps in the road register as



'pulses.' Carbin then uses CSHub research to convert these 'pulses' into the international roughness index, which is the standard for measuring pavement roughness.

Once it has measured a pavement's roughness, Carbin then calculates its impact on fuel consumption using a CSHub algorithm. After each trip, Carbin displays this data and adds it to an anonymous global map on www.fixmyroad.us.

How to Use Carbin

Carbin is free and simple to use. To begin, users first place the phone in a fixed position, like a phone mount, and then enter a destination or simply press the record button. Once Carbin has directed them to their destination or they are done recording, users can press a button to stop the collection of data. Afterward, they can view the data from their most recent trip and all past trips in a tab in the app.

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Improving Roads, Fighting Climate Change

Carbin provides users with a rich understanding of the roads on which they travel. In total, it has analyzed more than 150,000 miles of pavement in 27 countries.

As this data grows, Carbin will provide users with a suite of new benefits. These include directions for the most comfortable and efficient routes and "report cards" on the efficiency of users' driving.

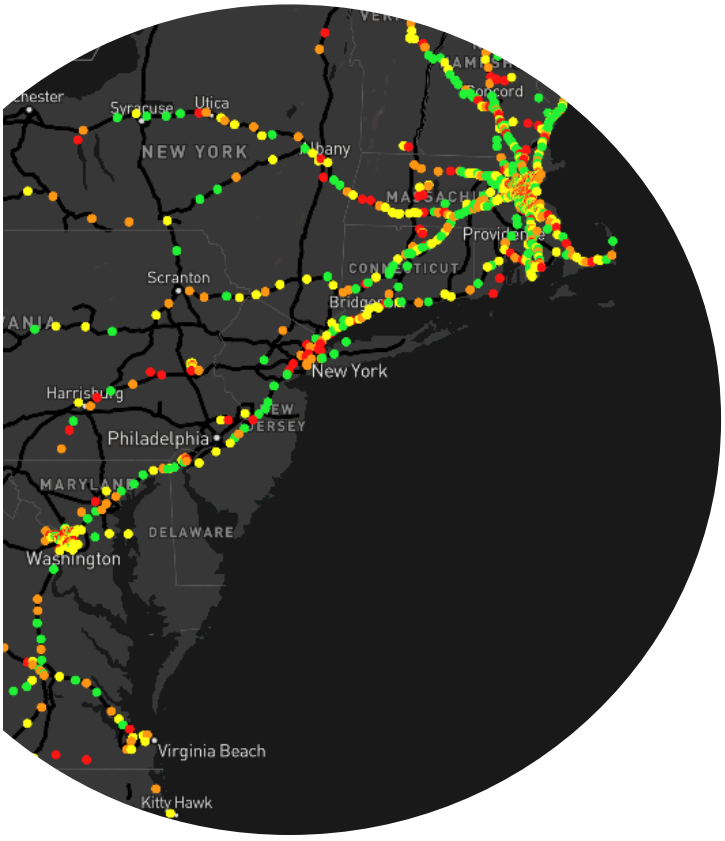
For the greatest impact, CSHub is also working with government agencies to apply this anonymous data.

Traditionally, state and city governments have had to resort to expensive or time-consuming techniques like laser scanning or visual inspection to inform road maintenance. Carbin represents an accurate and affordable alternative. To gather data of comparable quality, state departments of transportation (DOTs) would have to spend around $200 per mile. Carbin, on the other hand, is virtually free.

While Carbin was developed to help solve today's infrastructure and climate crises, CSHub hopes that it will facilitate broader change. By engaging the public, it could democratize infrastructure maintenance and foster a culture of sustainability to which everyone can contribute.

Learn More

- Download the app on the App Store or Google Play.
- To view the collection of data, visit fixmyroad.us.
- To learn more about CSHub pavements research, visit https://cshub.mit.edu/pavements.



Carbin has collected data from cities and highways across the country. Green points indicate comparatively higher pavement quality while red points represent lower comparative quality. The entire collection of data can be viewed at fixmyroad.us.

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