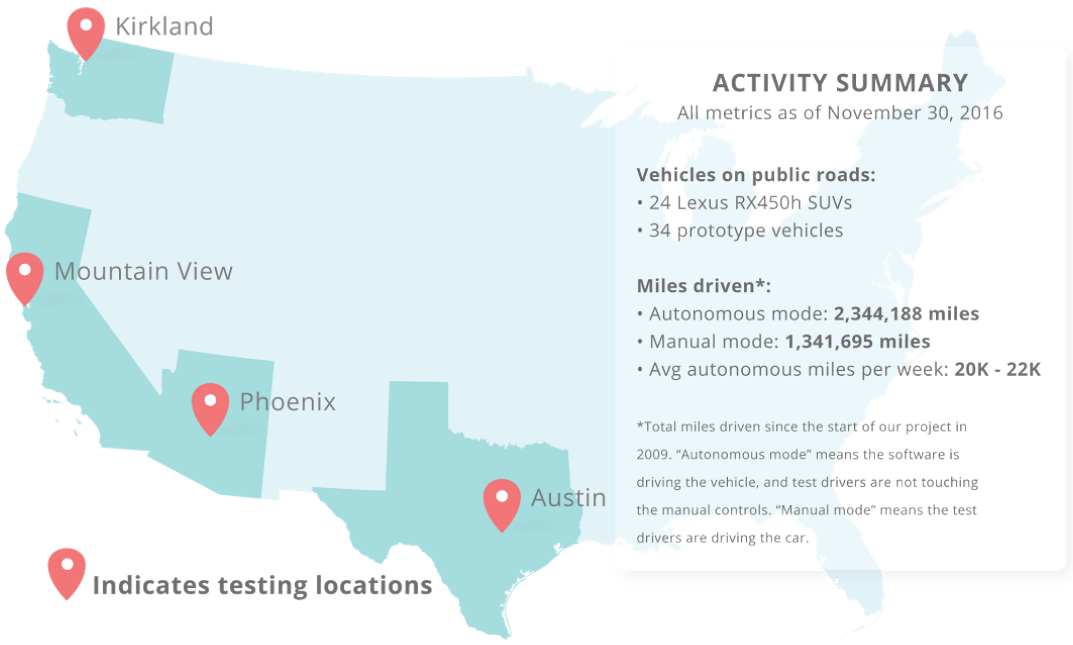
Google Self-Driving Car Project
Monthly Report

November 2016

ON THE ROAD



KEEPING MOTORCYCLISTS SAFE

Motorcyclists risk their lives daily on American roads each year – motorcyclists accounted for 27 times more deaths than drivers in cars in 2014, after adjusting for miles traveled. Human error from other drivers is often to blame, with drivers failing to spot motorcycles before making turns or changing lanes. By removing this human error, our self-driving cars have the potential to make the roads safer for riders and other road users.

While each type of road user has their own quirks, we've found motorcycles a particularly unique class. Though they obey the same traffic laws as cars, motorcycles come in very different shapes, sizes and styles of driving. This month senior software engineer Christian, who rides a BMW K1600 GT and is a card-carrying member of the American Motorcyclist Association, explains how he is using his firsthand knowledge to help Google's self-driving cars and motorcycles share the road safely.

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How do you think Google's self-driving cars help make your ride safer?

Christian: For a motorcyclist, the biggest issue is visibility. I've lost count of the number of times that a driver hasn't seen me coming on my bike, or has made a turn in front of me without first looking. Our self-driving cars don't get distracted and can see 360 degrees, two football fields away. Humans also have more difficulty seeing smaller things — like bikes — when there is less light. But thanks to our suite of sensors, our cars are just as capable of seeing motorcycles in the pitch dark as in full sunlight.

Our goal in designing a fully self-driving car is that the vehicle is responsible for 100% of the driving. Ultimately we think this is safer than partially autonomous vehicles, which could suddenly hand back control to a person who may not have full awareness of their surroundings, endangering themselves and those around them.

How do your self-driving cars recognize motorcycles and distinguish them from other objects on the road?

We know it is important that our cars can tell the difference between motorcycles and similar objects, such as bicycles. Our software doesn't need to have seen a particular model of motorcycle in order to recognize them on the road. Through a process called machine learning, our software mimics how humans recognize these road users. For example, you may have never seen a Harley Davidson Roadster or Ducati 899 Panigale before, but you still know that it is a motorcycle because it looks like other bikes you've come across.

Over the last 7 years, we've come across thousands upon thousands of motorcycles. Our software learns from these examples in order to build a broader recognition of motorcycles in general, accounting for differences in size, speed, design and countless other factors in behavior.

How does Google's technology account for the different ways motorcyclists move on the road?

The most obvious is lane splitting, when a motorcycle weaves through other vehicles between different lanes on the road. Recently my home state of California became the first state to formally legalize lane splitting — and it's very common, particularly during peak hour.

We've taught our software to recognize and safely respond to this type of riding. Because we've observed many instances of lane splitting, we're better able to predict how a rider will navigate around us and other cars. When safe, our cars will actually move slightly to the side to give a passing motorcycle more room to maneuver. And our software understands that motorcycles are quicker to brake and accelerate, so our vehicle acts accordingly, driving more conservatively and giving more room to nearby riders.

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TRAFFIC COLLISIONS INVOLVING AUTONOMOUS FLEET

Given the time we're spending on busy streets, we'll inevitably be involved in collisions; sometimes it's impossible to overcome the realities of speed and distance. Thousands of minor crashes happen every day on typical American streets, 94% of them involving human error, and as many as 55% of them go unreported. (And we think this number is low; for more, see here.)

For collisions occurring in CA, the following summaries are what we submitted in the "Accident Details" section of form OL316 Report of Traffic Accident Involving an Autonomous Vehicle.

None for the month of November.