GPS Bicycle Computers: The Black Box of Bicycle Accident Reconstruction

By Tim Joganich, Alex Ingram, and Chris Meacham

Bicycle speed is often a critical factor during a bicycle accident reconstruction and, with the advent of GPS bicycle computers, the exact speed at the time of an accident can be determined, provided the bicycle is equipped with a GPS computer. In addition to speed, GPS bicycle computers also monitor and record other ride metrics (location, pedaling cadence, heart rate, and power), which data can be useful in bicycle accident reconstruction. GPS bicycle computers are similar to the event data recorders (EDRs) or "black boxes" found in vehicles, which store parameters such as speed, braking, and seat belt usage.

The first bicycle computers came on the market in the mid-1980s, and they entailed a wired sensor mounted to the fork that counted wheel revolutions through a magnet and a display unit on the handlebars that showed current speed, average speed, maximum speed and distance. While these early computers could provide some useful information for bicycle accident reconstruction, determining the exact speed at the time of the accident was still not obtainable. However, with the advent of GPS navigation technology, bicycle computers can now continuously monitor and record a bicycle's speed and location at the time of an accident.

Evidence preservation is critical, given that GPS bicycle computer files can be easily deleted. During an investigation, if the bicycle had a GPS computer, the investigator should determine whether the data was uploaded to the device's application. If not, it may still be saved on the device and should be uploaded immediately. Obtaining ride data entails exporting the .FIT file, which contains basic GPS data plus physiological/workload parameters, while .GPX, .TCX files contain only GPS data.

Beyond the basic speed/distance/location ride metrics, advancements in GPS bicycle computer technology have also integrated physiological/workload parameters, i.e. heart rate, pedaling cadence, and power. These parameters can enable an accident reconstructionist to assess the cyclist's physical exertion level during the accident to determine if it was a factor. For example, research has shown that perception/reaction times will generally increase under higher physiological workloads.

GPS bicycle computers are also the genesis for the development of social media activity tracking platforms such as Strava, MapMyRide, and Garmin Connect, which have allowed millions of cyclists to upload and share their ride metrics. Strava alone boasts a massive user base of 36 million cyclists in 195 countries who logged 6.67 billion miles in less than a year. By data mining these activity platforms, an investigator can obtain information regarding bicycle traffic and roadway usage for particular sections of a roadway during specific time periods and can then compare the data from the accident to the larger rider population to see if there are significant differences.

CASE STUDY: DETERMINING SPEED ON ROUGH ROAD

A cyclist crashed on a descent while riding at 25 mph. He alleged that the roadway was unnecessarily dangerous and was the sole causative factor for his accident. Photographs of the site revealed some rough road, but it had since been repaved.

An analysis of Strava data was undertaken to access other cyclists' speeds on the same descent over a two-year period. The data showed that at least 82 cyclists had ridden through that section of roadway during that period. The maximum speeds of these cyclists were mapped on a frequency plot, along with the plaintiff's speed of 25 mph. Minimum speed was 17.3 mph and maximum was 47.3 mph. The median data point was 37.3 mph—12 mph faster than the plaintiff's speed. Additionally, only two of the 82 cyclists had speeds less than 25 mph. The Strava analysis provided the basis for the accident reconstructionist's expert opinion that the rough roadway was not unreasonably dangerous and was not a substantial factor in the plaintiff's accident.

BICYCLE ACCIDENT RECONSTRUCTION

In addition to conducting site inspections and gathering physical evidence (police reports, witness testimonies, scene photographs, and video footage), accident reconstructionists now have the potential added benefit of incorporating the latest technology in bicycle computer GPS navigation, as well as social media activity tracking platforms, into their investigations to help determine how or why a bicycle accident happened. These tools could prove invaluable in resolving cases where other forms of evidence may be limited or unavailable.

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