



D34 The Use of Strava in Bicycle Collision Analysis — A Case Study

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The goal of this presentation is to illustrate by example how Strava (a social network for athletes) was used to validate the conventional reconstruction methods applied to a bicycle collision analysis.

This presentation will impact the forensic science community by demonstrating the basics of Strava's online user activity page and by illustrating how time-base data can be employed to supplement the existing tools employed by the forensic investigator to analyze a bicycle collision.

The accuracy of traffic collision analysis depends on the quality and quantity of information gathered by law enforcement investigators. Often, additional information helps validate a conclusion by enabling an additional independent analysis that leads to the same conclusion. This is exemplified in the following case study used to understand a mishap involving a bicyclist.

This particular case involved road construction at the bottom of a particularly steep downhill section of a four-lane roadway having a posted 40mph speed limit. Road work included trenching across the road. The trench was concealed overnight with 6' x 8' steel plates. Because the steel plates rested on top of the traveled roadway surface, a tapered layer of asphalt was applied to the periphery of these plates to provide a graded transition from the roadway to the steel plate surface. Several road signs were positioned upstream of the steel plates in both directions to warn vehicle operators of the approaching surface irregularities.

A bicyclist's established daily home-to-office-to-home commute was composed of a regular route consisting of approximately seven miles in the morning and approximately nine miles at night. The accumulated average was approximately 50 miles per work week, excluding a typically longer weekend ride. Rainfall was one of the factors that would alter the rider's choice of transportation mode.

The incident occurred on the first clear, dry evening after nearly two weeks of inclement weather, during which time road construction had begun on the route taken by the rider in the evening. The rider was, therefore, unaware of any potential road hazard ahead. There were no eyewitnesses to the incident. The rider was found wearing a helmet, lying on his left side, both cycling shoes still attached to the pedals, and straddling the bicycle. The forward facing bike light was still illuminated and the taillight was flashing. The rider suffered multiple skin abrasions, but the more significant injuries included a fractured left clavicle, ribs, hip, and skull.

Investigators found an approximately 36-foot-long trail of metal, clothing, and tissue scuff marks on the roadway angled toward the curb and leading to a blood stain. The overall slide distance measured 44.2 feet. Using sliding friction (0.6g) and accounting for the upward roadway slope (1.3%), the rider's speed was calculated to be approximately 28.5mph when the front wheel struck the steel plate.

While the bicycle was equipped with a non-Global Positioning System (GPS) type cycle-computer, the rider routinely used Strava on his smart phone. Strava is an application for tracking runners and cyclists on a social network for athletes. Among other features, Strava users can track equipment use, personal goals, individual rides, accumulated mileage, and standings among other riders on similar route segments; however, this smart phone was passcode protected and thus attempts to retrieve data related to the incident from the Subscriber Identity Module (SIM) card were unsuccessful.



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Alternatively, the Activity Feed from two prior months was analyzed on the Strava account to determine a behavior pattern with regard to the rider's speed where the incident occurred. The Activity Feed is a timeline of the rides uploaded to a user's account. Clicking a ride link loads a page featuring a map view of a planned route and specific details such as ride time, distance, average speed, elevation, and energy output. Selecting the Analysis tab on the ride page provides time-base detail, such as current speed, estimated power output, heart rate (if captured), and ambient temperature. Using the mouse pointer and swiping either left or right, a dot on the route map advances forward or backward to indicate the rider's location on the route and their corresponding time-base data is featured below the map.

Using the Analysis tab, the incident rider's maximum speed on the steep downhill section was between 30.9mph and 36.7mph, with an average of 33.8mph. Narrowing the search to the approximate area in question revealed the rider's speed was between 27.3mph and 34.7mph, with an average of 30.7mph.

The speed of the bicyclist was calculated to be approximately 28.5mph at the time his front wheel struck the steel plate on the road. This calculated incident rider's speed was then validated by noting a behavior pattern established by analyzing the rider's Strava account data.

Strava, Bicycle, Reconstruction