

Comprehensive Analysis of the Relationship Between Real-Time Traffic Surveillance Data and Rear-End Crashes on Freeways

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Abstract

Rear-end collisions are the single most frequent type of crash on freeways. Their impact on freeway operation is also most noticeable because almost all of them occur during periods of medium to heavy demand. Preliminary explorations of average traffic speeds before a crash measured at loop detector stations surrounding the crash location showed that rear-end crashes can be placed into two mutually exclusive groups: first, those that occur under extended congestion and, second, those that occur with relatively free-flow conditions prevailing 5 to 10 min before the crash. With loop detector data preceding these two groups of rear-end crashes contrasted with randomly selected noncrash data, it was found that the first group can be attributed to parameters such as the coefficient of variation in speed and average occupancy measurable through loop detectors at stations in the close vicinity of the crash location. For the second group, traffic parameters such as average speed and occupancy at stations downstream of the crash location were significant as were off-line factors such as the time of day and presence of an on-ramp in the downstream direction. It was also observed that traffic conditions belonging to the first segment occurred rarely on the freeway but still made up about half the rear-end crashes. This observation, along with neural network-based classifiers, has been used to propose a strategy for real-time identification of conditions prone to the rear-end crashes. The strategy can potentially identify almost 75% of rear-end crashes, with reasonable false alarms.