

Public Abstract

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Title:SPEED-BASED SAFETY ANALYSIS FOR WORK ZONES

Speed is one of the characteristics of traffic flow that affect accident rates and severity near work zones. Approximately 25% fatal crashes in work zones involved high speed. In speed-related work zone traffic safety study, 85th percentile speed is usually considered as the measures of effectiveness in evaluating speed management strategies. However, in spite of the wide use of the 85th percentile speed, statistical methodology for comparing percentile speeds from different groups of speed population is not common. In this thesis, a statistical methodology for comparing 85th percentile speed is developed. In addition, two research projects that motivated this methodology are presented as case studies of speed-based safety analysis for work zones, as well as excellent illustrations of this new methodology.

One is the evaluation of the effectiveness of work zone speed limits. An appropriate policy for work zone speed limits has to delicately balance the safety and the efficiency impacts. Field studies were conducted on three Interstate 70 maintenance short-term work zones in rural Missouri for three different speed limit scenarios: 1) no posted speed limit reduction, 2) a 10 miles per hour (mph) posted speed limit reduction and 3) a 20 miles per hour posted speed limit reduction. The 85th percentile speeds and speed variance were found to be 81 mph and 10 mph; 62 mph and 8 mph; and 48 mph and 6 mph, respectively for the three scenarios. The differences in the 85th percentile speed and speed variance among all three scenarios were statistically significant. The percent of drivers who exceeded speed limit by over 10 mph were 15.4%, 4.8%, and 0.9%, respectively. Thus a reduction in posted speed limit was effective in reducing prevailing speeds and speed variances.

The other one is analysis of the sequential warning lights in night time work zone. Improving safety at nighttime work zones is important because of the extra visibility concerns. The deployment of sequential lights is an innovative method for improving driver recognition of lane closures and work zone tapers. Sequential lights are wireless warning lights that flash in a sequence to clearly delineate the taper at work zones. The effectiveness of sequential lights was investigated using controlled field studies. The speeds of approaching vehicles were used to determine the impact of sequential lights on safety. Traffic speeds were collected at the same field site with and without the deployment of sequential lights. The results of this study indicate that sequential warning lights had a net positive effect in reducing the speeds of approaching vehicles and enhancing driver compliance. Statistically significant decreases of 2.21 mph mean speed and 1 mph 85th percentile speed resulted with sequential lights. But a statistically significant increase of 0.91 mph in the speed standard deviation also resulted with sequential lights. Also, an economic analysis of Missouri nighttime work zones and historical crash data resulted in a benefit-cost ratio of around 5.