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RESEARCH PROJECT TITLE

Strategies to Address Nighttime Crashes at Rural, Unsignalized Intersections

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Strategies to Address Nighttime Crashes at Rural, Unsignalized Intersections

tech transfer summary

As rural nighttime crashes occur much more frequently than daytime accidents, this research investigates the effectiveness of lighting and other measures designed to reduce nighttime crashes at rural intersections.

Objectives

- Summarize common types of nighttime crashes at rural Iowa intersections and discuss strategies used by agencies to reduce nighttime crashes.
- Summarize lighting warrants and practices used by other states.
- Discuss results of a survey of Iowa counties and cities regarding their lighting installation practices.
- Present a rural Iowa intesection field analysis on the impact lighting has on safety.
- Develop draft lighting guidelines to be incorporated into the Statewide Urban Design and Specification (SUDAS) manual.

Background

Nighttime driving can be particularly problematic. The United States DOT and National Highway Transportation Safety Authority (NHTSA) report that nationally 45% of fatalities occur under dark conditions versus 27% of total crashes (U.S. DOT 2003). Therefore, citizens request the installation of roadway lighting in their communities to help improve safety. However, roadway lighting is expensive to install and maintain, and it is only one of several strategies available to address nighttime crash concerns. This research assists local agencies in making decisions about installation of rural intersection lighting.

Overview of Nighttime Crashes at Rural Intersections in Iowa

The types of crashes occurring at rural intersections were evaluated to determine the types of crashes that occur. Nighttime crashes were selected for all rural intersections in the state of Iowa for 2001 to 2005. Results show that 26% of crashes at rural intersections occur during nighttime conditions, and another 4% occur during dawn or dusk. In addition, it was found thatcrash severity is also determined by lighting condition, and that 29% of fatal and injury crashes occur during the nighttime.

The types of nighttime crashes for multiple vehicles that occur at rural intersections are presented in Table 1. As shown, broadside crashes made up 41.8% of crashes, followed by rear-end crashes (25.3%). Both types of sideswipe crashes made up 16.7% (13.6% same-direction sideswipe, 3.1% opposite-direction sideswipe).

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Table 1. Nighttime crashes by type

Type	Percent
Broadside	41.8
Rear-end	25.3
Sideswipe, same direction	13.6
Angle, oncoming left turn	9.6
Sideswipe, opposite direction	3.1
Head-on	3.0
Non-collision	2.3
Unknown	1.4

Strategies to Address Nighttime Crashes at Rural Intersections

A number of strategies are used to address nighttime crashes at rural intersections. Based on the literature review, all of the countermeasures in Table 2 resulted in reducing nighttime crashes to varying degrees with the exception of improved signing and marking, for which studies are being implemented.

Table 2. Summary of the effectiveness of non-lighting strategies in reducing nighttime crashes

Strategy to reduce nighttime crashes	Function of strategy
Advance signing	Signs alert driver to conditions in traffic control.
Overhead beacon	Overhead flashing lights warn drivers of an unexpected or hazardous situation.
Stop sign beacon	Flashing lights mounted on signs draw attention to intersection.
Reflective tape on sign posts	Reflective tape used around sign posts improve sign visibility.
Improved signing and marking	More visible signs (larger/wider or more retroreflective) draw attention to intersection.
Advance stop sign rumble strips	Strips on roadway warn drivers of upcoming intersection.

Figure 1. Sign-mounted beacons used to replace overhead flashing beacons (Image source: Mn/DOT 2006)

Findings on Lighting Effectiveness

A cross-sectional statistical evaluation was used to evaluate the safety benefits of lighting and other treatments, such as advance stop line rumble strips and flashing beacons at rural, unsignalized intersections. Data were collected in the field at 223 rural intersections. Intersections ranged from having no strategies to having multiple strategies, such as lighting and advance stop line rumble strips. A hierarchical Bayesian model using a Poisson distribution was used to fit a model for nighttime crashes. A number of variables were evaluated for both, including type of control, presence of overhead beacons, presence of advanced stop line rumble strips, presence of overhead street lighting, etc. The only significant variables were presence or absence of lighting and whether the location was a high-crash location (i.e., location had two or more nighttime crashes in a three-year period). The results indicated that locations without lighting had twice as many crashes as locations with lighting.

Although other countermeasures, such as advance stop line rumble strips or overhead beacons, were included in the study, the impact of nighttime crashes related to these countermeasures could not be detected. This may have been due to sample size or to the fact that crashes at rural intersections are still fairly rare events, and differences could not be detected. Only the presence or absence of lighting could be gauged, not the evaluatation of type, location, and quality of lighting.

Implementation Readiness

For a county engineer to utilize the results of this safety analysis, one simply needs to obtain the actual number of nighttime crashes over a three-year period along with a summary of severity and crash type. This information can be requested at no charge through the Iowa Traffic Safety Data Service (ITSDS) at CTRE (http://www.ctre.iastate.edu/itsds/index.htm).

Figure 3. Flashing beacons in a variety of settings (Image Source for LED Stop Sign: TAPCO)