Rural Lighting (1 of 2)

DESCRIPTION AND DEFINITION

Install destination-style street lighting at rural intersections. Utility companies typically provide one or two lights.

ROADWAY OPERATIONS

The installation of street lighting does not have an effect on the roadway traffic operations.

TYPICAL COSTS

Implementation Costs

- $8,000 for a single light, $14,000 for two lights
- $500 for installation with existing utility pole

Maintenance and Power Costs

- $25 to $50/month

SAFETY CHARACTERISTICS

The installation of street lights at rural intersections has been found to reduce single-vehicle, multiple-vehicle, and nighttime crashes.

A benefit-to-cost analysis found that the crash reduction benefits of street lighting at rural intersections outweigh the costs by a wide margin. The average benefit-to-cost ratio was about 15:1.

Case study research suggests that the use of street lighting is more effective at reducing nighttime crashes than either transverse rumble strips or overhead flashers.

PROVEN, TRIED, INEFFECTIVE, OR EXPERIMENTAL

- All FHWA Crash Reduction Clearinghouse studies documented reductions in nighttime crashes associated with providing intersection lighting.
- Documented crash reductions are in the range of 20 to 50 percent.
- Providing rural intersection lighting is considered a **PROVEN** effective safety strategy.

System-wide Comparative Analysis

Item	Intersections without Street Lights	Intersections with Street Lights	Reduction	Statistical Significance
Intersections	3,236	259		
Night Crashes	34%	26%	26%	Yes
Night Crash Rate	0.63	0.47	25%	Yes
Night Single-Vehicle Crashes	23%	15%	34%	Yes
Night Single-Vehicle Crash Rate	0.15	0.07	53%	Yes

Before vs. After Crash Analysis

Item	Before	After	Reduction	Statistical Significance
Intersections	12	12		
Number of Night Crashes	47	28	40%	Yes
Night Crashes/Intersection/Year	1.31	0.78	40%	
Total Crashes/Intersection/Year	2.44	2.08	15%	
Night Crash Rate	6.06	3.61	40%	Yes
Total Crash Rate	2.63	2.24	15%	Yes
Severity Index	43%	32%	26%	Yes
Night Single-Vehicle Crash Rate	4.0	2.84	29%	Yes
Night Multiple-Vehicle Crash Rate	2.06	0.77	63%	Yes

Source : Safety Impacts of Street Lighting at Isolated Rural Intersections, LRRB 1999-17.

Rural Lighting (2 of 2)

TYPICAL CHARACTERISTICS OF CANDIDATE LOCATIONS

Typical intersection characteristics that determine if a location is a good candidate for rural intersection street lighting installation are:

- *Rural Through and STOP intersections*—County road and county road intersections, or county road and state highway intersections.
- *Typical Volumes*—Agencies can develop their own volume criteria based on their roadway system characteristics. An example is Dakota County's lighting criteria, which ranks intersections with the major roadway volumes greater than 1,000 vehicles per day and intersections with a minor roadway volume of greater than 250 vehicles per day as minimum criteria for rural intersection lighting.
- *Crash History*—Crashes experienced at an intersection during a 5-year period. Additional weight may be given to locations with nighttime crashes versus locations with only daytime crashes.

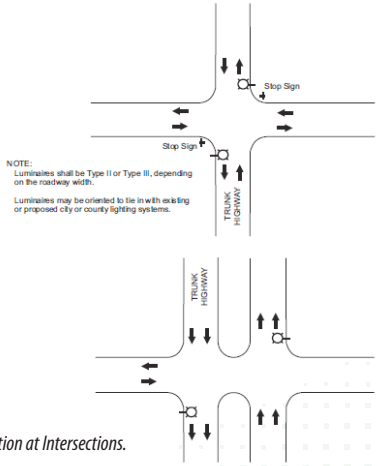
Other characteristics that can be used to determine at-risk locations include:

- *Geometry of Intersection*—Research has shown that skewed intersections have a higher risk of crashes.
- *Geometry of Roadway*—Research has shown that intersections located on or near a horizontal or vertical curve are subject to a higher level of risk.
- *Commercial Development in Quadrants*—Research has shown that intersections with commercial development located in one or more of the intersection quadrants have a higher level of risk. Private residences or farms are not considered locations with a high risk.
- *Distance from Previous STOP Sign*—Research has shown that driver attention decreases when travelling for longer distances between STOP signs.
- *Railroad Crossing on Minor Approach*—Intersections on or near a railroad line are subject to an increased level of risk. Drivers must navigate the railroad tracks while approaching the intersection.

DESIGN FEATURES

Many agencies are currently installing rural intersection lighting by mounting a davit arm and luminaries on existing utility poles. MnDOT's *Traffic Engineering Manual* also provides additional guidance if existing poles are not available.

Example of Using Luminaire Mast Arm on Existing Utility Pole
Source: MnDOT Traffic Engineering Manual.



Standard Location at Intersections.
Source: MnDOT Traffic Engineering Manual.

SOURCES

Safety Impacts of Street Lighting at Isolated Rural Intersections—Part II, Minnesota Local Road Research Board, Report 2006-35, 2006.
Safety Impacts of Street Lighting at Isolated Rural Intersections, Minnesota Local Road Research Board, Report 1999-17, 1999.
Strategies to Address Nighttime Crashes at Rural, Unsignalized Intersections, Iowa Highway Research Board (TR-540), 2008.
Statistical Models of At-Grade Intersection Accidents, FHWA-RD-96-125, March 2000.
Reducing Late-Night/Early Morning Intersection Crashes by Providing Lighting, FHWA-SA-09-017, 2009.

Rural Lighting Policy (1 of 2)

POLICY PURPOSE/INTRODUCTION

The purpose of this policy is to establish uniformity and consistency in the application, installation, and maintenance of rural street lighting on the ***<Insert Agency>***'s roadway system.

Research by the Minnesota Local Road Research Board (Report No. MN/RC-1999-17) has concluded that the installation of streetlights at rural intersection offers a low-cost and effective strategy for mitigation of nighttime vehicle crashes. Published reports have found that the installation of lighting at rural intersections resulted in a 20 to 50 percent reduction in the nighttime crash frequency. A benefit-cost analysis indicated the crash reduction benefits associated with the installation of street lighting at rural intersections outweigh the costs by a 15:1 ratio.

DEFINITIONS

Rural Intersection—Any intersection that is located outside of an Urban District, is not within the development area of a community, and has a speed limit of 45 mph or greater.

Urban District—The territory contiguous to and including any street that is built up with structures devoted to business, industry, or dwelling houses situated at intervals of less than 100 feet for a distance of ¼ mile or more.

POLICY

It is in the public's interest that ***<Insert Agency>*** should use the strategy of installing streetlights at rural intersections in order to reduce crashes and improve motorist guidance. The provisions are provided for use by the ***<Insert Agency>*** engineer in regulating the locations, design, and method of installation in a uniform manner of street lighting at rural intersections. It also provides detail cost responsibilities between local road authorities or governmental units and ***<Insert Agency>***.

POLICY CRITERIA

Installation of rural streetlights should be completed based on a comprehensive evaluation of the ***<Insert Agency>*** roadway system. Recognizing that rural street lighting cannot be implemented at all locations, two potential prioritization processes are included as references: the systemic intersection risk factors method, and the functional classification and traffic volumes method.

Systemic Intersection Risk Factors Method

The objective of the systemic method is the same as for the typically reactive black spot approach—to identify candidates for the deployment of safety improvement projects. However, the method makes one fundamental change in the approach. The black spot method assumes that the presence of (or large numbers of) crashes equals risk and that the absence of crashes indicates that there is no risk. The systemic method is based on the assumption that the absence of crashes does not equate to no risk. In order to support the development of a new approach that defines risk based on crashes plus a variety of surrogate measures, research was conducted that identified rural intersections with crashes and then documented the geometric and traffic features that were common among the various locations.

The risk factors, or surrogate measures, along with crash history include:

- Geometry of intersection (skew)
- Geometry of roadway (on/near curve—both vertical and horizontal)
- Commercial development in quadrants
- Distance to previous STOP sign (more than 5 miles from the previous stop)
- Average Daily Traffic (ADT) ratio (a ratio of 0.4 to 0.8)
- Railroad crossing on minor approach
- Crash history

If the necessary information to complete a Systemic Intersection Risk Factors method, which would incorporate the latest safety research, is not available, then the Functional Classification and Traffic Volumes method can be used to prioritize rural intersections for implementation of street lighting.

Rural Lighting Policy (2 of 2)

Functional Classification and Traffic Volume Method

Prioritization of the intersections will be based on the functional classification of the intersecting roadways. The following matrix will be used in determining the volume warrant for street lighting. The lower volume of a multiple classification intersection will take precedence in determining the priority. The functional classifications are based on the most current ***<Insert Agency>*** functional classifications map located in ***<Insert Agency>*** engineer's office, and volumes will be determined by placing traffic counters on all legs of the intersections.

Table 1—Ranking of Roadways based on Functional Class and Traffic Volume

Priority	Minor Arterial	Major Collector	Minor Collector	Local
Low	0 to 999	0 to 749	0 to 499	0 to 249
Moderate	1,000 to 2,000	750 to 1,000	500 to 750	250 to 500
High	More than 2,000	More than 1,000	More than 750	More than 500

Note: Use the appropriate classification above for the Major Street and Cross Street; the lower volume shall take precedence for priority.

Example: The Major Street is CSAH 35 and is classified as a Minor Arterial; the Cross Street is CR 117 and is classified as a Minor Collector. The ADT on CSAH 35 = 4,520 (rated High) and the ADT on CR 117= 520 (rated Moderate). The Moderate Priority would apply.

Financial Considerations

The ***<Insert Agency>*** Highway Department can authorize placement of street lighting at rural intersection and participate in the costs, based on the following criteria, provided that there are sufficient funds in the road and bridge budget:

1. ***<Insert Agency>*** will be responsible for all costs associated with the installation and maintenance of street lighting at warranted intersections under the county and city's jurisdiction, including electrical costs. If using volume warrants to meet this criterion, a "High Priority" in the volume matrix must be met. For those intersections that are under MnDOT's jurisdiction, a formal agreement, outlining the cost participation between the two agencies, or a MnDOT permit will be required.
2. Any local road authority or local unit of government that requests street lighting at an unwarranted intersection (if using volume warrants, this would mean a "Moderate" or "Low" priority in the volume matrix), will be responsible for all costs associated with the installation and maintenance of street lighting, including electrical costs. Under this provision, the local road authority or local unit of government will be required to apply for a utility permit for the installation of street lighting.

Design Details

For detail specification requirements on the standards of streetlight systems, refer to the MnDOT ***Traffic Engineering Manual***, Chapter 10—Lighting of Traffic Facilities.