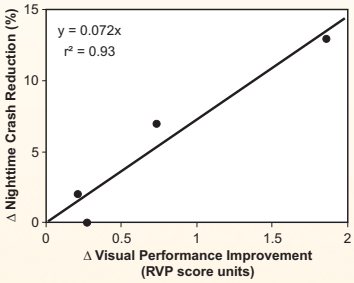
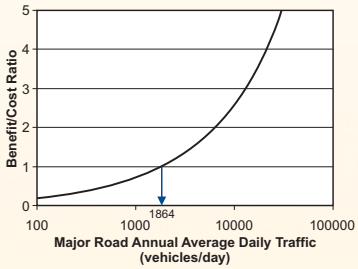
Intelligent Control of Roadway Lighting to Optimize Safety Benefits per Overall Costs

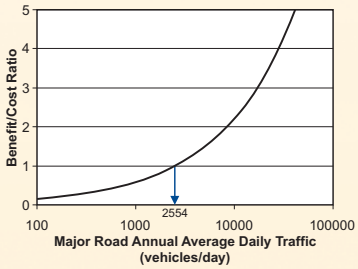
Roadway lighting is an important element of roadway safety. Because roadway lighting is neither installed randomly nor in isolation, estimates of the safety benefits from roadway lighting can be biased in many observational studies. Without consideration of possible confounding factors like roadway geometries and the presence of other safety treatments such as traffic signals, improved markings and signs, and turn lanes, the expected safety benefits of roadway lighting can be inflated. Sophisticated statistical models that control for these potential confounding variables were used to estimate the safety benefits of roadway lighting at intersections in Minnesota. A validated model of relative visual performance (RVP) was used to estimate the visibility impacts of roadway lighting at these same intersections. The results of that study indicated that the magnitude of safety improvements for the installation of lighting were consistent with the magnitude of the visibility improvements for the lighting system.



Provisional transfer function between visual performance improvements and observed nighttime crash reductions associated with roadway lighting at different intersection types.

Using this safety and visibility relationship, LRC researchers conducted benefit/cost analyses for roadway lighting. The costs of vehicle crashes and lighting systems (including installation, energy, maintenance, and overall annual costs) and benefit/cost analyses based on hourly nighttime traffic volumes were examined. Assessing the safety benefits per overall costs provides a simple, yet robust mechanism for evaluating the relative effectiveness of different control strategies, because the visibility provided by the lighting system can be related to the expected safety benefits. These analyses are not only useful in determining whether conventional roadway lighting systems can be justified in terms of their safety benefits per overall costs, but the approach can also be used to determine the value of intelligent roadway lighting systems.





Where traffic volumes exceed 1864 vehicles/day in rural unsignalized intersections (above) or 2554 vehicles/day in urban signalized intersections (below), the safety benefit per lighting system cost is greater than one, then the lighting system installation/operation can be justified.

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