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Intersection Illumination – Collision Correlation

How does street lighting affect roadway safety?

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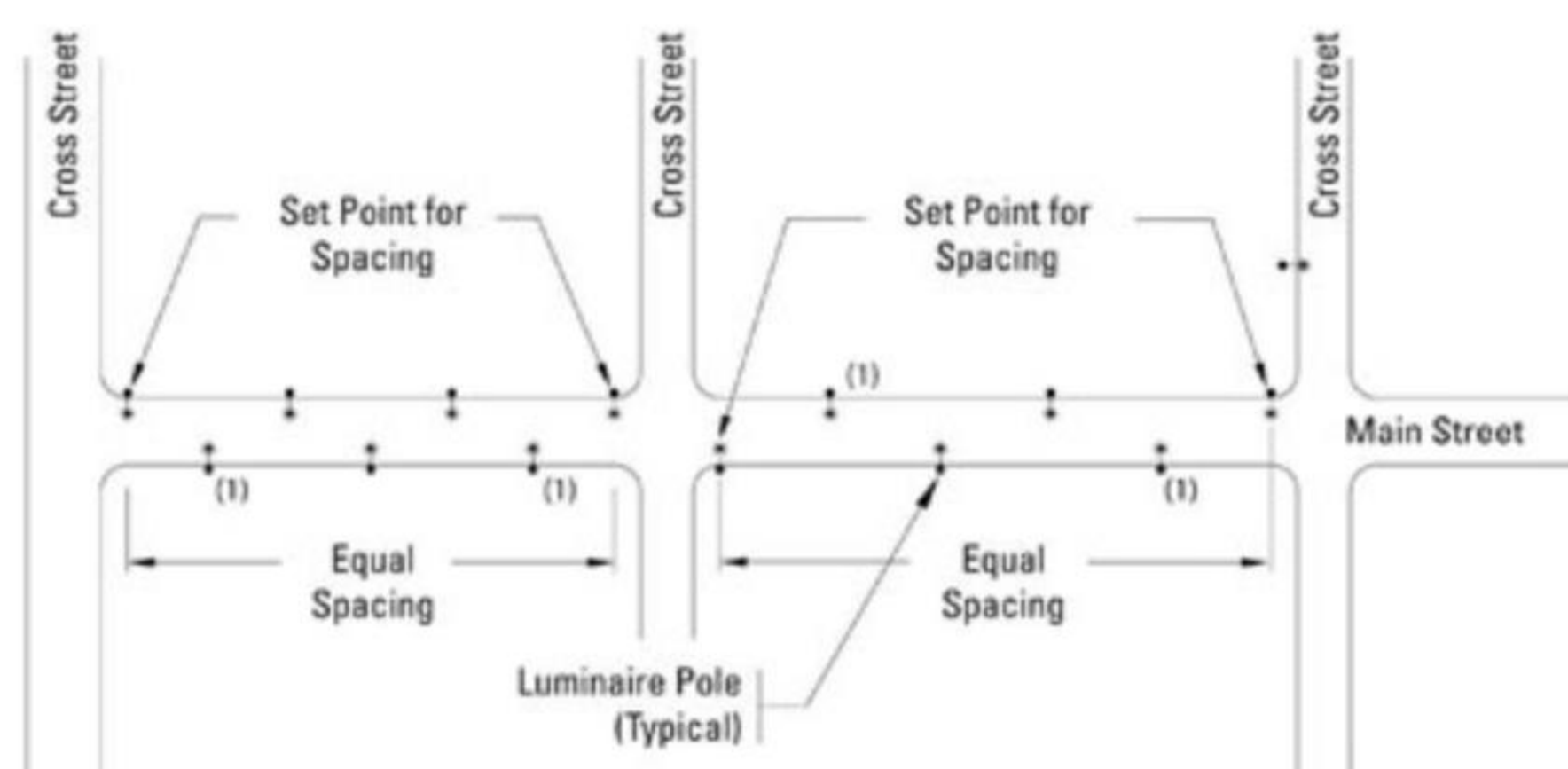
Abstract

Understanding the relationship between roadway intersection safety and street lighting is essential to developing effective intersection lighting standards. This study uses data from the Ohio Department of Transportation's (ODOT) Accident Databases (1 million+ accidents over 10 years) to explore the relationship between street lamps and accident occurrence via comparative statistics.

Accident occurrence ratios, calculated based upon seasonally categorized, time-matched accident data are compared and reported with and without artificial lighting as a variable. The results of the study indicate that artificial lighting is an important factor on accident rate occurrence via a correlation between lighting and roadway safety, guiding the opportunity for more research to recommend future lighting standards at Ohio's intersections.

Introduction

Presently, standards on intersection lighting are lacking nationwide and in Ohio. Only suggested guidelines on where to place street lamps and what type to use at certain intersections are currently available from sources including the Federal Highway Administrations (FHWA) Lighting Handbook.



FHWA Lighting Handbook 2012 – Roadway Lighting Guidance Layout Schematic

With an average of 1.27 million accidents occurring at Ohio's intersections each year, improving intersection safety is imperative. Ohio crash statistics show that 0.11 accidents occur per person per year in Ohio. Any improvement in roadway safety would theoretically see this ratio decrease.

Thus, the goal of this study is to analyze Ohio's crash data by isolating variables such as artificial lighting in order to determine a potential correlation between street lighting and accident rates.

Methodology & Experiment

Collecting Accident Information

Information and characteristics for 1 million intersection accidents from 10 years of data was downloaded from ODOT accident databases.

Screening Data to Create Independent Data Sets

The dataset was screened to focus on the impact of lighting conditions for accidents occurring Monday-Friday during:

	2-4PM	6-8PM	9-11PM
Summer	Daylight	Daylight	Darkness
Winter	Daylight	Darkness	Darkness

Accidents involving DUI and poor conditions were removed.

Calculation of Accident Ratios

Accident ratios were calculated to evaluate and compare:

- Impact of artificial lighting on accident occurrence
- Effects of seasonality during consistent time comparisons

Analysis of Ratios to Determine the Impact of Lighting

Ratios were analyzed, compared, and interpreted to draw conclusions concerning the impact of lighting on accident ratios compared based on lighting conditions.

Key Assumptions and Definitions

Assumptions

- Traffic volumes throughout Ohio's intersections are equivalent during winter and summer months
- 6-8 PM serves as a ambient light liaison reference period for evaluation (daylight in summer and darkness during winter)

Definitions

"*Accident*" – a vehicle collision with another vehicle, foreign object, animal, or pedestrian.

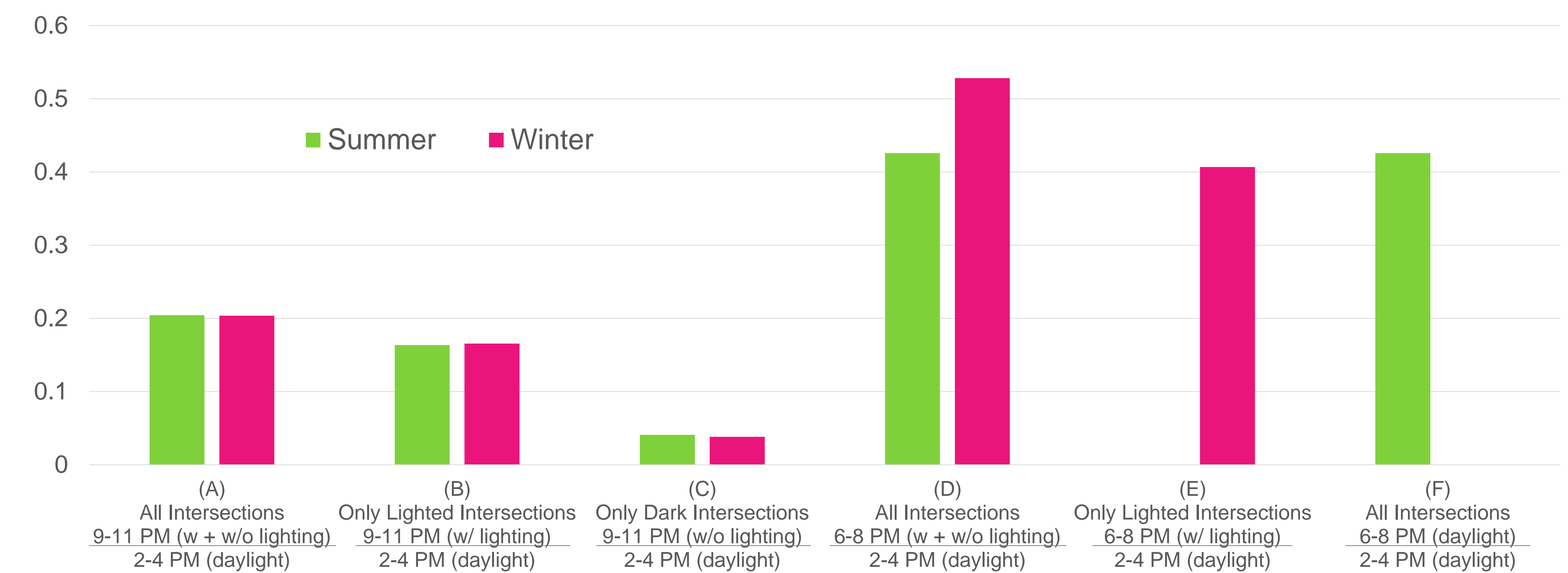
"*Lighted*" - presence of an artificial light source (street lamp).

"*Daylighting*" - natural light present during the day.

"*Dark*" - nighttime conditions with no daylight present and no artificial light sources.

Results and Discussion

Comparison of Accident Ratios



Accidents occurring at common time references during nighttime and daytime driving conditions are equivalent between summer and winter within each grouping. The calculated accident ratios are consistent for all intersections (A) and for intersections where artificial lighting is present (B) or completely absent (C).

When lighting conditions change between seasons, the accident ratios between summer and winter are no longer equivalent (D). The calculated accident ratio is actually about 20% lower when daylighting is present in the summer evening (6-8PM) compared to any lighting conditions during the same time in the winter.

When crash ratios from intersections containing lighting during winter evenings and daytime hours (E) is compared to accident ratios from all intersection during summer evenings and daytime hours (F), the resulting ratios are equivalent.

Conclusions

Key results indicate

- Observed differences in accident ratios occurring during evening hours in the summer and winter are due to accidents at intersections absent of lighting.
- This study suggests that adding artificial lighting to intersections is an effective means of simulating ambient daylight and reducing accident occurrence.

These findings are in agreement with nationally available data indicating that daytime driving is statistically safer than nighttime driving (demonstrated by fewer fatalities per daily vehicle miles travelled).

This study also addresses general trends for Ohio intersections as a whole, rather than individual intersections or particular artificial lighting scenarios. Therefore, additional research is needed to understand the influence of intersection lighting on individual intersection accidents.

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