Field Evaluation of Red Light Running Evaluation Methods

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Existing Red Light Running Research

• Countermeasure effectiveness vs. site selection

• Bonneson (2003): Video detection & automated camera enforcement to track red light runners

• Papaioannou (2007), Sharma et al. (2007), Lavrenz et al. (2014): Factors influencing driver behavior in dilemma zones

• Lu et al. (2015): Yellow Light Running Identification with Loop Detectors
Factors Behind Red Light Runners (RLRs)

**Dilemma Zones**

TYPE 1 DILEMMA ZONE

Stop bar

Should-stop Zone  TYPE 1 DILEMMA ZONE  Should-go Zone

Distracted Driving

TYPE 2 DILEMMA ZONE

Stop bar

Should-stop Zone  TYPE 2 DILEMMA ZONE  Should-go Zone

Split Failures & Other Congestion
Conceptual Overview

Field Evaluation of Red Light Running Evaluation Methods
Concept: How is a Red Light Runner Defined?

- End of Green Interval (10s)
- Yellow Interval (Length Varies)
- Start of Red Interval (10s)

Detector:
- On
- Off
Conceptual Example: US231 & State St.
Conceptual Example: US231 & State St.
Field mounting of cameras for video recording

**US231 & State St**

Camera behind sign

**US231 & River Rd**

Camera behind sign
Waiting Left Turning Car
Estimating RLR Driver Speed through the Intersection
Estimating RLR Vehicle Speed through the Intersection

Vehicle Length = 20ft

Detection Zone = 36ft

Detector On Time = 0.7s

\[ RLR\ Vehicle\ Speed = \frac{Distance_{Det\ On}}{Time_{Det\ On}} \]

\[ = \frac{(20ft + 36ft) \times \frac{1\ mile}{5,280ft}}{(0.7s) \times \frac{1\ hr}{3,600s}} \]

\[ = 54.5\ mph \]
US 231 & State St. Patterns & Trends

Field Evaluation of Red Light Running Evaluation Methods
Normalized RLR Distribution by Day of Week

The diagram shows the normalized red light running vehicle (RLR) distribution per 1000 ADT (Average Daily Traffic) across different phases (Phase 2, Phase 4, Phase 6, Phase 8) for each day of the week (SUN - SAT).

The chart indicates a peak in RLRs on Thursday (THU) and a lower occurrence on Saturday (SAT). The phases are color-coded: Phase 2 (blue), Phase 4 (gray), Phase 6 (orange), and Phase 8 (yellow).
RLR Distribution by Hour of Day

The graph shows the count of red light running vehicles by phase and hour of day. It displays the data for Phase 2, Phase 4, Phase 6, and Phase 8. The x-axis represents the hour of day, while the y-axis indicates the count of red light running vehicles. The diagram also includes a map of the intersection layout with phases labeled Phi 1 to Phi 8.
Normalized RLR Distribution by Hour of Day

Red Light Running Vehicle per 1000 ADT

Hour of Day

Phase 2  Phase 4  Phase 6  Phase 8
Normalized RLR Distribution by Timing Plan

![Graph showing Red Light Running Vehicle per 1000 ADT for different phases (Phase 2, Phase 4, Phase 6, Phase 8) during AM Peak, Midday, PM Peak, and Overnight.]

- AM Peak
- Midday
- PM Peak
- Overnight

Legend:
- Phase 2
- Phase 4
- Phase 6
- Phase 8

Phase 2 Phase 4 Phase 6 Phase 8

Φ1 Φ2 Φ3 Φ4
Φ5 Φ6 Φ7 Φ8
Benefits & Case Study Uses

Field Evaluation of Red Light Running Evaluation Methods
Statewide High Resolution Signal Ranking

- Approximately 140 signals in Indiana with hi-res data
- Opportunities for targeted law enforcement
- Safety countermeasure screening
Phase 2/6 Top 20 Intersections

Red Light Runners, All Lanes

Conceptual Ranking
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Left Turn Split Extension: US231 & River Rd
Red Light Runners

EB Left: 1500-1900 Split Increase

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Going from Actuated-Coordinated to Fully Actuated Operation: US231 & River Rd

![Map of US231 & River Rd]
EB Left: Coordinated $\rightarrow$ Free

Before

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Change from Coord to Free
Conclusions

• Intersection safety measures using in-place signal infrastructure
• Proper signal database maintenance is crucial
  • Proper phasing, clearance intervals
  • Identification of detector channels, lane movements, etc.
• Evaluation of Countermeasures
• Targeted Law Enforcement Opportunities