Field Evaluation of Red Light Running Evaluation Methods

Steven Lavrenz, Darcy Bullock
Purdue University

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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

Should-stop Zone

Stop bar

Should-go Zone

TYPE 2 DILEMMA ZONE

Stop bar

Distracted Driving

Split Failures & Other Congestion

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)

Det On  Det Off  Det On  Det 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
Detector Zone Occupied
Detector Zone
Unoccupied
Waiting Left
Turning Car
Red Light Runner
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

\[
\text{RLR Vehicle Speed} = \frac{\text{Distance}_{\text{Det On}}}{\text{Time}_{\text{Det On}}}
\]

\[
(20\text{ft} + 36\text{ft}) \times \frac{1\text{ mile}}{5,280\text{ ft}}
\]

\[
(0.7\text{s}) \times \frac{1\text{ hr}}{3,600\text{s}}
\]

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

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

Red Light Running Vehicle per 1000 ADT

Phase 2  Phase 4  Phase 6  Phase 8
RLR Distribution by Hour of Day

Count of Red Light Running Vehicles

Hour of Day

Phase 2 - Phase 4 - Phase 6 - Phase 8

Phase 2
Phase 4
Phase 6
Phase 8

W State St

Φ1 Φ2 Φ3 Φ4
Φ5 Φ6 Φ7 Φ8
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

Red Light Running Vehicle per 1000 ADT

AM Peak  Midday  PM Peak  Overnight

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

Conceptual Ranking

Red Light Runners, All Lanes
Left Turn Split Extension: US231 & River Rd
EB Left: 1500-1900 Split Increase

Red Light Runners

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Going from Actuated-Coordinated to Fully Actuated Operation: US231 & River Rd
EB Left: Coordinated $\rightarrow$ Free

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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