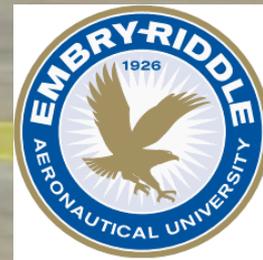


# REDUCING LEFT TURN VIOLATIONS WITH ILLUMINATED RAISED PAVEMENT MARKERS

Scott Parr, Ph.D.  
Embry Riddle



CALIFORNIA STATE UNIVERSITY  
FULLERTON

# Acknowledgements

This research was carried out entirely by the undergraduate ITE Student Chapter at Cal State Fullerton



# Illuminated Raised Pavement Marker (IIRPM)



LED lights embedded in the pavement to reinforce existing traffic control devices

# Overview

- LA Metro deployed IIRPM to reinforce signal control for at-grade light rail crossing in the absence of cantilever gates
- After deployment, red light running was counted during a 68 day on/off period along with 72 hr counts
- Statistical analysis determined the IIRPM significantly reduced the average number of violations

# LA Metro

- LA Metro is the Los Angeles County Metropolitan Transportation Authority
- They serve as transportation planner and coordinator, designer, builder and operator for one of the country's largest, most populous counties.
- More than 9.6 million people – nearly one-third of California's residents – live, work, and play within their 1,433-square-mile service area.

# Metro Gold Line

- Metro Gold Line is light rail transit that operations in the median of the road
- With operating speeds below 30 mph, at grade crossing do not require cantilever gates
- Road intersections therefore present a unique challenge to ensure safety, especially left turns



Eastbound train entering the intersection.

Typical line of sight for left turning vehicles.

Vehicle turning from eastbound to northbound

# Trial Usage of IIRPMs

- In 2014, LA Metro was approved for trial usage of Illuminated RPMs for at grade crossings of the Gold Line Eastside Extension
- Granted by FHWA
- In cooperation w/ LADOT & LA County



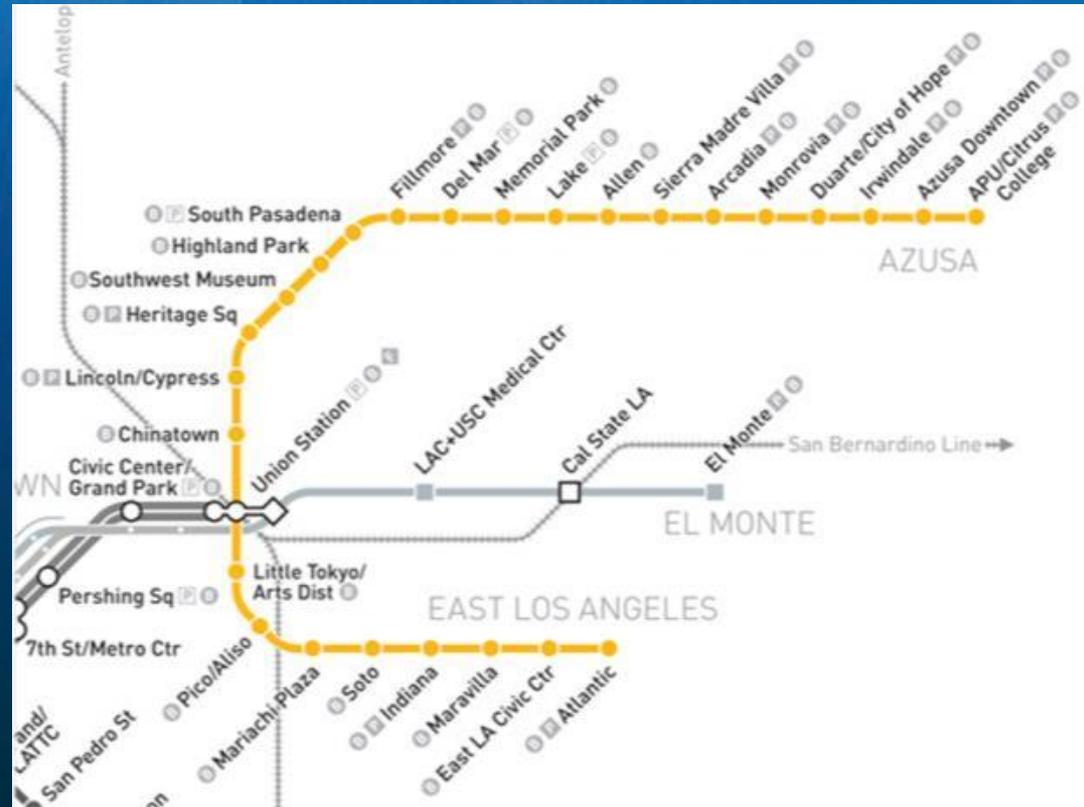
# LA Metro Gold Line

- Gold Line

- Opened 2003
- 31 Miles long
- 27 stations
- Light Rail

- Eastside Extension

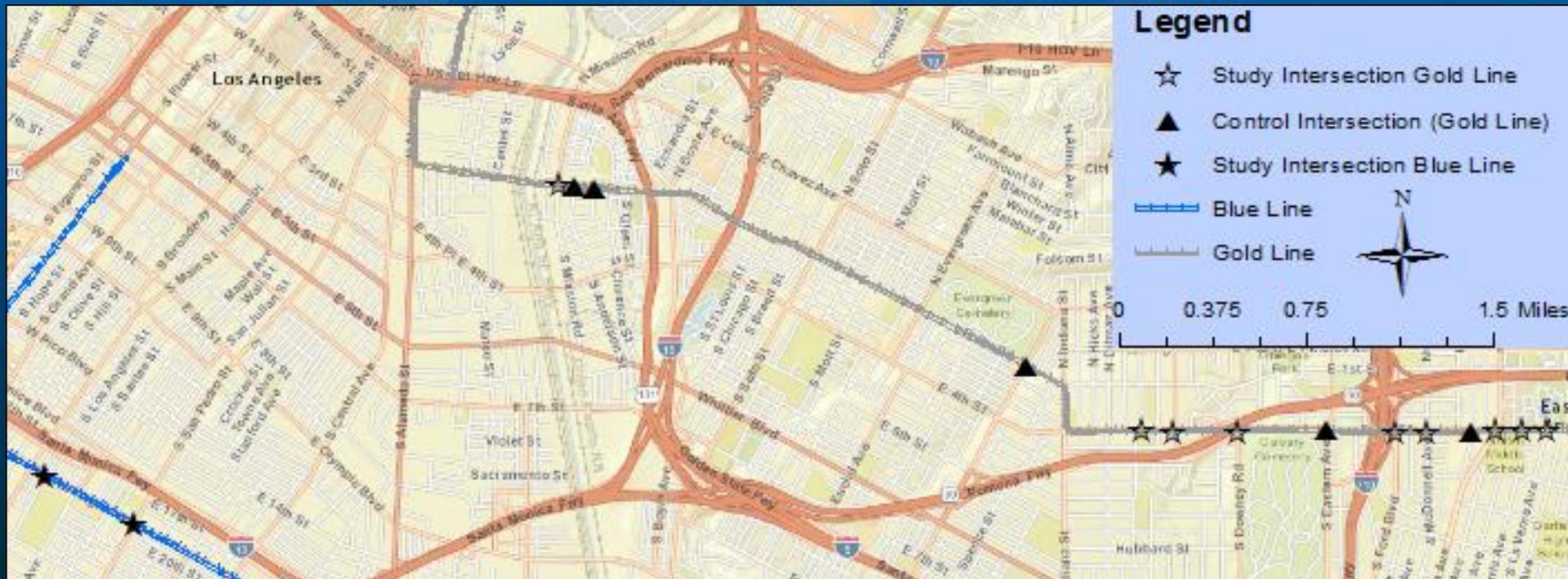
- Opened 2009
- 6 Miles long
- 8 Stations
- Passes 25 intersections



# Data Collection

- 14 Intersections
- Gold Line & Blue Line
- 18 “Study” movements & 10 “Control” movements
- LA Metro Provided:
  - Daily Left-turn violations from red light traffic cameras
  - 72 hour volume counts
  - 34 DAY “ON” & 34 DAY “OFF” periods

# Study Intersections



# Methodology

Tested 5 hypothesis using a series of T-test:

1. Traffic volume for “Study” and “Control”

“ON” = “OFF”

2. Avg. num. of Violations for “Study” movements

“ON” < “OFF”

3. Avg. num. of Violations for “Control” movements

“ON” = “OFF”

4. Rate of Violations during the “ON” period

“Study ” < “Control”

5. Rate of Violations during the “OFF” period

“Study ” = “Control”

# Results

Hypothesis	Test	Description	Expectation	Result	Interpretation
Hypothesis 1: Traffic counts (ON v. OFF)	1.1	Study movement	High p-value	0.9316	No significant differences between traffic counts at Study movements between ON and OFF periods
	1.2	Control movement	High p-value	0.8926	No significant differences between traffic count at Control movements between ON and OFF periods
Hypothesis 2: Avg. num. of violations for Study movements (ON v. OFF)	2.1	Gold and Blue lines	Low p-value	0.0271**	Significant reduction in the avg. num. of violations
	2.2	Gold line	Low p-value	0.0028***	Significant reduction in the avg. num. of violations
	2.3	Gold and Blue lines weekdays	Low p-value	0.0106**	Significant reduction in the avg. num. of violations
	2.4	Gold line weekdays	Low p-value	0.0099***	Significant reduction in the avg. num. of violations
	2.5	Gold and Blue line weekends	Low p-value	0.1012	No significant reduction in the avg. num. of violations
	2.6	Gold line weekends	Low p-value	0.1311	No significant reduction in the avg. num. of violations
Hypothesis 3: Avg. num. of violations for Control movements (ON v. OFF)	3.1	Gold line	High p-value	0.0508*	Slight differences in the avg. num. of violations
Hypothesis 4 & 5: Rate of violations (Study v. Control)	4.1	ON period	Low p-value	0.373	No Significant differences between the rate of violations at Study and Control movements
	5.2	OFF period	High p-value	0.3475	No Significant differences between the rate of violations at Study and Control movements

# Conclusion

- Results suggest IIRPMs may significantly reduce left-hand violations.
- Commuters benefited the most, as weekday violations showed the strongest correlation with reductions.
- These findings were expected and consistent with prior research that shows IIRPMs and in-roadway lights encouraging drivers to comply with traffic control devices.
- Data limitations prevented a more robust analysis of the hypothesis testing.
- It is recommended that LA Metro collect more data and investigate the reasons behind the few unexpected outcomes.

# Thank you!

Scott Parr, Ph.D.

Visiting Assistant Professor

Department of Civil Engineering

Embry-Riddle Aeronautical University

P: (386) 226 – 7530

E: [parrs1@erau.edu](mailto:parrs1@erau.edu)