

REDUCING LEFT TURN VIOLATIONS WITH ILLUMINATED RAISED PAVEMENT MARKERS

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Acknowledgements

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Illuminated Raised Pavement Marker (IIRPM)



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

Overview

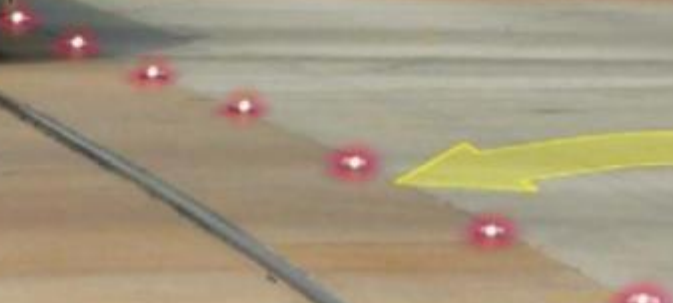
- LA Metro deployed IIRPM to reinforce signal control for at-grade light rail crossing in the absence of cantilever gates
- After deployment, red light running was counted during a 68 day on/off period along with 72 hr counts
- Statistical analysis determined the IIRPM significantly reduced the average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



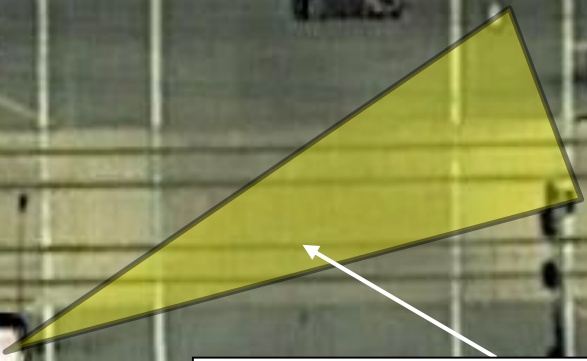
Eastbound train entering the intersection.



Vehicle turning from eastbound to northbound



Typical line of sight for left turning vehicles.



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



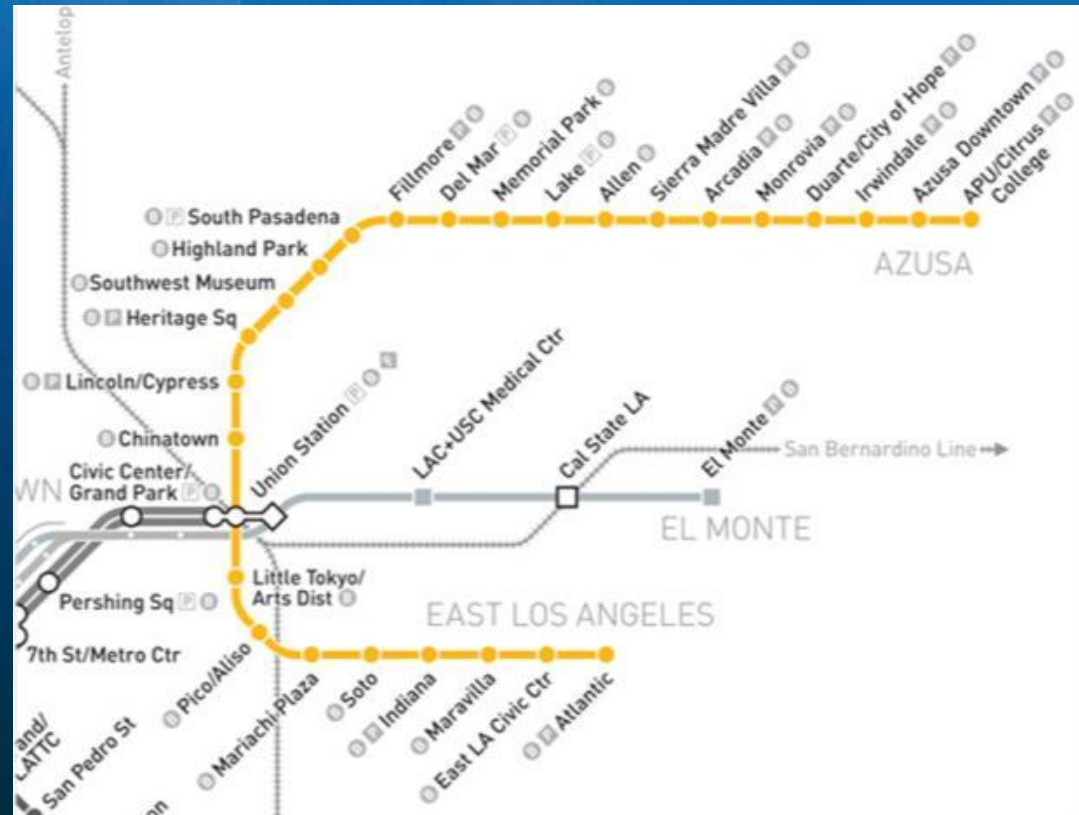
LA Metro Gold Line

- Gold Line

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

- Eastside Extension

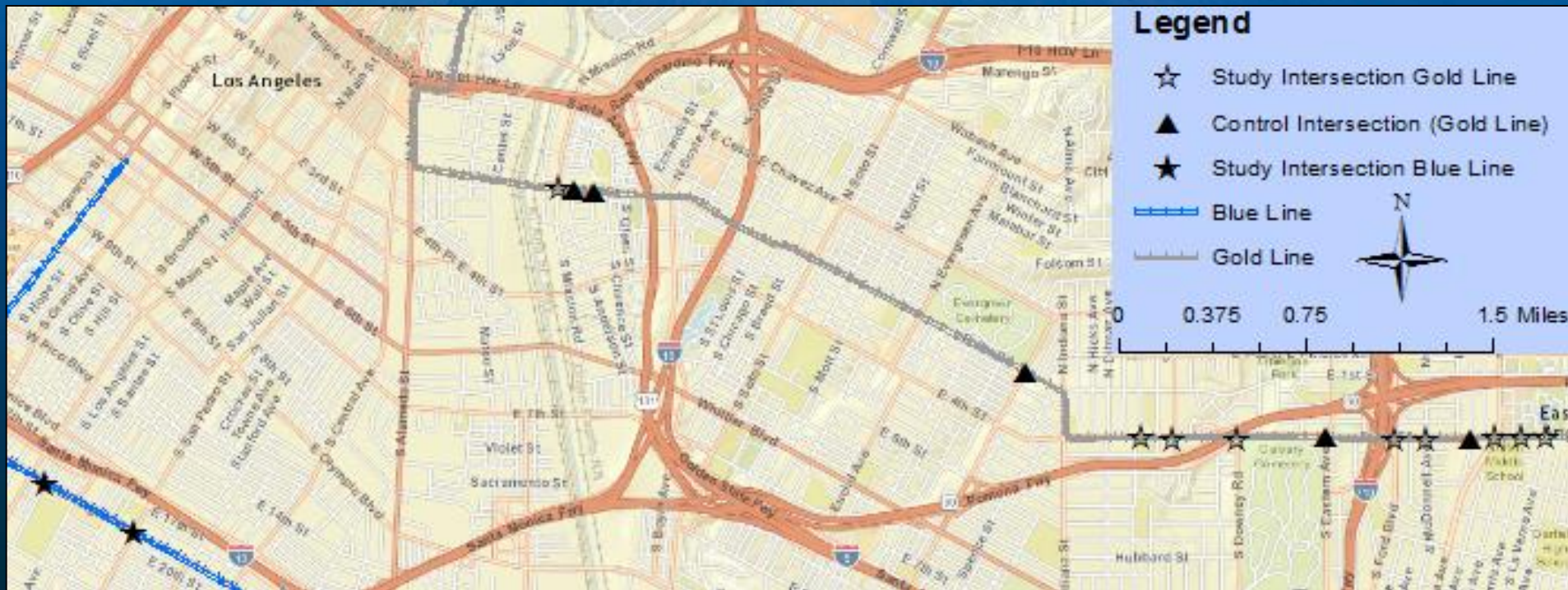
- Opened 2009
- 6 Miles long
- 8 Stations
- Passes 25 intersections



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!

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