



California Traffic Control Devices Committee Agenda Item Report



| | |
|--|---|
| Meeting Date: August 04, 2022 Item Number: 17-16 | From: Sam Morrissey, Iteris, Inc - LA Metro Consultant |
| Sponsored By: David Fleisch, CEAC, Assistant Director, Ventura County Public Works Agency | Presented By: Gurinderpal (Johnny) Bhullar, PE, TE, Secretary, CTCDC |
| Description: Request for Closure of Experiment on Internally Illuminated Raised Pavement Markers. | |

Recommendation:

Motion by committee to approve closure of this experiment, based on conclusions in the Final Report on this experiment submitted (dated 9/10/2018) by Basilia Yim & Jonathen Hofert of LA Metro, and Sam Morrissey, Iteris Inc., LA Metro Consultant's statements to Caltrans ending experimentation efforts with the completion of this experiment.

Agency Making Request/Sponsor:

Basilia Yim (LA Metro) & Sam Morrissey (LA Metro Consultant) / David Fleisch, CTCDC Member.

Background:

LA Metro requested approval from CTCDC to experiment with Internally Illuminated Raised Pavement Marker (IIRPM) systems at four Metro Orange Line (MOL) intersection light rail crossings. CTCDC provided approval in CTCDC's August 10, 2017, meeting.

This experiment proposed to evaluate the effectiveness of IIRPMs as a supplemental traffic control device to further reinforce the right turn on red prohibition, where right turns on red are prohibited at light rail crossing intersections. Despite existing traffic controls, vehicles regularly make illegal right turns when facing a solid red arrow traffic signal indication at these locations. The experiment proposed to evaluate the effectiveness of the IIRPMs in reducing the number of violations recorded at these locations on a daily and monthly basis, both before the installation of IIRPMs and after.

LA Metro conducted this larger experiment to evaluate effectiveness of IIRPMs in reducing right turn on red or left turn on red violations at many locations and on other Metro Lines under 2012 FHWA approval. These experiment locations ranged from 10 intersection crossing locations in one experiment to 12 in another experiment. Refer to FHWA Experiments 8(09)-8(E) and 3(09)-46(E).



California Traffic Control Devices Committee Agenda Item Report



LA Metro prepared and submitted Final Report (see attachment) on FHWA Experiment # 8(09)-8(E)) addressed to FHWA (Duane Thomas) dated 9/10/2018 by Lia Yim & Jonathen Hofert (LA Metro).

This report provided details on the initial experiment requests, with experiments beginning in 2015. Issues affecting the reliability and quality of the data in the initial 2-year evaluation period through early 2017, making it difficult to evaluate effectiveness, resulting in a modified evaluation plan.

Report conclusion generally indicated that IIRPMs have the potential to significantly reduce the average number of left-turn violations and encourages road users to comply with traffic control devices. The research did encounter data limitations that prevented a more robust analysis. LA Metro opted to use gates due to lack of compliance with IIRPMs.

Based upon the review of final report by Caltrans, no changes to CA MUTCD are recommended, because of these experiments. The report conclusions, although indicating reduction in left-turn violations and increased compliance, with results showing statistical significance in the effectiveness of IIRPMs, were not strong indicators of experiment's success. Limited success and compliance concerns do not warrant recommending a change to CA MUTCD to include usage of IIRPMs for the intended purpose in this experiment.

Caltrans contacted LA Metro on March 3, 2022, to follow up on the CTCDC experiment request. LA Metro consultant Sam Morrissey, Associate Vice President, Iteris, Inc. who had made the initial request to CTCDC on this experiment on behalf of LA Metro, informed that LA Metro had ended the experiment and submitted the final report, closing the CTCDC experiment. LA Metro, the experimenting agency, chose not to implement IIRPMs after completion of the experiment, due to their limited effectiveness and lack of compliance. LA Metro chose to use gates, as the primary device for field implementation at the experimentation locations to reduce left-turn violations after the experiment ended and the final report was submitted.

These LA Metro actions after completion of experiment, to choose to use gates for field implementation to reduce left-turn violations and not to use IIRPMs further validates Caltrans recommendation of not changing CA MUTCD as a result of this experiment.


Attachments:

Attachment – LA Metro's Final Report on FHWA Experiment # 8(09)-8(E)) dated 9/10/2018.



ATTACHMENT

Attachment – LA Metro’s Final Report on FHWA Experiment # 8(09)-8(E) dated 9/10/2018. (Page 1 of 3)



Metro

| | |
|----------------|--|
| Date | September 10, 2018 |
| To | Duane Thomas, FHWA |
| From | Lia Yim, LA Metro Jonathen Hofert, LA Metro |
| Subject | Experiment 8(09)-8 (E) |

Background

In September 2012, FHWA approved Metro’s Request to Experiment with an Internally Illuminated Raised Pavement Markers(IIRPM) system at ten intersections along the Metro Gold Line Eastside Extension (MGLEE) in the City of Los Angeles and the County of Los Angeles. In May 2013, two more intersections on the Metro Blue Line were approved for a total of twelve experiment locations. The IIRPM system is meant to supplement existing traffic signal indications at these intersections for the left turn lanes adjacent to the light rail corridor. This non-standard traffic control system, which uses a series of LED lights embedded in the roadway and is designed to increase the awareness of the presence of street running light rail trains among motorists when trains approach the intersections and deter them from making illegal left turns. The experiment is meant to evaluate any reductions in left turn violations associated with installation of the IIRPM system.

A two-year experiment period was to begin after the installation of IIRPMs at the twelve locations in May 2015. The original evaluation plan submitted to FHWA is based on data collected by Metro’s Photo Enforcement Camera program, with one intersection (1st /Indiana) utilizing manual counts of left turn violations since it is not included in the photo enforcement program. The proposed analysis used a before and after evaluation of left turn violation data to determine the effectiveness of the IIRPMs.

During the evaluation period, two issues affecting the reliability and quality of the data were noted. First, there appeared to have been an issue with the installation of some of the equipment. Equipment failures disrupted the data collection efforts. Our contractors addressed the affected equipment and continued inspections through the trial period. Second, the photo enforcement program replaced the photo enforcement cameras with higher resolution digital equipment during the evaluation period, which included the cameras used at the experiment locations. This affected the ability to compare the before data collected. All cameras were upgraded by June 2016.

Based on these data collection issues, Metro proposed a modified original evaluation plan, which was approved by FHWA (see Attachment A). Metro in partnership with California State University Fullerton Institute of Transportation Engineers assessed the effectiveness of the IIRPMs. The following summarizes the research conducted by CSUF ITE. Their full report is attached for reference (see Attachment B). Also included with this memo are Attachments C and D. Attachment C includes tables showing the actual number of average daily violations and average daily violation rates during the on and off periods. Attachment D shows images of the IIRPMs at the demonstration locations.

Attachment – LA Metro’s Final Report on FHWA Experiment # 8(09)-8(E) dated 9/10/2018. (Page 2 of 3)

Evaluation

Methodology

The dataset consisted of a small sample size, so t-tests were conducted for statistical analysis. The t-distribution curves used are thick at the tails and provide a more conservative result, which compensates for smaller data availability. The analysis used two types of t-tests; paired t-test and t-tests for sample means. A paired t-test is used when assessing any differences between the means of two related observations. It also indicates how significant the differences are. Therefore, paired t-tests were used to analyze the differences in left-turn violations when the IIRPMs were on and when they were off. A t-test for sample means assuming equal variances (also known as pooled variance t-test) is used when assessing the differences between the means of two different groups. For this reason, a t-test for sample means was used to compare the differences in left-turn violations between demonstration movements and control movements. Several hypotheses were tested using the two types of t-tests based on the sample characteristics and available data.

Data Collection

A two month before and after evaluation period was presented in the modified plan from February to March 2017. Due to equipment repair and count scheduling, the two month data collection occurred during alternate dates and a slightly longer time period, see table below.

| | Proposed | Actual |
|-------------------|---------------------------------|-----------------------------|
| On Period | February 1 to February 28, 2017 | February 1 to March 9, 2017 |
| Off Period | March 1 to March 31, 2017 | March 10 to April 12, 2017 |

Study intersections/movements were also modified due to equipment repairs and issues with count collection, see table below.

| Demonstration Intersection | Movement | Actual |
|-----------------------------------|-----------------|----------------|
| 1. 3 rd & Civic Center | EB to NB | Included |
| 2. 3 rd & La Verne | WB to SB | Included |
| 3. 3 rd & Mednik | EB to NB | Included |
| 4. 3 rd & Mednik | WB to SB | Included |
| 5. 3 rd & McDonnell | EB to NB | <i>Removed</i> |
| 6. 3 rd & McDonnell | WB to SB | <i>Removed</i> |
| 7. 3 rd & Ford | EB to NB | Included |
| 8. 3 rd & Ford | WB to SB | Included |
| 9. 3 rd & Downey | WB to SB | Included |
| 10. 3 rd & Gage | EB to NB | Included |
| 11. 3 rd & Gage | WB to SB | Included |
| 12. 3 rd & Rowan | EB to NB | Included |
| 13. 3 rd & Rowan | WB to SB | Included |
| 14. 1 st & Indiana | WB to SB | <i>Removed</i> |
| 15. 1 st & Mission | EB to NB | Included |
| 16. 1 st & Mission | WB to SB | Included |
| 17. Washington & San Pedro | EB to NB | Included |
| 18. Washington & San Pedro | WB to SB | Included |
| 19. Washington & Los Angeles | EB to NB | <i>Removed</i> |
| 20. Washington & Los Angeles | WB to SB | <i>Removed</i> |

Attachment – LA Metro’s Final Report on FHWA Experiment # 8(09)-8(E) dated 9/10/2018. (Page 3 of 3)

| <u>Control Intersection</u> | <u>Movement</u> | <u>Actual</u> |
|--------------------------------|-----------------|----------------|
| 1. Temple & Alameda | SB to EB | <i>Removed</i> |
| 2. 3 rd & Arizona | EB to NB | Included |
| 3. 3 rd & Arizona | WB to SB | Included |
| 4. 3 rd & Eastern | EB to NB | Included |
| 5. 3 rd & Eastern | WB to SB | Included |
| 6. 1 st & Lorena | EB to NB | Included |
| 7. 1 st & Lorena | WB to SB | Included |
| 8. 1 st & Clarence | EB to NB | <i>Removed</i> |
| 9. 1 st & Clarence | WB to SB | <i>Removed</i> |
| 10. 1 st & Utah | WB to SB | Included |
| 11. 1 st & Anderson | WB to SB | Included |

Results

Several hypotheses were tested in the statistical analysis:

- The first hypothesis test was used to ensure there were no statistical differences in traffic counts during when the IIRPMs were on and when they were off. This test found no differences in traffic counts for the on and off period.
- The second hypothesis tested the effectiveness of IIRPMs in deterring left-turn violations at demonstration movements and found a statistically significant reduction in the average number of left-turn violations for when the IIRPMs were on. Additionally, it was found that IIRPMs had a statistically significant reduction in left-turn violations during weekday travel.
- The third hypothesis examined whether there was a statistically significant difference in the average number of left-turn violations at control movements during the period when the IIRPMs were on and off. It was expected there would not be any differences between both periods, since this hypothesis examined only control movements. However, the testing showed a slight but statistically significant difference between the two periods. This difference could be attributed to the sample size having too few observations, but it could not be conclusively determined what may have caused the disparities.
- The fourth and fifth hypotheses analyzed the rate of violations for demonstration and control movements. The fourth hypothesis examined the differences between demonstration and control movements during the period when the IIRPMs were on and the fifth hypothesis examined the differences during the period when the IIRPMs were off. For the fourth hypothesis, it was expected that the rate of violations would be lower for demonstration movements; however it was found that there were no statistically significant reductions when the IIRPMs were active. The fifth hypothesis also found no differences between demonstration and control movements when the IIRPMs were off, which was expected. The sample size was very small for both the fourth and fifth hypotheses, which may have affected the results.

Conclusion

The results of this research have generally indicated that IIRPMs have the potential to significantly reduce the average number of left-turn violations. The findings contribute to prior research that has shown IIRPMs and in-roadway lights encouraging road users to comply with traffic control devices. The research did encounter data limitations that prevented a more robust analysis, but the results were still able to show a statistical significance in the effectiveness of the IIRPMs.