

# In Pavement Crosswalk Lighting System Evaluation – Pilot Project

## Civic Center Drive at Vera Schultz Drive



City Project No. 11045

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Department of Public Works  
Traffic Engineering

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## **1. INTRODUCTION**

The City of San Rafael located in Marin County has a population of approximately 56,300, with daytime population and traffic rising to significantly higher numbers due to commuter inflow to the Marin County Civic Center and other local employers. The roadway system in the City of San Rafael consists of 174 miles, including 20 miles of arterial roadways, 45 miles of collector, and 109 miles of local residential streets. The city is traversed north-south by Highway 101, and east-to-west by I-580 freeway along its southeastern border.

The focus of the overall pilot project described in this paper is the four lane wide pedestrian crossing on Civic Center Drive at the intersection of Vera Schultz Drive, located roughly two miles north of downtown San Rafael. Civic Center Drive is a north-south minor arterial that runs parallel to Highway 101 in the City of San Rafael. The County of Marin's Civic Center is located on this street (west side of the road). All County Government Departments are operating from the civic center building. Civic Center Drive has a posted speed limit of 25 miles per hour (mph).

## **2. BACKGROUND**

On Civic Center Drive, there are four pedestrian crosswalks that connect to the civic center building near the proposed project vicinity. However, there is one particular crosswalk on the subject street that connects the civic center building to the Jury parking lot (east side of the road).

The jurors, lawyers, judges, and visitors visiting the civic center building heavily use the Jury parking lot that is located across from the civic center (east side of the road). In addition, the nearby lake, special events, farmer's market, and the lush green lawns create additional pedestrian traffic throughout the day. The subject crosswalk is located at the intersection of Civic Center Drive/Vera Schultz Drive, where pedestrians using the crosswalk have to cross 4-lanes of traffic to reach the other side of the road. Currently this intersection has a two-way stop control on both sides of Vera Schultz Drive approaches (eastbound and westbound). A continuous sidewalk exists on both sides of

Civic Center Drive at this intersection. Near the vicinity of this crosswalk, Civic Center Drive carries approximately 9,400 vehicles per day.

The northbound direction of travel on Civic Center Drive at the crosswalk is flat with no unusual conditions. However, the southbound direction of travel has a small vertical curve where the crosswalk may not be apparent at some distances.

Concerns about pedestrian safety first initiated in 1998 when the city received complaints about the safety of the pedestrians at this crosswalk. City's traffic engineering staff has conducted several studies to improve the operation of this intersection. The subject intersection (Civic Center Drive/Vera Schultz Drive) did not meet the warrants for an all-way stop control and traffic signal installation. City staff then looked at other operating tools to improve the safety at this intersection. Numerous improvements have been installed at this intersection by City staff in recent years. These include improving signing (new lemon green signing) and striping, installing ladder crosswalk, changing roadway configuration, and eliminating on-street parking for additional visibility to motorists/pedestrians.

With all the above attempts made, the City still received complaints on pedestrian right-of-way, and speeding violations. The San Rafael Police Department enhanced their enforcement on Civic Center Drive and has issued more than 300 speeding and pedestrian right-of-way violation citations in past two years.

Early this year, the City's traffic engineering staff proposed a pilot pedestrian safety project to the Office of Traffic Safety entitled, "In Pavement Crosswalk Lighting System On Civic Center Drive At Vera Schultz Drive". In 2003, the Federal Highway Administration and Caltrans accepted the in pavement lighting system as an official traffic control device. Soon after their acceptance and adhering to the specifications, City staff initiated the implementation of this pilot project. A warrant of an in pavement crosswalk lighting system was also analyzed, and it was determined that this location met the warrants that were recently adopted. Because of the experimental nature of this

application and its potential to be an effective traffic control device, monitoring and before/after evaluation of traffic studies were needed.

### **3. INSTALLATION OF THE SYSTEM**

After an initial request for information from different vendors and contractors on all the systems available in the market, City staff carefully reviewed and wrote up a specification for a desired system that would fit the requirements of this unique location. A complete system (wireless or hardwire) was specified and installed, that included the following:

- Sixteen signal head assembly fixtures that will allow customized flashing configuration options.
- Two 12" LED yellow beacons.
- Two pedestrian push button system with audible messaging system.

The project went out for an informal bid. The lowest responsive and responsible bidder that met the requirements of the specifications was awarded the project.

### **4. PROJECT METHODOLOGY AND DATA**

A before and after study was performed at the intersection. A pedestrian step-out study was analyzed both before and after the installation of the system. In addition, a driver perception of the system and pedestrian usage of the system were also recorded. All these studies and data collection were performed on weekdays, between the hours of 9AM and 3PM on dry and clear days. All after studies were performed three months after the installation and operation of the system.

Turning movement counts, pedestrian counts, and average daily traffic data were also collected prior to the beginning of this study. Since this data can not be used for any specific evaluation or for any comparison to the installation of these devices, no discussions or data is being provided in this report.

### **Driver Reaction:**

A pedestrian step-out survey was conducted to measure driver reaction at the study crosswalk in both directions. Driver reaction was measured by using a pedestrian decoy waiting to cross the Civic Center Drive, with the following parameters for both before and after study installation:

- Approaching speed of vehicles at 200 feet advance of the crosswalk.
- Approaching speed of vehicles at 50 feet advance of the crosswalk.
- Driver reaction (*slow, stop or did not stop*) to the pedestrian using the crosswalk.

The before study was conducted in a manner that the decoy would stand on the sidewalk, and as soon as he would see a vehicle approaching in that direction, he would safely step out when a vehicle reached the marked 200 feet location. The other person sitting in the car would then observe the vehicular speed at the 200 feet location and then again at the 50 feet location. Speed and the motorist reaction were then recorded manually. The after study was similar, however, the decoy would activate the lighting system prior to safely stepping out on the crosswalk. All data collected was on randomly scattered vehicles, and the lead vehicle traveling in a platoon. A sample of 90 vehicles was collected for each approach on both occasions. Results of this study are discussed in the next section of this report.

### **Driver Survey:**

After the installation of the devices, San Rafael Police Department Officers assisted the traffic engineering staff to randomly stop pedestrian right-of-way violators who passed through the study crosswalk. A pedestrian decoy would activate the lighting system prior to safely stepping out on the crosswalk. Drivers who failed to stop or observe pedestrian right-of-way were stopped and were asked several questions, which included:

- What is the posted speed limit for approaching the crosswalk?
- Did you notice the crosswalk that you passed in the last block?
- Did you notice any pedestrians in or near that crosswalk?
- Did you notice the advance flashing beacon?
- Did you notice the in pavement crosswalk lights?

- What do the flashing in pavement lights mean to you?
- What was more noticeable, the flashing beacon or the in pavement crosswalk lights?

Results of this study are discussed in the next section of this report.

### **Pedestrian Use Survey:**

After the installation of the devices, an observation of two hours was analyzed to practically see the performance and usage of the system. Since this is a new traffic control device and not everyone is familiar with this device and its operation, a special temporary sign was installed on each corner to educate and inform pedestrians to push and activate the system. A sample data was collected to analyze this usage and the results of this study are discussed in the next section of this report.

## **5. ANALYSIS AND RESULTS**

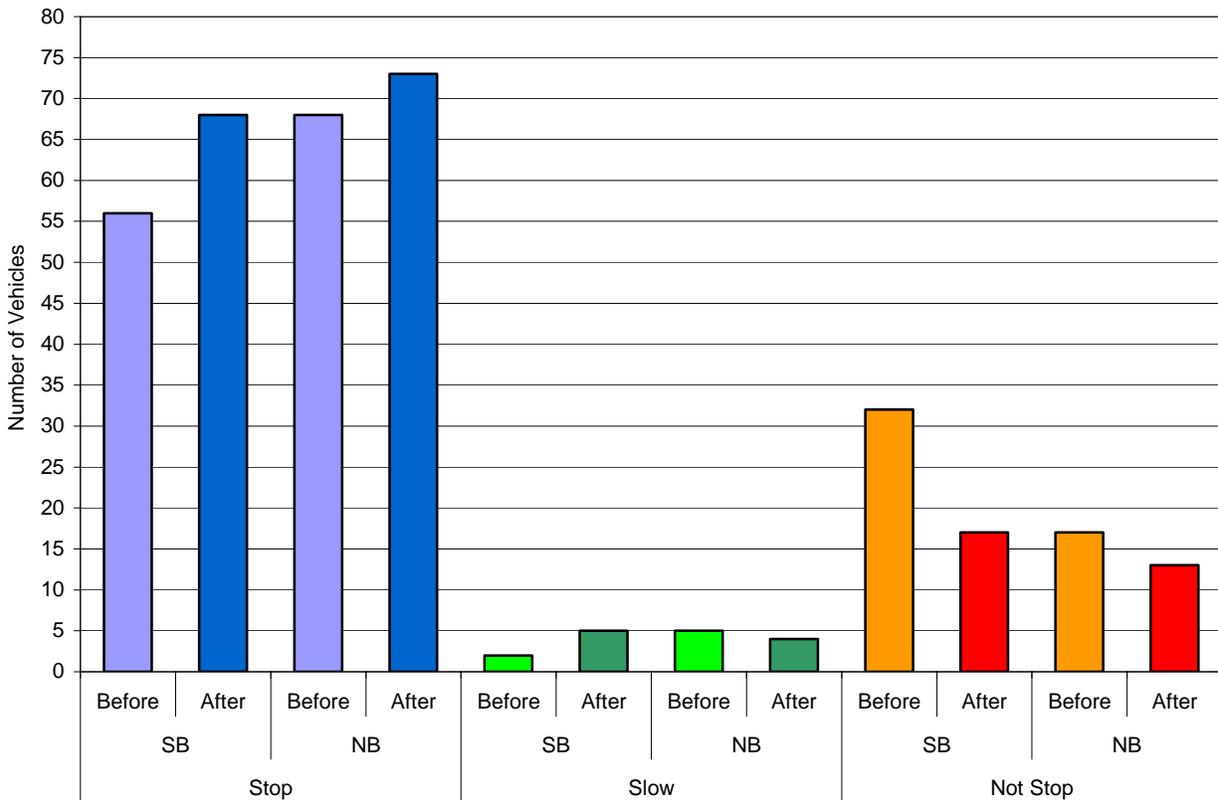
This section presents the results of the before and after studies. It is presented in three sections covering driver reaction, driver survey, and pedestrian use survey.

### **Driver Reaction:**

For southbound direction, motorists stopping for pedestrians increased by approximately 7% with the activation of the system. Similarly, vehicle speed of drivers at 50 feet approach to the crosswalk also decreased slightly. The raw data of the before and after study is attached in *Appendix A*.

*Exhibit 1* (shown on next page) summarizes the data results. For northbound direction, motorists stopping for pedestrians increased by approximately 8% with the activation of the system. Similarly, vehicle speed of drivers at 50 feet approach to the crosswalk also decreased slightly.

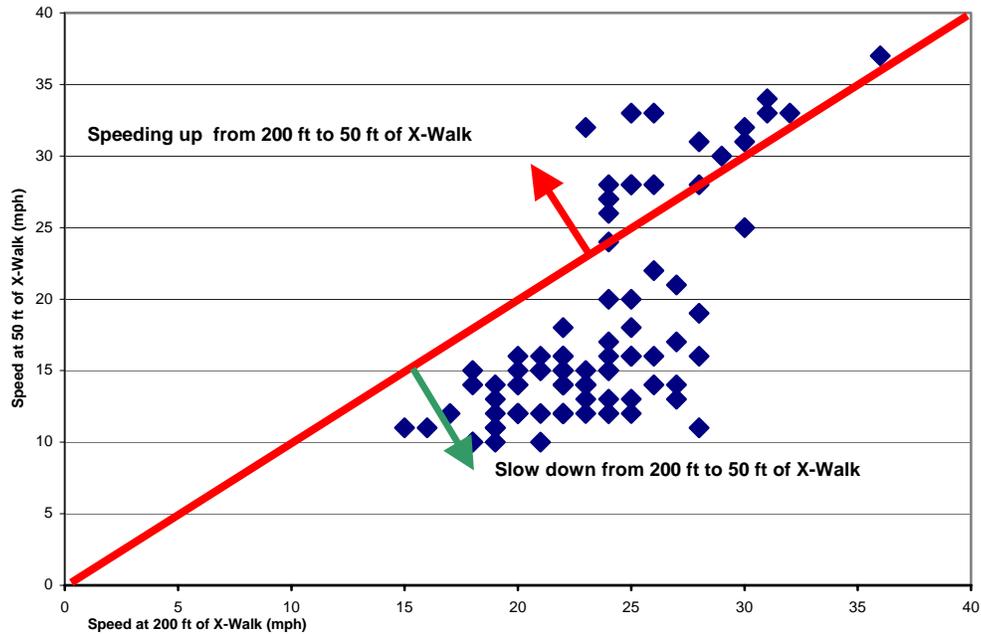
**Exhibit - 1**  
**Driver Reaction Study**



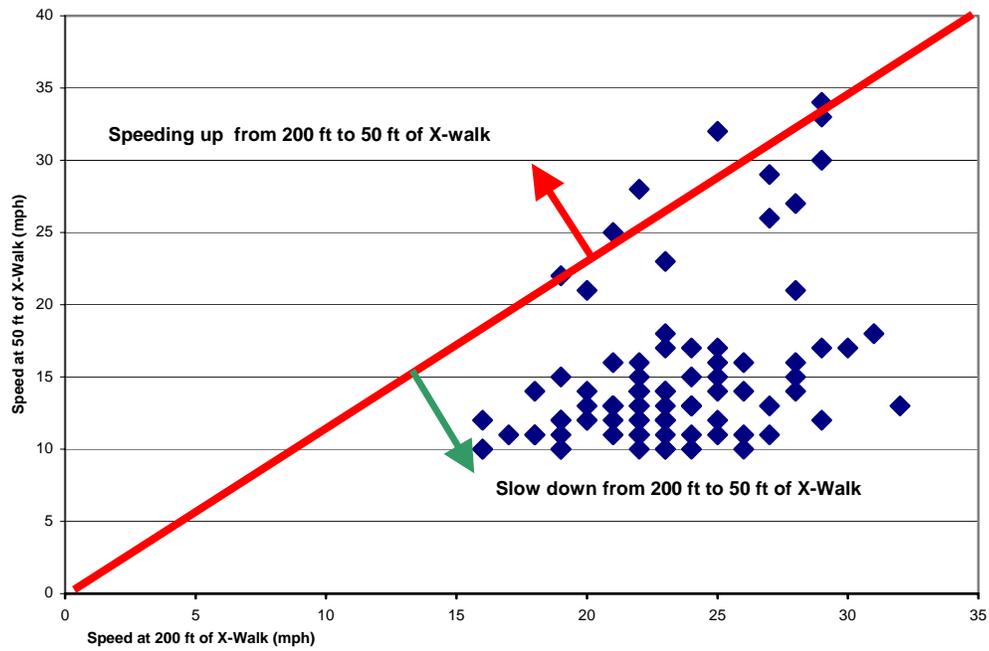
The following exhibits (*Exhibit 2, 3, 4 and 5*) summarizes the speed analysis in relation to driver reaction before and after the system was installed and activated.

All the ninety samples collected for each approach are depicted on these exhibits, which indicates the overall increase of motorists who stopped for the pedestrians when the system was activated. The raw data of the before and after study is attached in *Appendix A*.

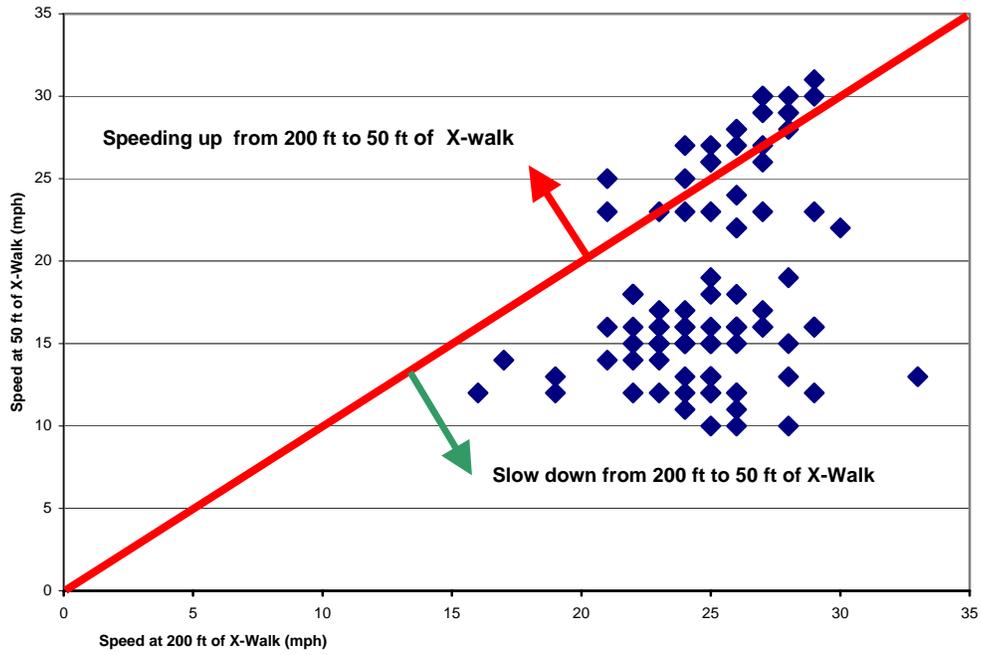
**Exhibit - 2**  
Northbound - Before Study



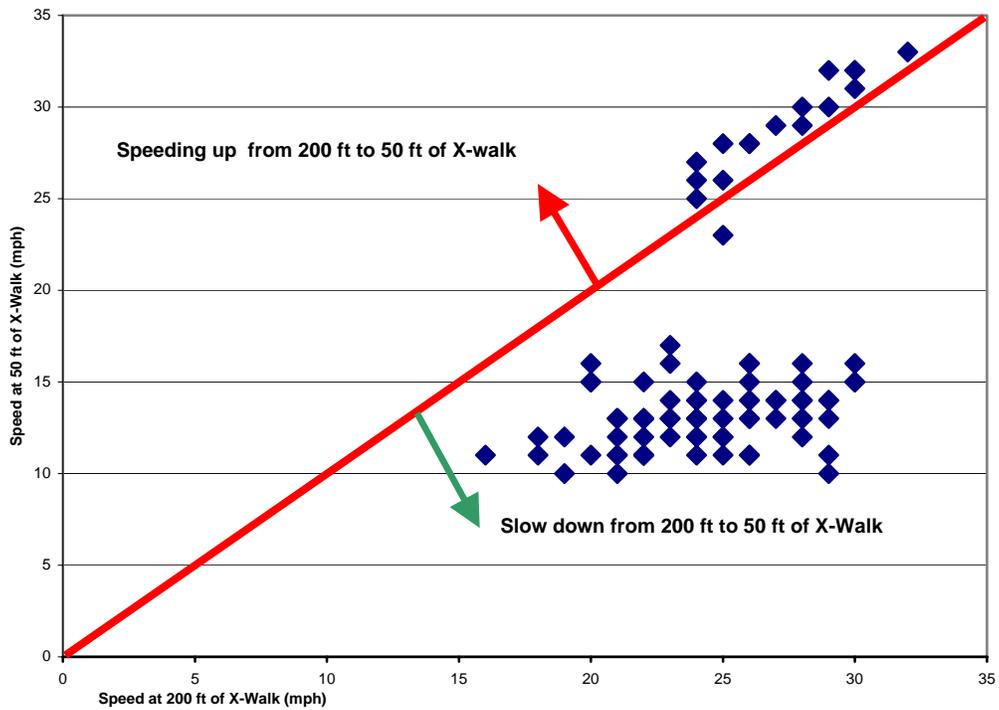
**Exhibit - 3**  
Northbound - After Study



**Exhibit - 4**  
**Southbound - Before Study**



**Exhibit - 5**  
**Southbound - After Study**



### **Driver Survey:**

The San Rafael Police Department Officers interviewed the drivers after the system was installed and operational. For a two-hour window ten violators were stopped that included motorists and bike riders, and it revealed the following results:

- 7 motorists noticed the pedestrians in or near the crosswalk.
- 3 motorists noticed the advanced flashing beacon.
- 8 motorists noticed the in pavement lights operational.
- 4 motorists indicated that flashing in pavement lights mean to slow down.
- By a ratio of 3:1, it was revealed that the in pavement flashing lights were more noticeable than the flashing beacon.

### **Pedestrian Use Survey:**

A study of pedestrian use survey indicated that more than 52% of the pedestrians did not use the pedestrian push button to activate the system. Overall, pedestrians were not receptive to this new device though several pedestrians, during the time of field visits, indicated that this system has a potential to be more effective.

It must be noted that all the studies were conducted only during the daytime hours. No evening or night time studies were conducted due to lack of pedestrian activities during those times.

## **6. CONCLUSIONS**

Based on the before and after study analysis, the in pavement lighting system, in combination with the advance flashing amber beacon, was found to be somewhat effective at alerting motorists of pedestrian presence in the crosswalk. The effect of in pavement lighting system on speeds at the approach to the crosswalk was noticeable. The number of motorists reacting to pedestrians by stopping when the system was active increased by 15% (See *Appendix A*). The system was evaluated under normal sunny and clear weather conditions. Last but not least, the effectiveness of this in pavement crosswalk system should be evaluated over time (once every year), as more

and more motorists become accustomed to these traffic control devices, and as more pedestrians activate the system.

During the time of this study, it was also discovered that there were some maintenance issues with the in pavement crosswalk lighting system. These issues included moisture penetration in the fixtures, minor vandalism, street cleaning operations, and possibly any future maintenance activities. Corrective actions were taken by the City and the manufacturer to address these issues.

Project deadline requirements and staff availability prevented the City from collecting a more comprehensive and detailed data to evaluate in-depth analysis of this system. It is recommended that more and more samples of studies be collected in the future to further assess the installation of these devices, in particular the system installed at the intersection of Civic Center Drive at Vera Schultz Drive.

**Reference**

*Manual on Traffic Control Devices for Streets and Highways, 2003 Edition.*

**Acknowledgment**

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**Disclaimer**

The opinions, findings, and conclusions expressed in this publication are those of the author and the local agency, and not necessarily those of the State of California Business Transportation and Housing Agency, or the National Highway Traffic Safety Administration.

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## **APPENDIX – A**

Raw Data  
Before and After Study