Yellow LED Border on Pedestrian Signal

An Evaluation to Determine the Effectiveness of Adding an Actuated Yellow LED Border to Standard Pedestrian Signals in the City of Redding, CA.

FHWA Experiment: 4(09)-13 (E) Yellow LED Border on Ped Signal – Caltrans

Prepared by:
Robert Stinger, P.E.
California Department of Transportation
District 2 – Traffic Engineering & Operations

Caltrans

October 2014

DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC ENGINEERING & OPERATIONS
1657 RIVERSIDE DRIVE, MS–11
REDDING, CA 96001
PHONE (530) 225-3229
FAX (530) 225-3299
TTY 711
www.dot.ca.gov

Serious drought.
Help save water!

October 29, 2014

Federal Highway Administration
1200 New Jersey Avenue, S.E., HOTO-1
Washington, DC 20590

Final Report: 4(09)-13 (E) Yellow LED Border on Ped Signal – Caltrans

I am pleased to submit the Final Report for the above referenced experiment. Approved by FHWA on December 11, 2011, the experiment was originally given a two-year timeframe for completion. However, due to difficulties and delays in procuring the necessary equipment to carry out the evaluation, a one-year time extension was granted by Bruce Friedman of the MUTCD Team on January 24, 2013.

I appreciate FHWA's approval to perform this experiment. It was a unique opportunity to work on something outside the normal everyday duties of a small district Traffic office. Although it presented many challenges along the way, we were determined to see the experimental process through to the end.

I hope that you find the final report informative and its recommendations worthy of consideration. Feel free to contact me if you have any questions or need more information. I can be reached at (530) 225-3229, or via email at rob.stinger@dot.ca.gov.

Sincerely,

ROB STINGER, P.E.
Chief, Traffic Engineering & Operations
District 2

c: FHWA California Division Office
Johnny Bhullar, Executive Secretary, CTCDC

EXECUTIVE SUMMARY

At most signalized intersections, there is a potential for conflict between pedestrians using a crosswalk and turning traffic. Many times, pedestrians are not noticed by motorists because they are out of their direct line of sight. Low light and/or inclement weather conditions can also contribute to poor pedestrian visibility.

The purpose of this experiment was to determine the effectiveness of adding an actuated yellow LED border to a standard pedestrian signal head. The intent of the modification was to advise vehicular and pedestrian traffic that the signal has received a call to serve a specific crosswalk. To measure its effectiveness, the study examined before and after-treatment video data to determine the percent change in the following areas:

1. Pedestrian-vehicle conflicts
2. Pedestrian crossing violations
3. Repeated pedestrian button pushes

Sixteen prototype pedestrian signal modules were manufactured to conduct the evaluations at five intersections in the City of Redding, CA. Each location was reviewed in the before and after-treatment condition for 5-7 consecutive days, 14-16 hours each day. The Yellow Pedestrian Border (YPB) modules were installed at each location for 24 to 67 days prior to collecting the after-treatment data.

The average results for all five locations show a modest reduction in pedestrian-vehicle conflicts of 17.1%. Considering the limited deployment of the device during the evaluation, the conflict results are likely conservative. Pedestrian violations showed a more significant decrease at 28.4%. Although not counted as accurately as the other categories, the largest reduction was for the repeated button pushes. For the 12 crosswalks studied in this experiment, the number of extra button pushes was reduced by an average of 60.2%. The standard deviations for these results were fairly large due to the range of outcomes between the different locations.

This experiment demonstrated that the yellow LED border is a positive enhancement to a standard pedestrian signal and has no apparent downside. The border does not distract motorists, nor does it adversely affect their driving behavior. It provides supplemental information to vehicular traffic while giving pedestrians reassurance that the signal will provide a WALK indication soon. Lastly, the border is most visible, providing the greatest benefit, to pedestrians and motorists during low light or inclement weather conditions when the potential for conflict is greatest.

It is recommended that the yellow LED border be approved as an optional feature on standard countdown pedestrian signals. Additionally, guidance should be provided so that the device is applied at locations similar to the ones studied in this experiment. The suggested intersection criteria are as follows:

- The traffic signal is located in an urbanized area with regular pedestrian activity
- The pedestrian signals are pushbutton actuated
- The posted speed limit is 40-mph or less
- One or more crosswalks operate concurrently with vehicular traffic

ACKNOWLEDGEMENTS

I would like to extend my sincere appreciation and deepest gratitude for the help and support to the following people and organizations who contributed in making this study possible.

Caltrans, District 2 Management, for their approval and support in pursuing this unique opportunity to promote safety and innovation.

Sue Gale, for her time and effort reviewing the video data for Location 2 (Shasta St. / Pine St.), for her assistance in purchasing the YPB modules, and for reviewing/editing this report.

Teri Anderson, P.E., for her time and effort reviewing the video data for Location 3 (Market St. / Eureka Way), for her help setting up the video recording equipment at Location 1, checking calculations, preparing location maps, and for her input throughout the evaluation process.

Zach Stinger, for his time and effort reviewing the video data for Location 4 (Shasta St. / Market St.) during his winter break from college, and for being a great son.

Ben Paull, for his help setting up the video recording equipment at all five locations, for compiling the video data to be reviewed, and for his starring role in the YPB demonstration video.

Jim Elgin, for his help in setting up the 2070 controller to operate the YPB, for his assistance in developing the prototype module, and for building a portable demo YPB signal/pushbutton.

Bill Gibson, for his assistance in numerous tasks throughout the project, including: setting up the video recording equipment at Locations 3, 4, and 5, building the portable demo YPB signal/ pushbutton, making the YPB demonstration video, and collecting field data for the report.

District 2 Maintenance Electrical Crew, for installing the YPB modules at all five locations, and for their help with the cameras and recording equipment at Location 2 (Shasta St. / Pine St.).

District 2 Public Information Office, for their time and effort promoting this project with the local media and within District 2, for making the laminated information flyers, preparing the online survey, and for posting the YouTube video.

City of Redding Public Works Department, for their support and participation in this experiment, and for allowing the evaluation to include Location 1 (Churn Creek Rd. / Hartnell Ave.).

Kimberly Konte, Leotek Electronics USA Corp., for her essential role in coordinating the development of the YPB prototype modules.

Gerry Gray, Redding Fire Department, for allowing access to the roof and hose tower of Fire Station 5, and for providing power, to set up the video recording equipment for Location 1 (Churn Creek Rd. / Hartnell Ave.).

Nicki Crandall, Members 1st Credit Union, for allowing cameras to be installed on the business sign posts adjacent to their building at the corner of the Shasta St. / Pine St. intersection.

Robbie Clearie, Clearie's Restaurant & Lounge, for allowing access to the roof of the restaurant, and for providing power, to set up the video recording equipment for Location 3 (Eureka Way / Market St.).

George Estrada, Shasta College, for providing access to the roof of the Downtown Health Sciences Building, and for providing power, to set up the video recording equipment for Location 5 (Tehama St. / Market St.).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

--- Background ---

In urban areas, the interaction between vehicles and pedestrians at signalized intersections can be confrontational at times. This typically happens when vehicles make right or permissive left turns at the same time pedestrians are given the indication to walk. In some cases, the motorist will begin their right turn just as the pedestrian is stepping off of the curb into the crosswalk. The surprised motorist normally reacts by either slamming on the brakes or swerving around the pedestrian. On the other side of the encounter, the pedestrian will usually stop mid-step and motion for the vehicle to pass by, or they will wait for an indication from the motorist to continue their walk across the intersection.

These conflicts usually occur when motorists are focusing their attention on the signal indications straight ahead, or when they are looking to the left for approaching traffic to make a right-on-red turn. In many situations, pedestrians are not noticed by vehicle traffic while they are waiting to cross from the near-side corner of the intersection – out of the motorist's direct line of sight. Pedestrian visibility is especially problematic during low light and/or inclement weather conditions.

Back in May 2011, transportation engineers in the California Department of Transportation (Caltrans), were dealing with this specific issue at a traffic signal in Redding, CA. During a brainstorming session on ways to address the problem, it was suggested that the conflict could be reduced if motorists were provided some form of notification that a pedestrian was waiting to use a crosswalk. One idea to accomplish this was to enhance the pedestrian signal indications with a ring of yellow LEDs around its border that would activate when the call button is pushed. The additional lights would serve as a quick visual cue for motorists to watch for pedestrians entering a crosswalk.

Although this equipment is installed for pedestrians and does not control traffic, motorists travelling parallel to a crosswalk can see the indications, just as pedestrians can view the traffic signal heads. The concept does not involve adjusting the existing pedestrian facilities to be more visible for vehicular traffic. Rather, the additional feature is simply "supplemental" information to drivers (and pedestrians) that the WALK symbol is pending.

As the concept was discussed further, a number of ideas were considered to increase the visibility of the yellow border or provide other benefits, such as when the WALK symbol is going to turn on. For example, flashing border lights may be more noticeable to vehicles, or a different color. One idea was to have the individual LEDs turn off sequentially around the border as a type of countdown to when the WALK symbol would come on. Another idea was to have the border be static initially when activated, then change to flashing 10 seconds prior to the WALK symbol. Ultimately, it was decided to stay with a basic modification so that the pedestrian signal does not become a distraction to motorists during initial testing.

In a typical scenario, the pedestrian signal operation would start by only displaying a red upraised hand. Once the pedestrian call button is pushed, the yellow LED border would come on and remain lit until the end of the pedestrian WALK phase. The border lights would turn off

when the WALK symbol switches to the countdown indication. Once the countdown is finished, the signal head would only display the red upraised hand until the call button is pushed again. The yellow border would only be activated on the two pedestrian signal heads for the specific crosswalk the pedestrian wants to use. The yellow borders at the other pedestrian signals remain dark until a call is made for their corresponding crosswalk.

The anticipated benefit of the proposed modification is fewer surprise moments between pedestrians and vehicles, resulting in better yielding behavior. Traffic making a right turn at an intersection will know the WALK symbol is coming and use more caution. Additionally, the visual information provided by the yellow border would provide the same benefit to motorists making permissive left turns that run concurrently with an adjacent crosswalk.

For pedestrians, the yellow border would provide confirmation that the signal received their call and that they do not have to keep pushing the button. This is similar to a feature of the Accessible Pedestrian Signal (APS) systems that are replacing older pushbuttons. An APS system has a small LED indication that illuminates when the button is pressed. Although the small LED provides assurance that the button was adequately pushed, the pedestrian may still have doubts about whether the signal actually received the call. Observing a different part of the signal respond when the button is pushed should mean more to pedestrians than the small LED indication and/or audible tone from the button device itself. It is anticipated that the yellow border will give pedestrians greater confidence that the signal call was successful and that the WALK phase is pending. The end result will be improved service to pedestrians using the facility and reduced wear on the call buttons.

The experimental feature may also address another problem that regularly occurs at many traffic signals – pedestrian compliance. Because pedestrians do not normally receive solid confirmation that the signal is going to serve them after pushing the walk-button, they sometimes become impatient and will look for an opportunity to cross before the WALK indication is displayed. This happens frequently at traffic signals that are part of a coordinated system. A coordination plan attempts to maximize throughput for mainline traffic, but typically incurs delays for side street traffic, and pedestrians waiting to cross, whether there is mainline traffic present or not. When pedestrians have to wait for an extended period, and there is little or no traffic on the mainline street, they begin to think there is something wrong with the signal or that the pushbutton didn't work. Eventually, they decide to forgo the signal and cross against the DON'T WALK (DW) symbol. It is expected that pedestrians viewing the yellow border will have less inclination to cross the intersection when the DW symbol is displayed.

The ultimate goal for this experiment is to determine whether the pedestrian signal enhancement provides an overall benefit to both vehicular traffic and pedestrians. If the additional information provided by the yellow border improves the interaction between vehicles and pedestrians, a corresponding improvement in safety could be realized.

--- Developing the Prototype Yellow Pedestrian Border (YPB) ---

Beginning in January 2012, a number of manufacturers from Caltrans' Pre-Qualified Product List for LED Traffic Signal Modules were contacted to see if they were interested in fabricating

the modified pedestrian signal for the experiment. Most manufacturers declined the opportunity, but after several months of correspondence with the Western Regional Marketing Manager of Leotek Electronics USA Corp., an arrangement was made to work together in developing a prototype YPB.

Leotek Electronics fabricated the first prototype pedestrian signal module by supplementing a standard pedestrian signal module with a ring of yellow LEDs positioned just inside the front edge. The individual LEDs were evenly spaced approximately 2 inches apart. Since no changes were made to the other components of the module, the yellow LEDs were positioned very close to the upraised hand and walking person symbols. This was determined to be acceptable for evaluating the concept because the yellow border does not impact the visibility of these symbols. However, should the YPB feature be approved for large scale production at some point the future, it would be advisable to reposition the upraised hand and walking person symbols within the module to provide more space for the yellow border.

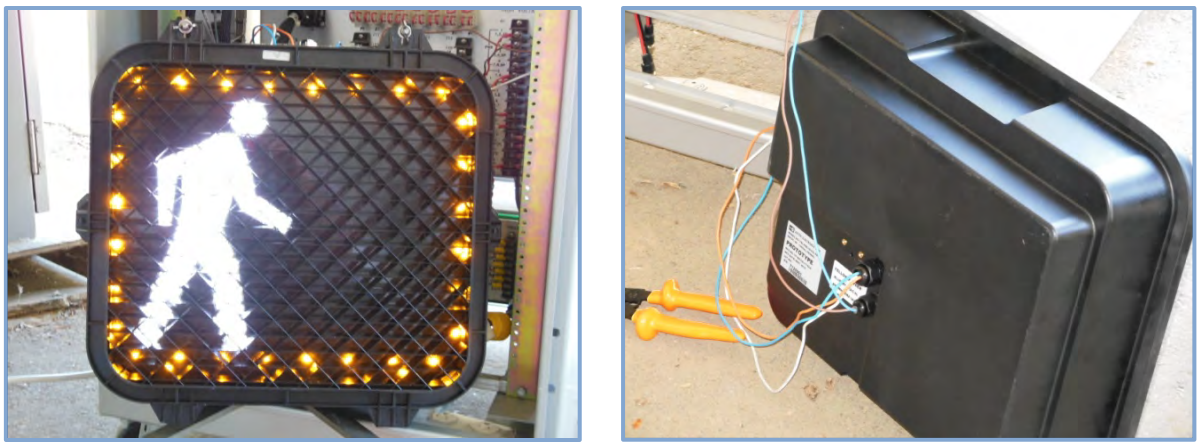


Figure 1 – Original prototype module manufactured by Leotek Electronics USA Corp.

Two conductors were provided for activating the border lights. The wires extend out of the back of the module and can be connected to spare conductors at the signal poles for each location. This allows the YPB to be activated directly by the signal controller during the evaluation period. Ultimately, additional engineering will be required by manufacturers to develop a smart control and regulation mode to operate the YPB system from within the module. This would eliminate the need for the extra connections at the signal poles.

Representatives from Leotek Electronics delivered the first prototype for a demonstration at a Caltrans facility in Sacramento on May 30, 2012. The module was connected to a pre-programmed 2070 traffic signal controller to exhibit how the yellow LED border would function when a pedestrian call is made. The prototype worked flawlessly during the demonstration and it was agreed to move forward with only one minor adjustment – reducing the spacing between the individual yellow LEDs from approximately 2 inches to 1-inch. The reduction in spacing was considered necessary to make the yellow border more visible in bright daylight conditions.

To stay within budget, it was decided that 16 prototype YPBs would be fabricated to carry out the experiment at the five intersections. Assuming four crosswalks per traffic signal, this would allow two intersections to be evaluated at a time. The modules would then be relocated to a new location when the data had been collected.

Figure 2 – Final prototype module with 1-inch LED spacing.

The process required to obtain the 16 prototype modules turned out to be a significant delay to the project. The procurement process began in August 2012 and the first modules finally arrived near the end of March 2013, nearly 8 months later.

The first eight modules were deployed at the Churn Creek Road / Hartnell Avenue intersection on April 23, 2013. All five locations are described in greater detail later in this report, along with their corresponding before and after-treatment results. A discussion of the cumulative results of the experiment is included near the end of the report.

--- Demonstration Video ---

A short video was created to provide a demonstration of this experimental device and identify its anticipated benefits. It can be viewed at the following link:

http://www.youtube.com/watch?v=e63SnWVA_ME&feature=youtu.be

EVALUATION PLAN

---- Experimental Design ----

To evaluate the efficacy of this experimental feature, a before/after analysis was performed at five intersections in the City of Redding, CA. Redding is located on Interstate 5 about 160 miles north of the State Capitol in Sacramento. It is the fourth largest city in the Sacramento Valley with a population of about 90,000 people.

Five locations were chosen that had high volumes of vehicle traffic making right turns through at least one crosswalk at the intersection. The intersections studied were:

- Location 1: Churn Creek Road / Hartnell Avenue
- Location 2: Shasta Street / Pine Street
- Location 3: Eureka Way / Market Street
- Location 4: Shasta Street / Market Street
- Location 5: Tehama Street / Market Street

Four of the traffic signals are operated and maintained by Caltrans, District 2. Only Location 1, Churn Creek Road / Hartnell Avenue, is a City of Redding traffic signal. Further discussion and specifics about each location is provided in the analysis section of this report.

During data collection, each location was observed in the before and after condition using digital video recording equipment. Video data was recorded for seven consecutive days, 24-hours per day. As much as possible, each recording period was completed during fair weather conditions to capture the greatest amount of pedestrian activity. Also, because Location 1 is near two schools, the before/after data was collected while the schools were in session.

Figure 3 – DVR and monitor placed in signal controller cabinet at Location 4.

A learning period for pedestrians and motorists was provided after the YPB modules were installed at each location. The after-treatment data was then collected when road users had an opportunity to observe the YPBs and gain an understanding of their purpose. Due to a number of variables including weather, holidays, end of school, and scheduling the installation of the YPBs, the duration of the learning periods vary considerably between the five locations. A minimum learning period of one month (30 days) was originally planned for all of the locations. However, in order to collect the after-treatment data prior to the end of school at Location 1, the learning period had to be shortened to 24 days.

The evaluation review period was planned to be seven days for all of the locations, between the hours of 6 am to 10 pm (note: Location 3 was reviewed from 6 am to 8 pm). The intent of reviewing 14-16 hours of video data each day was to capture a wide range of conditions at the

intersections. From low light, low volume periods in the early morning and late evening hours, to bright daylight conditions with heavy traffic volumes and pedestrians in the middle of the day.

After Locations 1 and 4 had been reviewed for the full 7-day periods, it became apparent that the considerable amount of time required to go through that much video data was unnecessary. Reducing the review period to the five busiest days of the week would provide sufficient results for the experiment, while reducing the amount of review time by more than 28%. As a result, Locations 2, 3, and 5 were evaluated for 5-day periods.

---- Data Review ----

The before/after video data was reviewed with a primary focus on two of the issues associated with crosswalks at signalized intersections: (1) vehicle-pedestrian conflicts and (2) pedestrian compliance. Although not as accurate due to limitations of the recorded video data, the reviews also monitored a secondary issue: (3) extra call button pushes.

Item 1: Pedestrian-Vehicle Conflicts

As described in the introduction, motorists turning right at a traffic signal are typically given a green indication at the same time pedestrians see the WALK symbol. A conflict is counted when both moves begin together and either the vehicle or the pedestrian (or both) has to stop/pause to determine who is going to proceed first.

Another situation this study counted as a conflict is when a driver initiates a legal right-on-red maneuver just before the signal changes to green and the DW symbol changes to WALK on the pedestrian signal. This was the most common pedestrian-vehicle conflict observed during the study.

Local motorists, familiar with the operation of a traffic signal, tend to drive more aggressively to minimize their delay at the intersection. For example, when the signal operates with a leading left turn, drivers turning right from the opposite direction realize they can begin their turn immediately following the last vehicle turning left. The driver making the right turn during that moment is unaware how much time is remaining before their signal changes to green. On the occasion when the last vehicle turning left enters the intersection during the yellow phase, there is little time remaining for the opposing vehicle to complete a right turn before the signal serves the through-traffic. If no pedestrians are waiting, there is no issue with this type of maneuver. However, given the same scenario with a pedestrian waiting to cross, the vehicle turning right enters the adjacent crosswalk at the same moment the pedestrian is given the indication to WALK.

Considering the conflict potential under these circumstances, a right-on-red turn performed in this manner was counted as a conflict whenever there was a pedestrian waiting to cross on the corner near the turn. To be conservative, this type of right turn was counted as a conflict even if it was completed several seconds before the beginning of the pedestrian phase. This approach was used as a way to determine whether the YPB improves the yielding behavior of drivers. If

effective, there should be a reduction in the number of drivers performing right-on-red turns when the YPB is activated.

As part of the data review, the total number of pedestrians crossing were counted. Also, at all of the locations except Location 2 (Shasta Street and Pine Street), the number of vehicles turning right (or left) were counted whenever pedestrians were within the marked crosswalk. This information was collected for comparing the amount of traffic and pedestrians during the before and after review periods.

Item No. 2: Pedestrian Compliance

Another problem that regularly occurs at traffic signals is when pedestrians become impatient and decide to cross before the WALK symbol is displayed. This can partly be attributed to pedestrians not receiving some type of confirmation that the signal is going to serve them after pushing the call button. Even if the pushbutton has an LED indication and makes an audible tone when the button is pushed, some pedestrians may have doubts as to whether the signal actually received the call and that the WALK phase is coming. The unsatisfactory confirmation, combined with gaps in traffic during low volume periods, can give pedestrians an excuse to cross before being served by the signal.

As part of this experiment, pedestrian compliance was monitored to determine whether the YPB had an effect on pedestrian behavior. At the locations tested for this experiment, all of the buttons were older and did not have any of the features included in newer APS devices.
It is anticipated that pedestrians will notice the yellow border activate across the intersection when they push the button, and have greater confidence that they will be served. The result should be a reduction in the number of pedestrian crossing violations.

Item No. 3: Extra Call Button Pushes

When people have to wait for long periods after initially pushing the call button, many will return to the pole to push the button again. As noted in Item 2, pedestrian confidence that they will be served is questionable when there is little or no verification that the button actually did anything. The fact that people feel they need to return to the pole and push the button again demonstrates the uncertainty they have with the pedestrian signals. Additionally, the repeated button pushes add unnecessary wear to the equipment.

As part of the video data review, the number of times pedestrians returned to push the button was counted. Since the ability to determine whether more than one button push occurred was dependent on the view from the camera, the count results for this item are not as accurate. Some corners of the intersections were too far away or partially obstructed to clearly see if extra button pushes occurred. Since this was a secondary issue for the evaluation, only the obvious repeat button pushes were counted, such as when the pedestrian obviously turns or walks several steps back to the pole to push the button again. The maximum “extra button pushes” per pedestrian

was one. Even if the same person went back to the pole several times, it was counted as a single event.

Another scenario that was counted as an extra button push was when a different pedestrian walked up, after the initial call had been made, and presses the button again. This includes pedestrians pushing the button across the street to use the same crosswalk. The idea being that with the YPB modules, pedestrians would recognize that a call had already been made and nothing would be gained by pushing the button again, even when the only other pedestrian at the intersection is across the street.

--- Pedestrian Survey ----

After the YPB modules were installed and functioning, laminated flyers were placed at each corner of the intersection. The flyers inform pedestrians about the experimental devices and provide website information where they can take a brief survey. The flyer also included a scan code for people with Smartphones to link directly to the Caltrans District 2 webpage (see Appendix B). From the District 2 webpage, users simply click on the icon image from the flyer and rate the following five questions about the device (strongly disagree, disagree, neutral, agree, or strongly agree):

1. *The yellow border lights are noticeable.*

2. *The yellow border lights are effective in confirming the push button worked and that the walk symbol is coming soon.*

3. *The purpose of the yellow border lights is easy to understand.*

4. *Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*

5. *Overall, the yellow border lights are effective and a good addition to pedestrian signal heads.*

Item 6 on the survey was included for people to provide written comments. It said, *"Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights."*

The responses from the survey are summarized later in the report, and complete individual responses are included in Appendix C. The results from the survey are factored into the overall evaluation of the YPB device.

LOCATION 1 – CHURN CREEK ROAD / HARTNELL AVENUE

TABLE 1: LOCATION 1 SUMMARY

	ADT	No. Lanes				No. X-walks		Crosswalk length	Speed Limit	Learning Period
		N	S	E	W	Total	Studied			
Churn Creek Rd.	22,200	5	5			2	2	86’	35-mph	24 days
Hartnell Ave.	17,300			6	7	2	2	102’	35-mph	

The first location studied was the intersection of Churn Creek Road and Hartnell Avenue. The traffic signal at this intersection is operated and maintained by the City of Redding. This location was considered an ideal intersection to evaluate the YPB device because it has four crosswalks, heavy traffic volumes, and a large amount of pedestrian traffic. Also, there are two nearby schools that have a significant impact on the traffic signal: a middle school approximately 1,000 ft. to the west on Hartnell Avenue, and a high school about 2,000 ft. to the south on Churn Creek Road. (See Appendix A, page 38)

A camera and DVR were placed on the roof of Redding Fire Station 5 near the southwest corner of the intersection. The placement of the camera offered a full view of all four crosswalks. However, due to the distance and location of the pushbuttons, observing repeated button pushes was very limited in the northeast and southeast corners of the intersection. Therefore, the results for repeated button pushes were primarily observed from the other two corners of the intersection.

Figure 4 – Camera placement on Redding Fire Station 5.

The before-treatment video data was collected for seven consecutive days, from March 12 - 19, 2013. On April 23, two YPB modules were installed for each of the four crosswalks of the intersection. Laminated flyers with information about the online survey were also posted at each corner of the intersection on the same day.

The learning/adaptation period is a vital part of the experiment to allow motorists and pedestrians an opportunity to notice the device and understand its purpose. It was originally intended to have the YPB modules installed and operational for at least one month before to collecting the after-treatment video data. Unfortunately, the schedule had to be advanced by one week to collect data while school was still in session and the influence of Memorial Day weekend could be avoided. Therefore, the after treatment data was collected with only a 24 day learning period, from May 16 - 22.

The YPB modules were removed from this intersection on May 31 to move the study to the next location. The original flyers posted at each corner of the intersection were replaced with a

different flyer as a notification that the experiment was complete and the devices had been removed (see Appendix B, page 45). The second flyer also included the website information in case there were pedestrians who wanted to participate in the survey.

TABLE 2: CHURN CREEK/HARTNELL - RESULTS

BEFORE	S	M	T	W	Th	F	S	7-Day Total
Pedestrians	685	883	894	886	853	958	703	5862
Rt. Turns	394	824	870	812	834	936	543	5213
Conflicts	36	70	70	50	74	49	46	395
Violations	32	20	33	36	38	37	25	221
Extra Pushes	54	57	95	101	75	75	52	509

Note: Review period was 16 hours per day (6am – 10pm)

AFTER	S	M	T	W	Th	F	S	7-Day Total
Pedestrians	385	835	813	800	801	986	677	5297
Rt. Turns	211	712	782	906	676	793	422	4502
Conflicts	14	56	53	61	67	56	30	337
Violations	10	11	16	14	19	29	24	123
Extra Pushes	4	7	19	10	26	17	11	94

Note: Review period was 16 hours per day (6am – 10pm)

Each 7-day period represent 112 hours of intersection activity for the four crosswalks. It was noticed that the intersection legs with right turn channelization (i.e. westbound and eastbound Hartnell Ave.) had the largest number of pedestrian-vehicle conflicts. Traffic travelling northbound or southbound on Churn Creek Rd. do not have a separate lane for right turns. Those vehicles perform a right turn from the lane adjacent to the curb, which is also used by traffic continuing straight through the intersection.

Many times, the first vehicle waiting at the limit line on Churn Creek Rd. is going straight and blocks the ability for a trailing vehicle to turn right until the signal changes to green. This situation precludes the right-on-red type conflict described earlier in the report. Similar to a Leading Pedestrian Interval (LPI), pedestrians starting from the near side of the intersection are usually well into the crosswalk by the time the trailing vehicle turning right gets to the limit line. Since the pedestrians are in full view and have established the right-of-way, the vehicle must yield until the right turn path is clear.

Data Breakdown

In the before condition, 395 conflicts were observed for 5,862 pedestrians. Applying this ratio to the number of pedestrians counted during the after-treatment period (5,297), the expected number of conflicts would be 357. The actual number of conflicts recorded with the YPB modules was 337, or 5.6% less than expected. Comparing against the number of vehicles turning right, the actual number of conflicts were only 1.2% less than expected. Averaging the conflict results for the two factors yields an overall reduction of 3.4%.

The number of pedestrian violations showed a greater reduction in the after-treatment condition. Before the YPB modules were installed, the study observed 221 violations for the 5,862 pedestrians that used the four crosswalks. During the after-treatment review, 123 violations were counted for 5,297 pedestrians, which is 38.5% lower than the expected number of 200.

The number of extra button pushes decreased dramatically with the YPB modules installed, from 509 to 94. Accounting for the changes in the number of pedestrians counted during the two periods, the extra button pushes were 79.6% less than expected.

TABLE 3: BEFORE/AFTER COMPARISON

LOCATION 1	Conflicts / Pedestrians	Conflicts / Right Turns	Pedestrian Violations	Extra Button Pushes
% Change	-5.6	-1.2	-38.5	-79.6

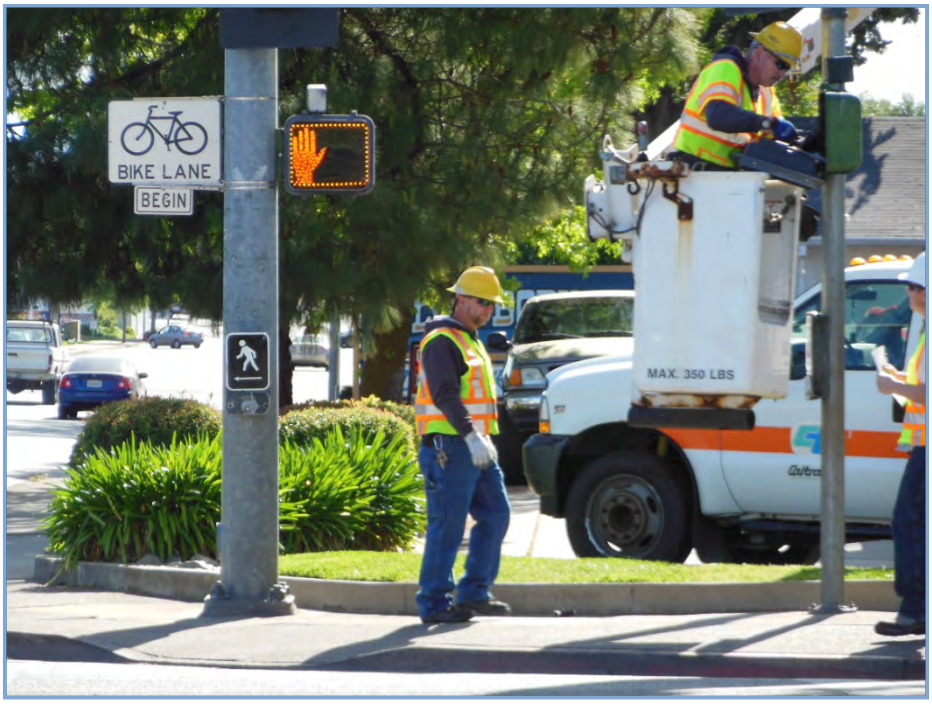


Figure 5 – Caltrans Maintenance Electrical Employees installing the YPB modules at Location 1.

LOCATION 2 – SHASTA STREET / PINE STREET

TABLE 4: LOCATION 2 SUMMARY

	ADT	No. Lanes				No. X-walks		Crosswalk length*	Speed Limit	Learning Period
		N	S	E	W	Total	Studied			
Shasta St.	15,800			4	3	2	1	65’	30-mph	67 days
Pine St.	15,500	3	3			2	1	58’	30-mph	

**Lengths shown are for the crosswalks studied.*

This intersection is located at the westbound entrance into downtown Redding. About two blocks to the east, the two westbound lanes of the State Route (SR) 44 freeway transition into four lanes of a one-way city street (Shasta Street). The westbound freeway segment of SR-44 connects the eastern part of Redding, and traffic from Interstate 5, to the downtown area and destinations further west on SR-299. During regular weekday morning hours, the inbound traffic volumes are heavy with commuters either continuing west through the intersection on Shasta Street, or turning north onto Pine Street.

This location is the intersection of two one-way streets: westbound traffic on Shasta Street and northbound traffic on Pine Street. Shasta Street is unique in that it is a State highway on the east side of the intersection (approaching), and a city street on the west side (departing). Pine Street is the northbound segment of SR-273 within the downtown one-way couplet. The street widths are consistent through the intersection, with three lanes and parallel parking on both sides. The only exception is the westbound approach of Shasta Street, where the parking was eliminated along the north side of the street to make room for an additional right turn lane. (See Appendix A, page 39)

The primary reason this intersection was selected was to observe the interaction between pedestrians crossing the northern crosswalk on Pine Street and the heavy amount of traffic making right turns from two of the westbound lanes on Shasta Street. Pedestrians from nearby businesses and motels typically use the northern Pine Street crosswalk to access the coffee shop and the gas station mini-mart located on that side of the street just east of the intersection. The stream of vehicular traffic coming into the downtown area is fairly constant through most of the day. Motorists turning right are reluctant to stop at the intersection when the signals are green and tend to be impatient with pedestrians using the crosswalk. Given these circumstances, this crosswalk was considered to be a good test of the effectiveness of the YPB device.

The second crosswalk studied at this intersection is the north-south crosswalk on the west leg of Shasta Street. This crosswalk is served when the signals change to green for northbound traffic on Pine Street. Thus, when a northbound vehicle wants to left turn onto Shasta Street, there is a potential for conflict with pedestrians using the crosswalk.

Two cameras were placed at the northwest corner of the intersection to collect video data for the two crosswalks. The cameras were mounted on a sign post for the credit union building located at the corner of the intersection. The power source and storage for the DVR was provided by the

signal controller cabinet located in the same corner of the intersection. The cameras provided excellent visibility of the two crosswalks and most of the pushbuttons. The only exception was the view of the pushbutton in the northwest corner of the intersection that is used by pedestrians heading south across Shasta Street. This part of the intersection was too close to the camera facing to the south to be included in the view.

Figure 6 – Cameras placed on business sign post.

The number of right and left turns made while pedestrians were using the two crosswalks was not counted for this location. The height and orientation of the camera facing the Pine Street crosswalk made it difficult to clearly see when the pedestrian(s) had entered/exited the limits of the crosswalk. This, combined with the significant volume of traffic using the dual right turns, made it impractical to tally the information. Since the right turns were not going to be counted for Pine Street, the left turns at the Shasta Street crosswalk were not counted either.

It was determined that a five-day evaluation period would be sufficient for this intersection. The days reviewed were Friday through Tuesday. In the before-treatment condition, those days were May 3 - 7, 2013. The YPB modules were installed on June 3, 2013. They were in use for 67 days before the after-treatment data was collected August 9 - 13, 2013.

TABLE 5: SHASTA/PINE - RESULTS

BEFORE	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	164	183	167	-	-	240	117	871
Rt./Lt. Turns	-	-	-	-	-	-	-	-
Conflicts	5	5	3	-	-	16	1	30
Violations	40	51	44	-	-	45	25	205
Extra Pushes	2	2	8	-	-	62	4	78

Note: Review period was 16 hours per day (6am – 10pm)

AFTER	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	81	114	153	-	-	193	144	685
Rt./Lt. Turns	-	-	-	-	-	-	-	-
Conflicts	2	5	18	-	-	0	0	25
Violations	8	11	29	-	-	25	14	87
Extra Pushes	2	3	1	-	-	0	1	7

Note: Review period was 16 hours per day (6am – 10pm)

The total number of hours reviewed for each five day period was 80. In studying the results, the percentage of pedestrians using the north-south crosswalk on Shasta Street was slightly more than the east-west crosswalk on Pine Street (59% in the before condition; 54% in the after condition). However, the percentage of conflicts was significantly higher for the pedestrians crossing Pine Street. During the before condition, the east-west crosswalk accounted for 87% of the total number of conflicts, and 88% of the conflicts in the after condition. Considering the volume and behavior of inbound traffic on Shasta Street using the dual right turn, these results were not surprising.

Data Breakdown

In the before-treatment condition, 30 conflicts were counted for 871 pedestrians using the two crosswalks. Applying this ratio to the number of pedestrians counted during the after-treatment period (685), the expected number of conflicts would be about 24. The actual number of conflicts with the YPB modules was slightly higher at 25, or 4.2% higher than expected. The number of conflicts was not compared to the turning volume since that data was not collected at this location.

In reviewing the overall conflict results, it appears that the YPB signals had little effect on driver behavior. The aggressive characteristics of the motorists using the dual right turns during peak hours did not change. Since that move accounted for the majority of the conflicts, it had the greatest effect on the final results.

One positive result worth noting was the number of conflicts that occurred between 5 pm and 7 pm in the evening. In the before-treatment condition, 10 conflicts were observed in the Pine Street crosswalk for 65 pedestrians that crossed during those hours over the 5-day period. Only 2 conflicts were observed when 31 pedestrians crossed during those same hours with the YPB modules installed. This is about 60% less than expected.

There are a couple of factors that could explain the reduction in conflicts during those hours of the day. First, the volume of westbound traffic coming into the downtown area decreases in the late afternoon. The lower volume of traffic tends to reduce the aggressiveness of drivers and their unwillingness to wait for pedestrians.

The second factor is the visibility of the intersection and the pedestrian signal indications. In the late afternoon hours, the position of the sun is low and shines into the windshields of westbound motorists approaching the intersection. The lower sun position also means much of the intersection is in shade from the nearby buildings and trees along the west side of the street. The pedestrian signal indications are more noticeable in the shade or low light conditions, suggesting that the yellow border treatment may have had some influence on driver behavior.

The number of pedestrian violations decreased considerably in the after-treatment condition. Before the modules were installed, the study observed 205 violations for the 871 pedestrians that

used the two crosswalks. During the after-treatment period, 87 violations were counted for 685 pedestrians, which is 46.0% lower than the expected number of 161.

The number of extra button pushes went down significantly when the YPB modules were installed, from 78 to 7. Accounting for the changes in the number of pedestrians counted during the two periods, the extra button pushes were 88.5% less than expected.

TABLE 6: BEFORE/AFTER COMPARISON

LOCATION 2	Conflicts / Pedestrians	Conflicts / Lt.-Rt. Turns	Pedestrian Violations	Extra Button Pushes
% Change	+4.2	N/A	-46.0	-88.5

Figure 7 – YPB signal in the southeast corner of Location 2, looking east.

LOCATION 3 – EUREKA WAY / MARKET STREET

TABLE 7: LOCATION 3 SUMMARY

	ADT	No. Lanes				No. X-walks		Crosswalk length*	Speed Limit	Learning Period
		N	S	E	W	Total	Studied			
Eureka Way	20,000			5	5	2	1	75’	30-mph	41 days
Market Street	18,500	5	3			1	1	98’	30-mph	

**Lengths shown are for the crosswalks studied.*

This intersection is located at the most northern end of the one-way couplet in downtown Redding. It was selected because of the high volume of traffic making right turns across two of the three crosswalks. There is also a fair amount of pedestrian activity at this intersection. Several fast food restaurants, coffee shops, and a number of motels in the area produce a consistent amount of pedestrian traffic throughout the day.

This intersection is the junction of three State routes: SR-44, SR-273, and SR-299. In addition to a significant amount of local commute traffic, the intersection also serves non-local traffic travelling between Interstate 5 and the coast on SR-299. The south leg of the intersection is the beginning of the southbound direction of the one-way couplet. It has three lanes with room for parallel parking, which begins about 120 ft. south of the intersection. The east leg is essentially the end of the northbound side of the one-way couplet. It has five lanes: a left, two through lanes, and dual right turns. The north leg is a two-way street with five lanes: two lanes northbound, two lanes southbound, and a southbound right turn lane. The west leg has three lanes in the eastbound direction consisting of dual right turns and a single left turn. The west leg also has two westbound lanes. (See Appendix A, page 40)

The two crosswalks that were studied were on the west and south legs of the intersection. The north-south crosswalk on Eureka Way serves pedestrians when southbound Market Street traffic has a green indication. The east-west crosswalk on the south leg of the intersection allows pedestrians to cross while westbound Eureka Way traffic is being served. At this crosswalk, rather than a conflicting right turn, the conflicting move is a permissive left turn that operates concurrently with the pedestrian phase. An additional element with this crosswalk is the dual right turns for approaching eastbound traffic on Eureka Way. It is common to witness aggressive drivers making right-on-red turns around pedestrians that are legally using the south crosswalk.

The north-south crosswalk on the east leg of the intersection was not studied because there are no turn conflicts with traffic while pedestrians are being served.

For this location, the best placement for the camera equipment was on the roof of a restaurant near the southeast corner of the intersection. The rooftop location was secure and had a power outlet for operating the equipment. The view from the camera was adequate to observe pedestrians using the two crosswalks to be evaluated. Unfortunately, the signal controller cabinet blocked much of the view in the southeast corner of the intersection, so it was not possible to observe repeated button pushes. Similarly, the large sign structure for the restaurant (near the

signal controller cabinet) blocked the view of the pedestrian pushbutton in the northwest corner of the intersection. The southwest corner (where the two crosswalks meet) provided the best view of pedestrians waiting to be served by the signal.

Video data was collected for the before-treatment condition from June 21 - 28, 2013. The YPB modules were installed on August 1, 2013. They were in use for 41 days before the after-treatment data was recorded. The after-treatment video was recorded from September 11 - 17, 2013.

Based on preliminary reviews of the video data, it was decided to perform a five-day evaluation of this intersection (Monday through Friday). Also, because pedestrian activity dropped off significantly in the evening hours, the daily review period was shortened by 2 hours (6 am – 8 pm).

TABLE 8: EUREKA/MARKET - RESULTS

BEFORE	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	265	204	332	323	320	-	1444
Rt./Lt. Turns	-	270	172	254	236	267	-	1199
Conflicts	-	33	16	17	7	12	-	85
Violations	-	9	18	38	22	24	-	111
Extra Pushes	-	5	0	6	13	6	-	30

Note: Review period was 14 hours per day (6am – 8pm)

AFTER	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	326	302	349	359	343	-	1679
Rt./Lt. Turns	-	246	239	226	261	235	-	1207
Conflicts	-	9	6	15	20	6	-	56
Violations	-	9	10	7	24	12	-	62
Extra Pushes	-	0	1	1	2	0	-	4

Note: Review period was 14 hours per day (6am – 8pm)

The total number of hours reviewed for each five-day period was 70. According to the data collected, over 70% of the pedestrians at this intersection use the north-south crosswalk on the west leg versus the east-west crosswalk on Market Street. This is primarily due to the fast food restaurants and coffee shops along that stretch of Market Street. Also, the length of the crosswalk (98 ft.) and the volume of traffic turning south may motivate some pedestrians to cross Market Street at a different location.

The dual right turns from Eureka Way to the three southbound lanes on Market Street were a significant factor regarding the vehicle conflicts with pedestrians using the south crosswalk. The

single westbound left turn from Eureka Way is a low volume move, which results in a large number of right-on-red turns from the eastbound side while the traffic signal is green for the westbound direction. This is the same phase when the pedestrians are permitted to cross. Drivers performing a right-on-red turn at this location are typically less patient with pedestrians because the crosswalk is so long and they don't want to lose their opportunity before the signal serves southbound Market Street traffic.

Data Breakdown

In the before condition, 85 conflicts were observed for 1,444 pedestrians. Applying this ratio to the number of pedestrians counted during the after-treatment period (1,679), the expected number of conflicts would be 99. The actual number of conflicts recorded with the YPB modules was 56, or 43.4% less than expected. Comparing against the number of vehicles turning across the two crosswalks, the actual number of conflicts were 34.9% less than expected. Averaging the conflict results for the two factors yields an overall reduction of 39.1%.

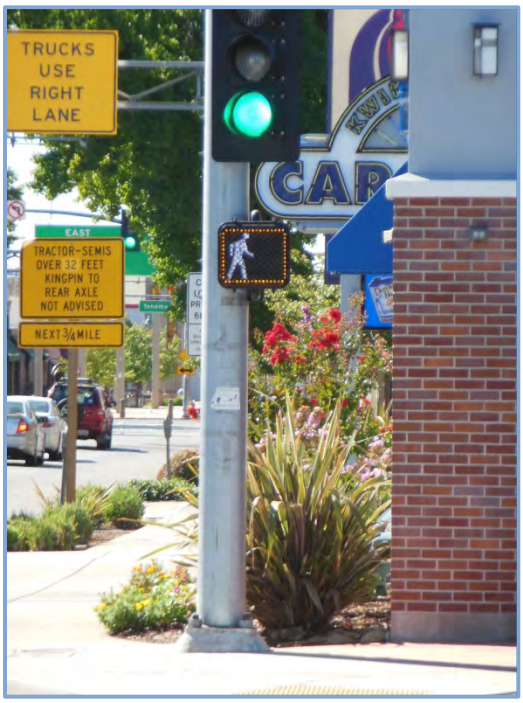


Figure 8 – YPB signal in the southwest corner of Location 3, facing south.

The number of pedestrian violations also decreased in the after-treatment condition. Before the modules were installed, the study observed 111 violations for the 1,444 pedestrians using the two crosswalks. During the after-treatment review, 62 violations were counted for 1,679 pedestrians, which is 51.9% lower than the expected number of 129.

As with the first two locations, the number of extra button pushes decreased greatly after the YPBs were installed, from 30 to 4. Accounting for the changes in the number of pedestrians counted during the two periods, the extra button pushes were 88.6% less than expected.

TABLE 9: BEFORE/AFTER COMPARISON

LOCATION 3	Conflicts / Pedestrians	Conflicts / Lt.-Rt. Turns	Pedestrian Violations	Extra Button Pushes
% Change	-43.4	-34.9	-51.9	-88.6

LOCATION 4 – SHASTA STREET / MARKET STREET

TABLE 10: LOCATION 4 SUMMARY

	ADT	No. Lanes				No. X-walks		Crosswalk length*	Speed Limit	Learning Period
		N	S	E	W	Total	Studied			
Shasta Street	11,800			3	3	2	1	50’	25-mph	46 days
Market Street	16,900	3	3			2	1	42’	30-mph	

**Lengths shown are for the crosswalks studied.*

This intersection is located in the one-way couplet area of downtown Redding, one block south of Location 3. It was selected because of the many businesses along Market Street and the limited amount of on-street parking, which together create a significant amount of pedestrian activity. In particular, a popular family restaurant located in the southwest corner of the intersection generates considerable pedestrian traffic in the evening hours.

In this area, Market Street is a combined State route for highways 44 and 273. The one-way street has three southbound lanes and parallel parking on both sides. On the south side of the intersection, sidewalk bulb-outs reduce the crossing distance by 16 ft. compared to the north side.

The east leg of Shasta Street is a one-way facility for westbound traffic approaching the intersection. It has three lanes and limited parallel parking. The left westbound lane can only turn south (left) on Market Street, while the center and right lanes continue west through the intersection. A fire station is located about 100 ft. to the east of the intersection and occasionally pre-empts the traffic signal when responding to emergency calls.

On the west leg of the intersection, Shasta Street is a two-way facility consisting of two westbound lanes, a single eastbound lane, and parallel parking on both sides. The single eastbound lane can only turn right at the intersection to head south on Market Street. (See Appendix A, page 41)

Only two of the four crosswalks were studied at this location. The crosswalks on the west and south legs were evaluated because pedestrians are permitted to cross when turning traffic is given a green indication. The west crosswalk is served while southbound Market Street is green, and the south crosswalk allows pedestrians to cross when westbound Shasta Street is being served. For Shasta Street, however, the conflicting move is a permissive left turn rather than the more common right turn conflict. The one-way streets at this intersection eliminate any possibility of turning conflicts between vehicles and pedestrians at the other two crosswalks.

To record the before and after-treatment video for this location, a camera was placed on a light pole for a parking lot just north of the intersection, on the west side of Market Street. The power source and storage for the video equipment was provided by the signal controller cabinet located in the northwest corner.

The camera location provided good visibility of the two crosswalks to be evaluated, as well as the pedestrian signal indication facing north. Observing pedestrians in the southeast corner of the intersection was difficult, especially during hours of darkness. The two other corners were clearly visible for observing whether extra button pushes were made.

The before-treatment video data was collected for seven consecutive days, from November 14 - 21, 2013. The YPB modules were installed on November 22, along with the laminated flyers for the online survey. The modules were in place at this location through the holiday season to give motorists and pedestrians ample time to become familiar with their function. After 46 days in operation, the after-treatment video was recorded from January 7 - 13, 2014.

TABLE 11: SHASTA/MARKET - RESULTS

BEFORE	S	M	T	W	Th	F	S	7-Day Total
Pedestrians	341	437	359	471	491	652	753	3504
Rt./Lt. Turns	42	54	48	48	68	84	68	412
Conflicts	2	3	2	2	7	6	5	27
Violations	21	21	21	22	11	12	22	130
Extra Pushes	5	8	8	6	6	21	14	68

Note: Review period was 16 hours per day (6am – 10pm)

AFTER	S	M	T	W	Th	F	S	7-Day Total
Pedestrians	345	509	566	562	556	772	513	3823
Rt./Lt. Turns	62	65	76	65	67	82	77	494
Conflicts	2	8	9	3	1	1	3	27
Violations	17	21	34	35	33	23	36	199
Extra Pushes	7	10	10	5	2	0	5	39

Note: Review period was 16 hours per day (6am – 10pm)

Of the two crosswalks studied at this intersection, about three quarters of the pedestrians use the north-south crosswalk on the west leg. This is primarily due to the variety of restaurants and shops along the west side of Market Street that attract pedestrians. Also, during the evening hours, the on-street parking west of the intersection (Shasta Street) is convenient for people going to the popular restaurant located at the southwest corner.

Although the east-west crosswalk on the south leg had only about a quarter of the pedestrians in the before condition, it accounted for 84% of the crossing violations, and about 44% of the vehicle-pedestrian conflicts. This is probably due to a combination of the bulb-outs that shorten the length of the crossing and the large number of turns through the crosswalk onto southbound Market Street.

Data Breakdown

In the before-treatment condition, 27 conflicts were counted for 3,504 pedestrians. Applying this ratio to the number of pedestrians counted during the after-treatment period (3,823), the expected number of conflicts would be 29. The actual number of conflicts recorded with the YPB modules was the same as the before-treatment condition (27), or 6.9% less than expected. Comparing against the number of vehicles turning across the two crosswalks, the actual number of conflicts were 15.6% less than expected. Averaging the conflict results for the two factors yields an overall reduction of 11.2%.

At this location, the number of pedestrian violations increased in the after-treatment condition. Before the YPB modules were installed, the study observed 130 violations for the 3,504 pedestrians. During the after-treatment review, 199 violations were counted for 3,823 pedestrians, which is 40.1% higher than the expected number of 142.

A closer look at the data shows a significant shift where the crossing violations occurred in the intersection after the YPB modules were installed. As noted earlier, the south crosswalk accounted for 84% of the total violations before the YPB modules were installed. In the after-treatment condition, the south crosswalk dropped to 55% of the total violations. Thus, the crossing violations increased at the west crosswalk from 16% before the YPB modules were installed, to 45% in the after-treatment condition.

It is uncertain why the total number of crossing violations increased in the after-treatment condition, specifically at the west crosswalk on Shasta Street. One possibility could be the difference in low temperatures between the before and after review periods combined with the shorter crosswalk length. The average low temperatures were colder during the after-treatment review period (42.1° F before vs. 35.8° F after). People are typically less patient at shorter crosswalks and more likely to cross a on their own when they are uncomfortable due to the cold.

As a check, the violation rates at the west crosswalk were compared after sunset between 6 pm and 10 pm. The results show there was a higher rate of violations during the colder evening hours in the after-treatment condition (0.6% before vs. 3.0% after). Considering that almost 77% of the pedestrians counted in the after-treatment condition used the west crosswalk during these hours, the increased violation rate did have a notable impact on the final results.

The number of extra button pushes showed a moderate reduction for this location with the YPB equipment installed. In the before condition, there were 68 extra button pushes for 3,504 pedestrians. This equates to 74 extra button pushes expected for the 3,823 pedestrians counted in the after-treatment condition. The actual after-treatment number was 39, which is 47.3% less than expected.

TABLE 12: BEFORE/AFTER COMPARISON TABLE

LOCATION 4	Conflicts / Pedestrians	Conflicts / Lt.-Rt. Turns	Pedestrian Violations	Extra Button Pushes
% Change	-6.9	-15.6	+40.1	-47.3

Figure 9 – Looking at the southwest corner of Location 4.

LOCATION 5 – TEHAMA STREET / MARKET STREET

TABLE 13: LOCATION 5 SUMMARY

	ADT	No. Lanes				No. X-walks		Crosswalk length	Speed Limit	Learning Period
		N	S	E	W	Total	Studied			
Tehama Street	8,500			3	3	1	1	58’	30-mph	55 days
Market Street	16,900	3				1	1*	61’	30-mph	

**Pedestrian crossing violations and repeated button pushes only*

The intersection of Tehama and Market Streets is located in the one-way couplet area of downtown Redding, just one block south of Location 4. Market Street ends at this intersection, with traffic either turning right to head west over to the southbound part of the one-way couplet (SR-273), or left to travel east out of the downtown area to the freeway entrance of SR-44. This “T” intersection also acts as the northern boundary of the Market Street Promenade, which is a 12-acre block of retail, professional, and service businesses. The Promenade also serves as a local gathering place for special events such as the Redding Beer and Wine Festival.

Location 5 is surrounded by businesses and on-street parking. A public parking structure is located about half a block to the west. Another significant feature is the large building in the southwest corner of the intersection, which houses the Health Services Division of Shasta College. The combination of all of these elements provides an intersection with significant pedestrian-vehicle interaction.

At this location, the combined State routes on Market Street split at Tehama Street: SR-44 heads east from the intersection, and SR-273 heads west. To accommodate the high volume of traffic leaving the downtown area during the late afternoon commute, Market Street has a triple left turn at the intersection. The outside lane also serves right turns for the smaller volume of traffic heading west.

Tehama Street is a one-way street with three eastbound (departing) lanes on the east side of the intersection, and a two-way street on the west side (two lanes westbound, one lane eastbound). There are two crosswalks at the intersection, an east-west crosswalk on the Market Street leg, and a north-south crosswalk on the west leg of Tehama Street. (See Appendix A, page 42)

The primary crosswalk studied at this intersection is the north-south crosswalk on Tehama Street (referred to as “Tehama X-Walk”). Due to the “T” configuration of the intersection and the one-way streets, it is the only crosswalk of the two with the potential for the type of conflicts between pedestrians and vehicles this study is evaluating. The east-west crosswalk on Market Street (referred to as “Market X-Walk”) was also studied, but only to collect more data for pedestrian crossing violations and repeated button pushes.

To gather the before/after treatment video data, a camera was placed on top of the 2-story Shasta College building in the southwest corner. This location was secure and provided excellent visibility of both crosswalks from a high vantage point. Although the pedestrian signal

indications were not visible, it was possible to determine pedestrian compliance based on which leg of the intersection was serving traffic when the pedestrian(s) crossed.

The before-treatment video data was collected for five days, from October 4 - 10, 2013. The days observed, Tuesday through Saturday, were considered to be the busiest days of the week for this part of Redding. Each day, the intersection was reviewed from 6 am until 10 pm, adding up to 80 hours total for each 5-day period. The experimental modules were installed at this location on the same day as Location 4, which was November 22. The intent of having the YPB modules at two consecutive intersections in the downtown area was to give the device better exposure to local motorists and pedestrians. They were in use through the holiday season before the after-treatment video was recorded, which resulted in a 55-day learning period. Video data was collected for the after-treatment period from January 16 - 22, 2014.

Figure 10 – Camera placement on the 2-story Downtown Health Sciences Building for Shasta College.

TABLE 14: TEHAMA X-WALK – RESULTS

BEFORE (Tehama X-Walk)	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	-	655	650	705	745	1469	4224
Rt. Turns	-	-	603	522	625	692	732	3174
Conflicts	-	-	67	60	72	44	64	307
Violations	-	-	66	65	49	42	116	338
Extra Pushes	-	-	44	36	40	25	43	188

Note: Review period was 16 hours per day (6am – 10pm)

AFTER (Tehama X-Walk)	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	-	753	671	747	802	998	3971
Rt. Turns	-	-	670	598	610	723	562	3163
Conflicts	-	-	44	48	48	56	29	225
Violations	-	-	43	32	48	47	39	209
Extra Pushes	-	-	18	20	25	20	17	100

Note: Review period was 16 hours per day (6am – 10pm)

TABLE 15: MARKET X-WALK – RESULTS

BEFORE (Market X-Walk)	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	-	163	177	164	160	322	986
Violations	-	-	31	34	26	20	44	155
Extra Pushes	-	-	8	10	4	2	11	35

Note: Review period was 16 hours per day (6am – 10pm)

AFTER (Market X-Walk)	S	M	T	W	Th	F	S	5-Day Total
Pedestrians	-	-	169	188	161	169	336	1023
Violations	-	-	16	18	21	19	23	97
Extra Pushes	-	-	6	8	6	2	9	31

Note: Review period was 16 hours per day (6am – 10pm)

Comparing the two crosswalks, the Tehama X-Walk has about four times the amount of pedestrians as the Market X-Walk. This is not surprising since the Tehama X-Walk is the most direct access between the public parking structure and the businesses along Market Street.

The pedestrian violation rate is higher for the Market X-Walk than for the Tehama X-Walk: 15.7% vs. 8.0% in the before condition; 9.5% vs. 5.3% in the after condition. This is likely due, in part, to the amount of green time allotted to serve the higher volumes of traffic on Market Street in the signal coordination plans. All of the traffic signals in the downtown one-way couplet area operate in coordination 24 hours per day, seven days a week. During off-peak times in the early morning or late evening hours, the control plans can create sluggish response times to pedestrian calls – even when traffic volumes are light. During these periods, pedestrians are more inclined to disregard the signal indications and cross the intersection on their own. From the observations made during this study, it is evident that signal timing has a major impact on pedestrian compliance, particularly during off-peak hours.

Data Breakdown - Tehama X-Walk

In the before condition, 307 conflicts were observed for 4,224 pedestrians. Applying this ratio to the number of pedestrians counted during the after-treatment period (3,971), the expected number of conflicts would be 289. The actual number of conflicts recorded with the YPB modules was 225, or 22.1% less than expected. Comparing against the number of vehicles turning right, the actual number of conflicts were 26.5% less than expected. Averaging the conflict results for the two factors yields an overall reduction of 24.3%.

For the Tehama X-Walk, the number of pedestrian violations decreased moderately in the after-treatment condition. Before the modules were installed, the study observed 338 violations for the

4,224 pedestrians that used the crosswalk. During the after-treatment review, 209 violations were counted for 3,971 pedestrians, which is 34.3% lower than the expected number of 318.

The number of extra button pushes also showed a moderate decrease, from 188 to 100. Accounting for the changes in the number of pedestrians counted during the two periods, the extra button pushes were 43.5% less than expected.

Data Breakdown - Market X-Walk

Similar to the Tehama X-Walk, the number of pedestrian violations also showed a moderate decrease when the YPB modules were installed. In the before-treatment condition, 155 violations were observed for the 986 people who crossed. During the after-treatment review, there were 97 violations for 1,023 total pedestrians, which is 39.8% less than expected.

The number of extra button pushes saw a modest decrease with the YPB signals installed, from 35 to 31. Adjusting for the additional pedestrians in the after-treatment condition, the extra button pushes were 13.9% less than expected.

TABLE 16: TEHAMA X-WALK – BEFORE/AFTER COMPARISON

LOCATION 5 (Tehama X-Walk)	Conflicts / Pedestrians	Conflicts / Rt. Turns	Pedestrian Violations	Extra Button Pushes
% Change	-22.1	-26.5	-34.3	-43.5

TABLE 17: MARKET X-WALK – BEFORE/AFTER COMPARISON

LOCATION 5 (Market X-Walk)	Conflicts / Pedestrians	Conflicts / Rt. Turns	Pedestrian Violations	Extra Button Pushes
% Change	N/A	N/A	-39.8	-13.9

CUMULATIVE ANALYSIS

The five locations studied as part of this experiment presented a variety of pedestrian and vehicle situations for determining the effectiveness of the YPB module. From a large multilane intersection near two schools, to a smaller T-intersection in a downtown one-way couplet. The test locations were selected because of their potential for pedestrian-vehicle conflicts that could benefit from the experimental device.

The following table summarizes the study results for all five locations:

TABLE 18: CUMULATIVE PERCENT CHANGE

	Conflicts / Pedestrians	Conflicts / Rt.-Lt. Turns	Pedestrian Violations	Extra Button Pushes
Location 1	-5.6	-1.2	-38.5	-79.6
Location 2	+4.2	N/A	-46.0	-88.5
Location 3	-43.4	-34.9	-51.9	-88.6
Location 4	-6.9	-15.6	+40.1	-47.3
Location 5 (Tehama X-Walk)	-22.1	-26.5	-34.3	-43.5
Location 5 (Market X-Walk)	N/A	N/A	-39.8	-13.9
CUM. AVERAGE	**-14.8**	**-19.5**	**-28.4**	**-60.2**
Std. Deviation	18.6	14.6	34.1	30.2

Overall, the cumulative results from the study show a modest decrease in pedestrian-vehicle conflicts after the YPB modules were installed. Averaging these results for the two conflict categories (number of pedestrians and number of turns) yields a 17.1% decrease. Pedestrian violations showed a more significant decrease at 28.4%. Although not counted as accurately as the other categories, the largest reduction was with the extra button pushes. For the 12 crosswalks studied in this experiment, the number of extra button pushes was reduced by an average of 60.2%.

There was a wide spread in the percent change results between the different locations, which produced the large standard deviations shown at the bottom of the table. It is difficult to point to any single element or intersection characteristic that contributed to the broad range of results from this study. Based on observations made both in the field and during many hours of video data review, the following factors were identified as having some influence on the variation of results among the five locations:

1. **Size of the intersection.** Pedestrian signals are farther away and less noticeable to vehicle traffic at large intersections, especially during bright daylight conditions. At smaller intersections, the shorter crosswalks tend to have more pedestrian compliance issues. This is particularly evident during non-peak hours when traffic volumes are light. For the five locations studied in this experiment, the crosswalk lengths ranged from 42 ft. to 102 ft.

2. **Duration of the learning period.** Local motorists could have driven through an intersection multiple times a day and never witnessed the device in operation. Unless the driver happened to encounter a pedestrian using a crosswalk parallel to their direction of travel, they would not have known anything was different. The longer the YPB modules were in place prior to collecting the after-treatment data, the greater the opportunity for pedestrians and drivers to observe the device and recognize its intended purpose. For the five intersections studied, the learning period ranged from 24 to 67 days.

3. **Composition of local vs. non-local vehicle traffic.** Four of the five intersections studied were State routes. Although the traffic volumes for the State route intersections consisted of a high percentage of local commuter traffic, there was also a significant amount of non-local traffic travelling between Interstate 5 and destinations to the west on SR-299. Motorists from outside the Redding area were less likely to have an understanding of the device on a chance one-time encounter when they passed through town during the study period.

4. **Number of pedestrians.** The individual crosswalks observed had a range of pedestrian activity throughout the day. Some were used less often by individuals or small groups, while others had large groups of pedestrians crossing almost every cycle during peak times. Motorists had a greater opportunity to observe the yellow border at the crosswalks with higher pedestrian activity. Interestingly, it could be argued that the lower volume crosswalks had more to gain from the YPB signals from the standpoint of alerting traffic that a pedestrian was waiting to cross. A single pedestrian standing on the corner of an intersection is much less noticeable to drivers than a large group. Location 1 provided a good example of this situation. When the two schools released their students in the afternoon, there could be more than 20 children waiting at a corner. During those times, it would be difficult for motorists not to recognize that the crosswalks were going to be used when the signal changed.

5. **Time of day and orientation of the pedestrian signals.** The YPB signal is most visible during low light conditions. In daylight hours, the indications tend to be less noticeable to motorists, especially at those times when the sunlight is shining directly into the signal face. Even though pedestrian signal modules are set inside an enclosure behind a grated

screen, west-facing signals can be washed out when the afternoon sun is low enough to shine directly into the device. The same thing can occur in the mornings for the pedestrian signals facing the east. This situation had a greater impact on some of the crosswalks studied than others.

6. **Single right turn vs. dual right turn.** Of the 12 crosswalks studied, only Location 2 had a dual right turn that was served concurrently with the pedestrian phase. As noted in the Location 2 discussion, the dual turns typically serve a larger volume of traffic that tends to be less patient with pedestrians using the crosswalk. This was particularly noticeable during the morning commute hours when motorists do not want to be delayed. Although the YPBs may help alert the driver that a pedestrian is crossing, it does not necessarily change their aggressive driving behavior if they are running late for work.

7. **Pedestrian behavior.** The characteristics of the pedestrians varied between the different locations and could also have contributed to the range of results. Because of the two schools near Location 1, there was a significant amount of younger pedestrians using the crosswalks. Although the younger pedestrians seemed impatient and usually hit the pushbutton many times, they were more apt to wait for the signals to change before crossing. Conversely, a large percentage of the pedestrians in the downtown area were adults who had less regard for the pedestrian signals. The different pedestrian traits not only affected the violation and pushbutton results between the locations, they also had some influence on driver behavior. For example, at Location 1, motorists generally seemed to exercise more caution around the younger pedestrians than they did for the adults.

While reviewing the after-treatment video for all of the locations, it generally appeared that drivers made their turns more cautiously when the YPB modules were activated. This was especially true at the smaller intersections in the downtown area. Motorists would acknowledge the pedestrian(s) waiting, and then slowly initiate their right-on-red turn. In many cases the turn was performed just before the traffic signal changed and the pedestrian was given the WALK indication, so it was still counted as a conflict for purposes of the study. However, in these cases, there were no safety issues because the turns were slow and deliberate.

As drivers notice the YPB signals and realize their purpose over time, it appears they begin to actively look for the pedestrian(s) waiting to cross when they see the border illuminated. This improved behavior is particularly important at night or during inclement weather when pedestrians can be difficult to see.

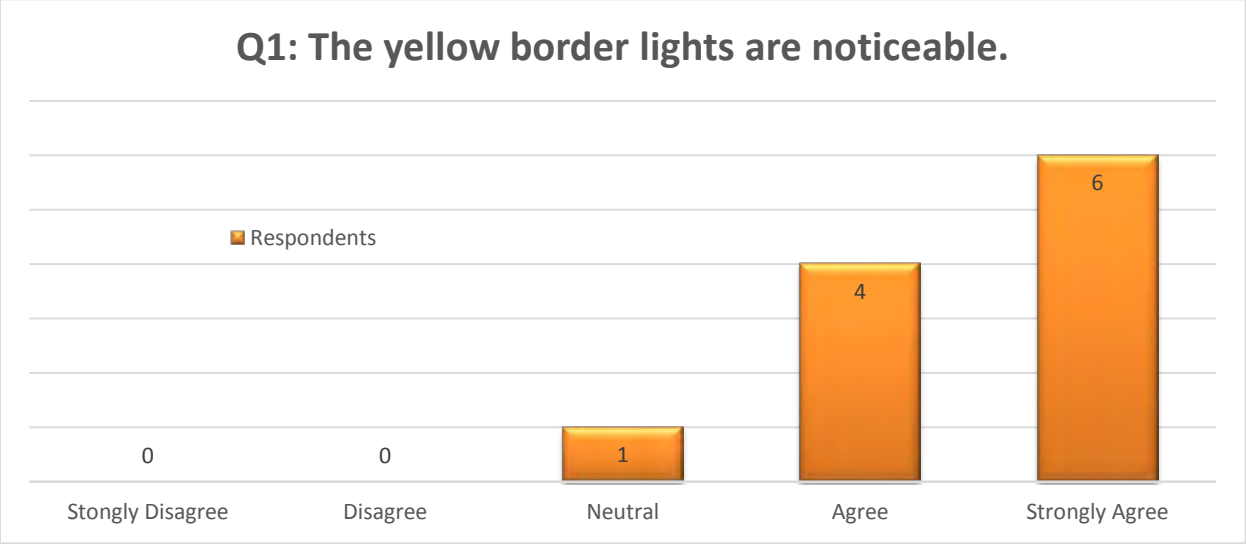
ONLINE SURVEY RESULTS

As discussed earlier in this report, flyers were posted at each location to notify pedestrians of the experiment and to provide them with an opportunity to take an online survey. The response to the survey was fairly small given the amount of time the flyers were in place at the five locations. In total, 15 people responded to the survey and only seven provided written comments after rating the five questions.

Figure 10 – Laminated flyer strapped to signal pole at Location 2.

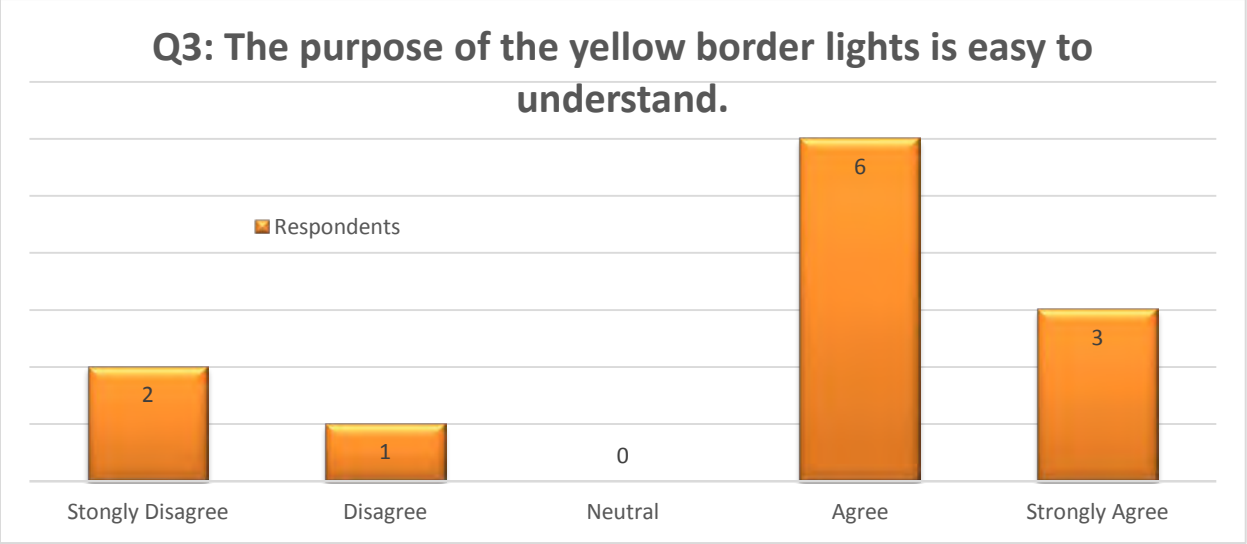
Several of the respondents completed the survey in less than 40 seconds and gave the same rating to all five questions without providing comments. This suggests that the questionnaire was completed in a hurry and with little consideration. Unfortunately, it only takes a few of these types of responses to have a significant impact on a small survey. For example, two of the respondents said they "strongly disagree" to all five questions. They represented only 13% of the total number of people who took the survey, but accounted for 67% of the "strongly disagree" scores. With this in mind, it was decided to discard the surveys from three respondents who provided the same answer to all questions without any comments, reducing the total number of "acceptable" survey results to 12.

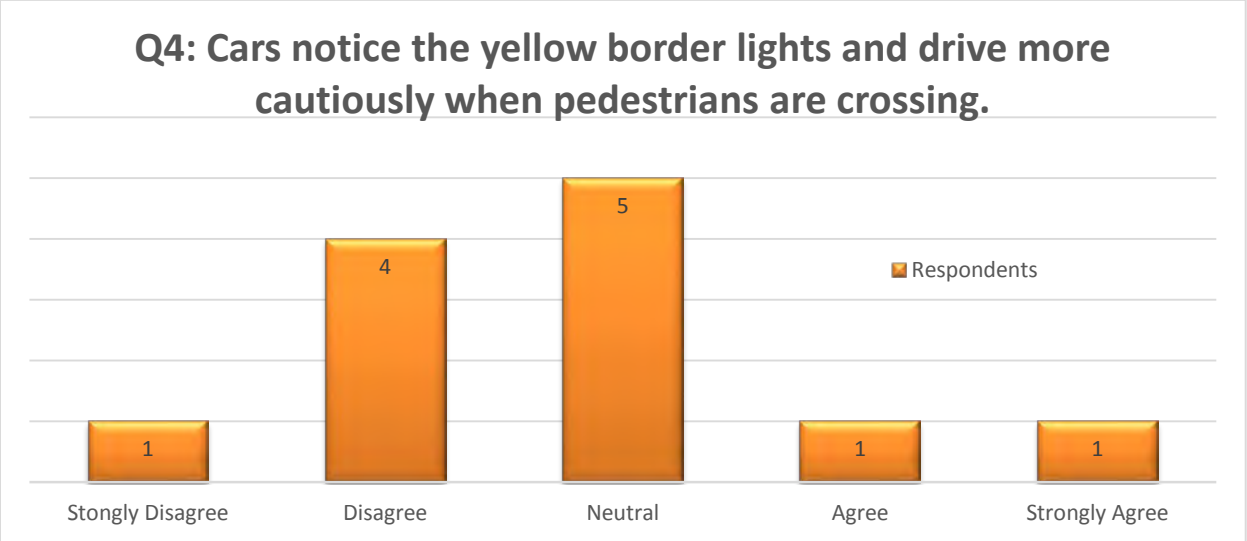
The following charts summarize the results of the online survey. Also listed are the seven written comments from some of the respondents. The individual survey for all 15 respondents is included in Appendix C.

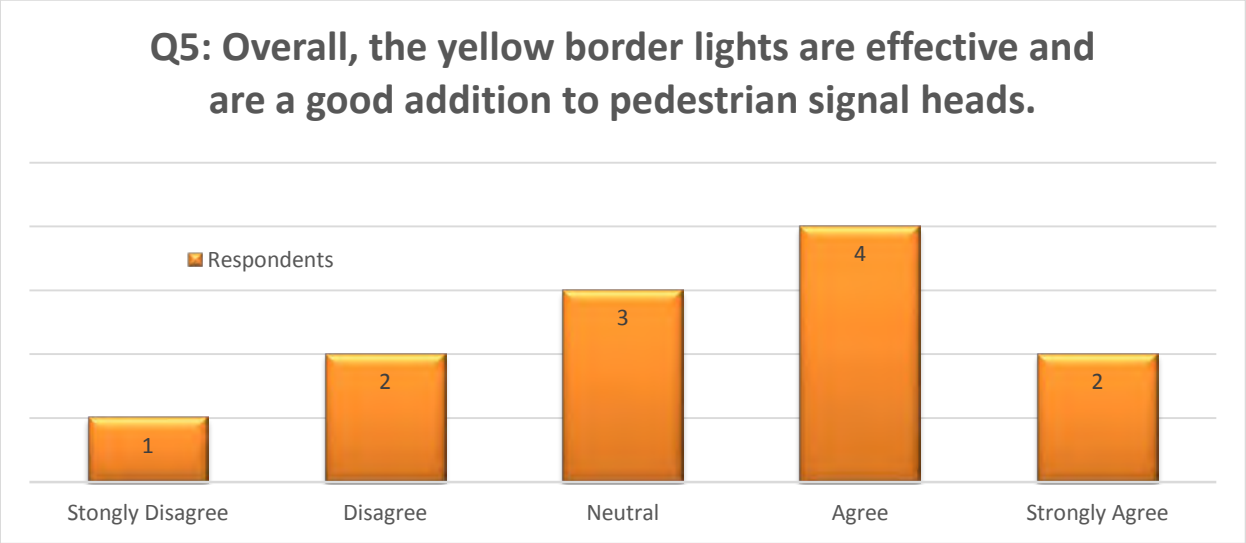


Note: there were only 11 responses to Question 1.


Q2: The yellow lights are effective in confirming that the pushbutton worked and that the walk symbol is coming on soon.
Respondents
1
2
0
4
5
Stongly Disagree
Disagree
Neutral
Agree
Strongly Agree


Q3: The purpose of the yellow border lights is easy to understand.
Respondents
2
1
0
6
3
Stongly Disagree
Disagree
Neutral
Agree
Strongly Agree


Q4: Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.
Respondents
1
4
5
1
1
Stongly Disagree
Disagree
Neutral
Agree
Strongly Agree



Comments from the Survey:

1. Respondent #6 August 12, 2013 (8:32 am)
   "I feel that people will continue to just push the button a lot as I experienced I had already pushed the button and someone came up and pushed it again many times even though the yellow border was on. People are just not observant."

2. Respondent #8 August 12, 2013 (5:37 pm)
   "If your trying to make it look pretty then ok but it's not improving the actually use of the signal. A waste of time and tax money."

3. Respondent #9 August 22, 2013 (9:25 am)
   "Consider having the border lights animate by using chasing style or alternating two colors for contrasting shades."

4. Respondent #10 August 25, 2013 (7:09 am)
   "Maybe a stale green indicator would be helpful for cars. Also fresh green indication might be helpful for cars that may charge through intersection on new green while cross traffic may still be clearing the intersection. Maybe it could even receive input from car sensors."

5. Respondent #12 December 6, 2013 (2:02 pm)
   "The purpose is clear as a pedestrian, but drivers should be informed about what the new lights mean."

6. Respondent #13 January 8, 2014 (12:21 pm)
   "had to look up just now what the border was. Now that i know i will probably notice more when driving."

7. Respondent #14 March 2, 2014 (2:52 am)
   "What a great idea! I loved using this in downtown redding. Now I don't push the pedestrian crossing button 50 times before I cross."

In reviewing the charts for the five survey questions, the overall public response to the YPB signals is favorable. Most respondents agree or strongly agree that the yellow border is noticeable and effective in confirming the call when the button was pushed. They also agree that the purpose of the additional ring of lights is easy to understand. However, with regard to its visibility for motorists and its effect on driver behavior, the respondents were more skeptical. Most were neutral or disagreed that the yellow border influenced motorists to drive more cautiously when pedestrians were crossing.

As to whether the yellow border lights are an effective addition to pedestrian signals, six respondents agreed or strongly agreed, and three were neutral. Only three respondents were negative about the overall benefit of the device.

The results from the limited survey appear to be consistent with comments made by passersby when visiting the five locations during the evaluation. Most people recognized the yellow border and thought it was a good idea, but weren't sure about its effect on drivers.

CONCLUSION

Pedestrian signal indications are meant to notify walkers when it is safe to cross an intersection. At most traffic signals, vehicles travelling parallel to a crosswalk are served at the same time pedestrians are given the WALK indication. This creates the potential for conflict when a vehicle needs to turn through a crosswalk that is being used. Advising motorists that pedestrians are going to use a crosswalk before they begin their turn will help reduce this type of conflict and improve safety.

Although pedestrian signals are oriented for people on foot who need to cross an intersection, the indications are commonly visible to vehicle traffic travelling in the same direction as the crosswalk. Similar to how pedestrians can see the traffic signal indications and anticipate when they will be able to cross, motorists can benefit from ancillary information provided by the pedestrian signals.

The purpose of this experiment was to determine whether the interaction between motorists and pedestrians improves when pedestrian signal heads are supplemented with an actuated yellow LED border (YPB). Additionally, the experiment set out to determine if the modification reduces pedestrian crossing violations and repeated call button pushes.

The average of the results from the five intersections showed a modest decrease in pedestrian-vehicle conflicts when the YPB modules were installed (17.1%). Considering the limited deployment of the device during the evaluation, the conflict results are likely conservative. Had the study been able to upgrade more intersections and cover a larger area of the community, there would have been an increased opportunity for motorists to recognize the purpose of the yellow border.

The YPB signals had more of an impact with pedestrians. With the exception of one location, the number of pedestrian violations decreased significantly. The average reduction for all five locations was 28.4%. Although not as accurately evaluated, the decrease in the number of extra button pushes showed an even more dramatic reduction of 60.2%.

The results show that the YPB signal improves pedestrian behavior. When they see the yellow border activate across the street, the pedestrians are more confident that the “button worked” and feel less need to push the button again or try cross on their own.

Overall, this experiment demonstrated that the yellow LED border is a positive enhancement to a standard pedestrian signal. From the many hours of observations made during this study, there does not appear to be a downside to the modification. The YPB is not a distraction to motorists, nor does it adversely affect driver behavior. The device provides supplemental information to motorists while giving pedestrians reassurance that the signal will provide a WALK indication soon. Lastly, the border is most visible, providing the greatest benefit, to pedestrians and motorists during low light or inclement weather conditions when the potential for conflict is greatest.

RECOMMENDATIONS

It is recommended that the yellow LED border be approved as an optional feature on standard countdown pedestrian signals. Additionally, guidance should be provided so that the device is applied at locations similar to the ones studied in this experiment.

The suggested intersection criteria are as follows:

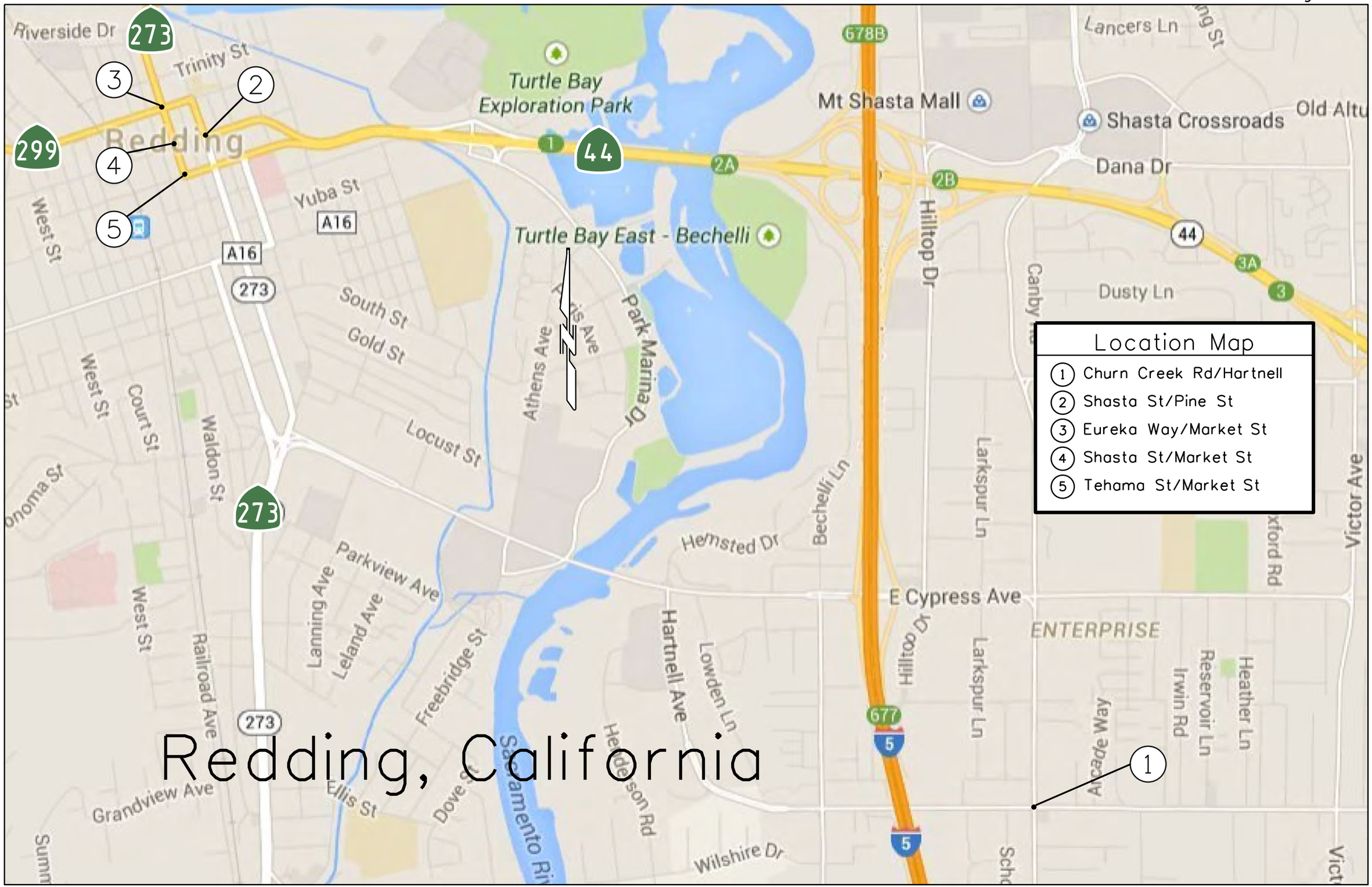
- The traffic signal is located in an urbanized area with regular pedestrian activity
- The pedestrian signals are pushbutton actuated
- The posted speed limit is 40-mph or less
- One or more crosswalks operate concurrently with vehicular traffic

The enhancement is best suited for pedestrian actuated signals so that the yellow border is only activated when a pedestrian is present. At pre-timed or non-actuated signals, the border would simply indicate that the DON'T WALK symbol will soon be changing to WALK. Although this may still be considered useful information to drivers and pedestrians, further studies would likely be needed to determine whether the YPB provides a benefit at non-actuated signals.

From the results of this experiment, there is nothing to suggest that YPB signals would have negative impacts if they were utilized at rural, high-speed intersections with relatively few pedestrians. Since the likelihood for pedestrian-vehicle conflicts is much lower in a rural environment, the main benefit of the device would be in reducing pedestrian crossing violations and extra button pushes. Until the YPB is utilized on a broader scale and becomes more familiar to drivers in urban settings, it is suggested that additional studies for rural applications be deferred.

Location Maps

APPENDIX A



Redding, California

Location Map

1. Churn Creek Rd/Hartnell
2. Shasta St/Pine St
3. Eureka Way/Market St
4. Shasta St/Market St
5. Tehama St/Market St

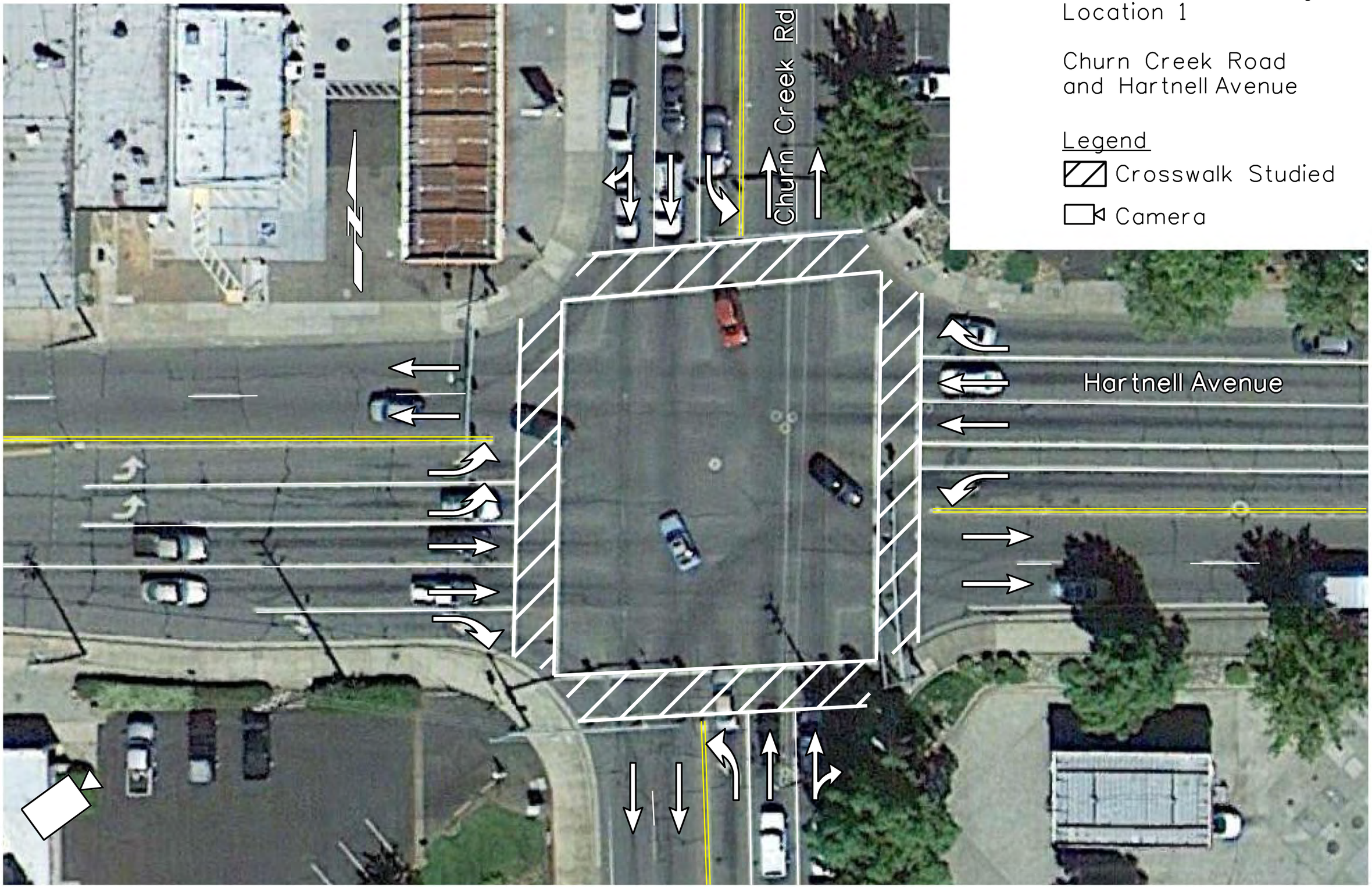
Location 1

Churn Creek Road
and Hartnell Avenue

Legend

Crosswalk Studied

Camera



Location 2

Shasta Street
and Pine Street

Legend

Crosswalk Studied

Camera

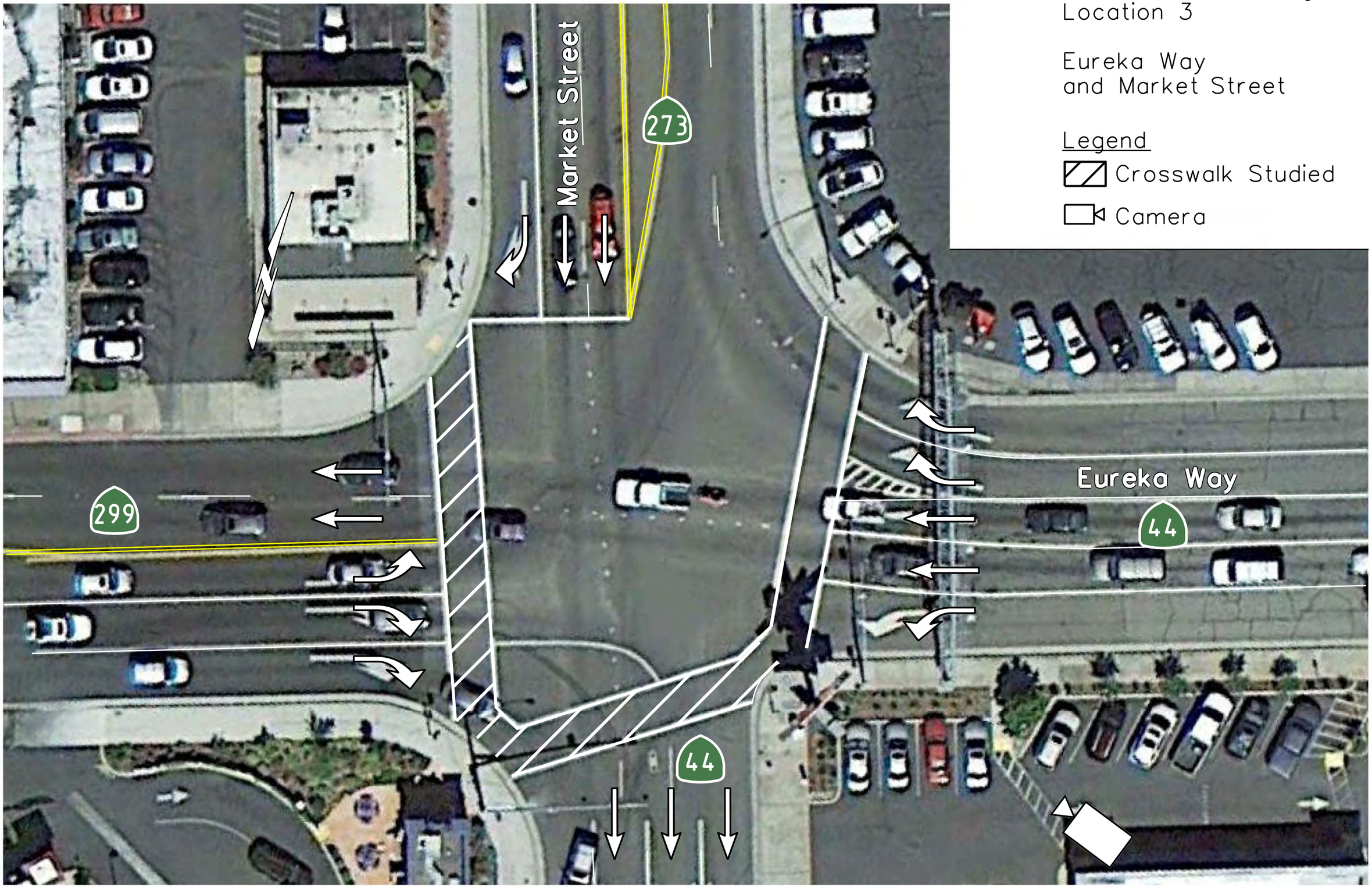
Location 3

Eureka Way
and Market Street

Legend

Crosswalk Studied

Camera



Location 4

Shasta Street
and Market Street

Legend

Crosswalk Studied

Camera

Location 5

Tehama Street
and Market Street

Legend

Crosswalk Studied

Camera

Pedestrian Survey Flyers

APPENDIX B

EXPERIMENTAL PEDESTRIAN SIGNAL

Visit our website
caltrans2.info
or scan code

Caltrans

EXPERIMENTAL PEDESTRIAN SIGNAL

If you would still like to comment, visit our website **caltrans2.info** or scan code

Caltrans

Survey Responses

APPENDIX C

Online Pedestrian Survey

Respondent #1 **Date/Time: Thursday, May 09, 2013 2:30:21 PM** **Time Spent: 00:00:25** REJECTED	
Q1: *The yellow border lights are noticeable.*	Agree
Q2: *The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Agree
Q3: *The purpose of the yellow border lights is easy to understand.*	Agree
Q4: *Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Agree
Q5: *Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Agree
Q6: *Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.	

Respondent #2 **Date/Time: Tuesday, May 21, 2013 4:42:44 PM** **Time Spent: 00:00:15** REJECTED	
Q1: *The yellow border lights are noticeable.*	Strongly Disagree
Q2: *The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Disagree
Q3: *The purpose of the yellow border lights is easy to understand.*	Strongly Disagree
Q4: *Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Strongly Disagree
Q5: *Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Strongly Disagree
Q6: *Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.	

Online Pedestrian Survey

Respondent #3 REJECTED	
Date/Time: Monday, June 10, 2013 9:05:52 PM	
Time Spent: 00:00:40	
Q1: *The yellow border lights are noticeable.*	Strongly Disagree
Q2: *The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Disagree
Q3: *The purpose of the yellow border lights is easy to understand.*	Strongly Disagree
Q4: *Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Strongly Disagree
Q5: *Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Strongly Disagree
Q6: *Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.	

Respondent #4	
Date/Time: Friday, June 14, 2013 11:24:31 AM	
Time Spent: 00:00:27	
Q1: *The yellow border lights are noticeable.*	Strongly Agree
Q2: *The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Agree
Q3: *The purpose of the yellow border lights is easy to understand.*	Strongly Agree
Q4: *Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Neutral
Q5: *Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Agree
Q6: *Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.	

Respondent #5 **Date/Time: Sunday, August 11, 2013 5:22:58 PM** **Time Spent: 00:03:04**		
Q1:	*The yellow border lights are noticeable.*	Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Disagree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Neutral
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Neutral
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.		

Respondent #6 **Date/Time: Monday, August 12, 2013 8:32:39 AM** **Time Spent: 00:04:44**		
Q1:	*The yellow border lights are noticeable.*	Strongly Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Strongly Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Agree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Neutral
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"I feel that people will continue to just push the button a lot as I experienced I had already pushed the button and someone came up and pushed it again many times even though the yellow border was on. People are just not observant."		

Respondent #7 **Date/Time: Monday, August 12, 2013 5:33:38 PM** **Time Spent: 00:01:16**		
Q1:	*The yellow border lights are noticeable.*	Neutral
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Disagree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Strongly Disagree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Disagree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Disagree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.		

Respondent #8 **Date/Time: Monday, August 12, 2013 5:37:41 PM** **Time Spent: 00:03:04**		
Q1:	*The yellow border lights are noticeable.*	Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Disagree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Strongly Disagree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Strongly Disagree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Strongly Disagree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"If your trying to make it look pretty then ok but it's not improving the actually use of the signal. A waste of time and tax money."		

Respondent #9 **Date/Time: Thursday, August 22, 2013 9:25:27 AM** **Time Spent: 00:06:16**		
Q1:	*The yellow border lights are noticeable.*	Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Disagree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Disagree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Disagree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"Consider having the border lights animate by using chasing style or alternating two colors for contrasting shades."		

Respondent #10 **Date/Time: Sunday, August 25, 2013 7:09:03 PM** **Time Spent: 00:18:30**		
Q1:	*The yellow border lights are noticeable.*	Strongly Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Neutral
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Agree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"Maybe a stale green indicator would be helpful for cars. Also fresh green indication might be helpful for cars that may charge through intersection on new green while cross traffic may still be clearing the intersection. Maybe it could even receive input from car sensors."		

Online Pedestrian Survey

Respondent #11 **Date/Time: Saturday, September 21, 2013 3:27:49 PM** **Time Spent: 00:00:46**		
Q1:	*The yellow border lights are noticeable.*	Strongly Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Neutral
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Strongly Agree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.		

Respondent #12 **Date/Time: Friday, December 6, 2013 2:02:01 PM** **Time Spent: 00:02:15**		
Q1:	*The yellow border lights are noticeable.*	Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Neutral
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Agree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"The purpose is clear as a pedestrian, but drivers should be informed about what the new lights mean."		

Respondent #13 **Date/Time: Wednesday, January 8, 2014 12:21:08 PM** **Time Spent: 00:01:06**		
Q1:	*The yellow border lights are noticeable.*	Strongly Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Disagree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Neutral
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"had to look up just now what the border was. Now that i know i will probably notice more when driving."		

Respondent #14 **Date/Time: Sunday, March 2, 2014 2:52:44 AM** **Time Spent: 00:01:32**		
Q1:	*The yellow border lights are noticeable.*	Strongly Agree
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Strongly Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Strongly Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Strongly Agree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Strongly Agree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
"What a great idea! I loved using this in downtown redding. Now I don't push the pedestrian crossing button 50 times before I cross."		

Online Pedestrian Survey

Respondent #15 **Date/Time: Tuesday, March 4, 2014 1:06:13 PM** **Time Spent: 00:01:09**		
Q1:	*The yellow border lights are noticeable.*	*(Left Blank)*
Q2:	*The yellow lights are effective in confirming that the pushbutton worked and that the walk signal is coming on soon.*	Agree
Q3:	*The purpose of the yellow border lights is easy to understand.*	Agree
Q4:	*Cars notice the yellow border lights and drive more cautiously when pedestrians are crossing.*	Disagree
Q5:	*Overall, the yellow border lights are effective and are a good addition to pedestrian signal heads.*	Agree
Q6:	*Caltrans appreciates your comments. Please feel free to provide us with any suggestions you would like to make regarding the new pedestrian signal lights.*	
Respondent skipped this question.		

Before/After Spreadsheets

APPENDIX D

Churn Cr. / Hartnell	Summary	Ped Total: 5862
		Veh Total: 5213
BEFORE	Weekday: 7-Day Total	Conflict Total 395
	Total Hrs: 112	Violation Total: 221
	Conditions:	Extra Push Total: 509

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	4	11		0	0	0	
	B	10	22		6	0	0	
	C	3	14		2	1	1	
	D	0	8		2	1	0	
HOUR TOTALS		17	55	0	10	2	1	
0700-0800	A	75	85		2	4	11	
	B	129	94		13	6	5	
	C	68	122		2	12	9	
	D	23	42		3	4	0	
HOUR TOTALS		295	343	0	20	26	25	
0800-0900	A	107	60		5	4	14	
	B	45	36		3	2	0	
	C	26	52		5	6	3	
	D	32	41		3	7	0	
HOUR TOTALS		210	189	0	16	19	17	
0900-1000	A	85	53		2	5	13	
	B	54	47		2	3	1	
	C	23	51		2	9	5	
	D	59	52		4	6	0	
HOUR TOTALS		221	203	0	10	23	19	
1000-1100	A	119	61		1	5	13	
	B	83	67		3	4	3	
	C	23	78		3	16	4	
	D	68	83		6	10	2	
HOUR TOTALS		293	289	0	13	35	22	
1100-1200	A	210	81		3	10	32	
	B	86	55		3	2	2	
	C	36	89		2	13	4	
	D	74	75		4	16	4	
HOUR TOTALS		406	300	0	12	41	42	
1200-1300	A	238	110		2	11	21	
	B	147	102		3	0	6	
	C	66	135		1	18	9	
	D	64	50		1	8	0	
HOUR TOTALS		515	397	0	7	37	36	
1300-1400	A	307	214		3	14	32	
	B	124	143		3	4	5	
	C	93	277		4	23	14	
	D	81	94		3	15	0	
HOUR TOTALS		605	728	0	13	56	51	
1400-1500	A	280	159		4	9	25	
	B	177	162		2	1	3	
	C	88	247		6	16	13	
	D	105	136		8	12	0	
HOUR TOTALS		650	704	0	20	38	41	
1500-1600	A	243	176		3	10	27	
	B	159	168		5	7	1	
	C	85	217		6	19	14	
	D	85	119		5	20	0	
HOUR TOTALS		572	680	0	19	56	42	
1600-1700	A	214	116		5	11	20	
	B	133	111		1	6	1	
	C	69	144		0	17	7	
	D	118	114		3	14	2	
HOUR TOTALS		534	485	0	9	48	30	
1700-1800	A	175	124		4	15	14	
	B	122	101		3	6	0	
	C	51	123		5	16	13	
	D	74	110		6	15	0	
HOUR TOTALS		422	458	0	18	52	27	
1800-1900	A	90	88		3	8	3	
	B	48	48		1	2	0	
	C	36	128		2	10	8	
	D	35	69		5	11	1	
HOUR TOTALS		209	333	0	11	31	12	
1900-2000	A	69	92		7	5	6	
	B	33	59		3	1	1	
	C	18	83		7	8	5	
	D	18	70		2	9	1	
HOUR TOTALS		138	304	0	19	23	13	
2000-2100	A	29	50		4	4	6	
	B	26	38		2	2	3	
	C	7	67		1	3	2	
	D	24	50		4	6	1	
HOUR TOTALS		86	205	0	11	15	12	
2100-2200	A	10	29		2	0	2	
	B	8	34		1	1	0	
	C	14	75		5	3	3	
	D	8	51		5	3	0	
HOUR TOTALS		40	189	0	13	7	5	

Churn Cr. / Hartnell	Summary	Ped Total: 5297
		Veh Total: 4502
AFTER	Weekday: 7-Day Total	Conflict Total 337
	Total Hrs: 112	Violation Total: 123
	Conditions:	Extra Push Total: 94

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	3	12		2	0	2	
	B	13	36		1	0	0	
	C	7	16		1	0	0	
	D	4	14		1	0	2	
HOUR TOTALS		27	78	0	5	0	4	
0700-0800	A	79	102		2	0	18	
	B	95	85		0	0	0	
	C	55	117		1	3	8	
	D	27	47		1	1	1	
HOUR TOTALS		256	351	0	4	4	27	
0800-0900	A	95	64		2	0	15	
	B	40	26		0	0	0	
	C	25	54		1	1	4	
	D	28	30		2	0	1	
HOUR TOTALS		188	174	0	5	1	20	
0900-1000	A	102	48		0	0	11	
	B	60	91		2	0	0	
	C	10	32		3	3	2	
	D	35	57		2	0	2	
HOUR TOTALS		207	228	0	7	3	15	
1000-1100	A	113	58		0	1	18	
	B	63	63		3	1	0	
	C	23	92		2	7	2	
	D	65	52		0	5	1	
HOUR TOTALS		264	265	0	5	14	21	
1100-1200	A	143	58		3	0	23	
	B	83	65		1	0	1	
	C	58	108		2	6	10	
	D	51	52		4	4	2	
HOUR TOTALS		335	283	0	10	10	36	
1200-1300	A	200	80		0	1	18	
	B	84	65		1	0	0	
	C	36	86		1	7	6	
	D	54	63		3	3	0	
HOUR TOTALS		374	294	0	5	11	24	
1300-1400	A	198	86		1	0	22	
	B	130	105		2	0	1	
	C	44	129		2	3	5	
	D	65	71		2	1	2	
HOUR TOTALS		437	391	0	7	4	30	
1400-1500	A	258	171		0	2	20	
	B	173	162		1	0	1	
	C	129	338		4	8	24	
	D	93	123		1	6	0	
HOUR TOTALS		653	794	0	6	16	45	
1500-1600	A	205	140		5	2	15	
	B	133	139		1	0	4	
	C	52	193		5	2	5	
	D	62	68		3	4	1	
HOUR TOTALS		452	540	0	14	8	25	
1600-1700	A	186	113		4	0	16	
	B	119	86		3	0	3	
	C	41	109		2	1	4	
	D	47	77		5	1	1	
HOUR TOTALS		393	385	0	14	2	24	
1700-1800	A	158	107		1	2	22	
	B	122	101		0	2	0	
	C	34	105		6	3	9	
	D	90	86		2	3	1	
HOUR TOTALS		404	399	0	9	10	32	
1800-1900	A	92	89		2	0	5	
	B	65	78		5	0	1	
	C	20	92		2	0	5	
	D	45	70		1	5	0	
HOUR TOTALS		222	329	0	10	5	11	
1900-2000	A	61	103		3	1	7	
	B	37	73		2	0	1	
	C	26	100		3	1	3	
	D	18	47		1	4	0	
HOUR TOTALS		142	323	0	9	6	11	
2000-2100	A	41	83		3	0	4	
	B	36	84		2	0	2	
	C	9	73		2	0	2	
	D	19	69		0	0	1	
HOUR TOTALS		105	309	0	7	0	9	
2100-2200	A	12	40		2	0	2	
	B	21	44		1	0	0	
	C	6	47		2	0	1	
	D	4	23		1	0	0	
HOUR TOTALS		43	154	0	6	0	3	

Shasta / Pine	Summary	Ped Total: 871
		Veh Total: 80
BEFORE	Weekday: 5-Day Total	Conflict Total 30
	Total Hrs: 80	Violation Total: 205
	Conditions:	Extra Push Total: 78

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	5	10		5	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	11		3	0	0	
HOUR TOTALS		5	21	0	8	0	0	
0700-0800	A	5	11		7	0	1	
	B	0	0		0	0	0	
	C	0	0		0	5	0	
	D	0	25		3	4	0	
HOUR TOTALS		5	36	0	10	9	1	
0800-0900	A	5	17		5	5	2	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	42		5	3	1	
HOUR TOTALS		5	59	0	10	8	3	
0900-1000	A	5	15		2	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	31		5	1	1	
HOUR TOTALS		5	46	0	7	2	1	
1000-1100	A	5	21		9	1	2	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	40		6	3	0	
HOUR TOTALS		5	61	0	15	4	2	
1100-1200	A	5	15		6	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	36		5	0	0	
HOUR TOTALS		5	51	0	11	1	0	
1200-1300	A	5	33		8	1	2	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	37		4	0	0	
HOUR TOTALS		5	70	0	12	1	2	
1300-1400	A	5	35		10	3	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	42		8	0	1	
HOUR TOTALS		5	77	0	18	3	2	
1400-1500	A	5	28		6	11	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	31		10	0	1	
HOUR TOTALS		5	59	0	16	11	1	
1500-1600	A	5	40		10	22	4	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	37		4	3	0	
HOUR TOTALS		5	77	0	14	25	4	
1600-1700	A	5	14		10	6	3	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	27		5	0	0	
HOUR TOTALS		5	41	0	15	6	3	
1700-1800	A	5	43		13	2	4	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	39		9	0	0	
HOUR TOTALS		5	82	0	22	2	4	
1800-1900	A	5	22		2	0	6	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	29		1	0	0	
HOUR TOTALS		5	51	0	3	0	6	
1900-2000	A	5	17		6	4	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	24		8	0	0	
HOUR TOTALS		5	41	0	14	4	1	
2000-2100	A	5	11		7	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	39		9	0	0	
HOUR TOTALS		5	50	0	16	0	0	
2100-2200	A	5	21		7	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	28		7	1	0	
HOUR TOTALS		5	49	0	14	2	0	

Shasta / Pine	Summary	Ped Total: 685
		Veh Total: 80
AFTER	Weekday: 5-Day Total	Conflict Total 25
	Total Hrs: 80	Violation Total: 87
	Conditions:	Extra Push Total: 7

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	5	10		3	0	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	10		3	0	0	
HOUR TOTALS		5	20	0	6	0	1	
0700-0800	A	5	4		4	0	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	8		0	0	0	
HOUR TOTALS		5	12	0	4	0	1	
0800-0900	A	5	11		3	0	3	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	37		3	0	0	
HOUR TOTALS		5	48	0	6	0	3	
0900-1000	A	5	11		2	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	26		2	0	1	
HOUR TOTALS		5	37	0	4	0	1	
1000-1100	A	5	25		2	0	4	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	25		1	0	0	
HOUR TOTALS		5	50	0	3	0	4	
1100-1200	A	5	27		1	1	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	23		0	0	0	
HOUR TOTALS		5	50	0	1	1	1	
1200-1300	A	5	31		2	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	29		1	0	1	
HOUR TOTALS		5	60	0	3	1	1	
1300-1400	A	5	18		1	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	23		1	0	0	
HOUR TOTALS		5	41	0	2	0	0	
1400-1500	A	5	21		4	0	4	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	17		0	0	0	
HOUR TOTALS		5	38	0	4	0	4	
1500-1600	A	5	28		3	2	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	22		3	0	0	
HOUR TOTALS		5	50	0	6	2	1	
1600-1700	A	5	28		7	0	3	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	16		1	0	0	
HOUR TOTALS		5	44	0	8	0	3	
1700-1800	A	5	13		1	0	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	12		1	0	1	
HOUR TOTALS		5	25	0	2	0	2	
1800-1900	A	5	18		5	1	1	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	26		3	0	0	
HOUR TOTALS		5	44	0	8	1	1	
1900-2000	A	5	34		6	1	2	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	21		5	0	0	
HOUR TOTALS		5	55	0	11	1	2	
2000-2100	A	5	22		6	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	37		5	0	0	
HOUR TOTALS		5	59	0	11	0	0	
2100-2200	A	5	14		6	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	38		2	0	0	
HOUR TOTALS		5	52	0	8	1	0	

Eureka / Market	Summary	Ped Total: 1444
		Veh Total: 1199
BEFORE	Weekday: 5-Day Total	Conflict Total 85
	Total Hrs: 70	Violation Total: 111
	Conditions:	Extra Push Total: 30

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	7	10		0	1	0	
	D	4	19		4	1	1	
HOUR TOTALS		11	29	0	4	2	1	
0700-0800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	23	18		2	0	2	
	D	17	31		4	2	4	
HOUR TOTALS		40	49	0	6	2	6	
0800-0900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	32	28		0	1	1	
	D	34	61		6	1	4	
HOUR TOTALS		66	89	0	6	2	5	
0900-1000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	38	29		1	1	0	
	D	36	34		0	3	2	
HOUR TOTALS		74	63	0	1	4	2	
1000-1100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	48	32		3	1	4	
	D	75	87		5	0	5	
HOUR TOTALS		123	119	0	8	1	9	
1100-1200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	31	21		0	0	1	
	D	56	87		7	2	7	
HOUR TOTALS		87	108	0	7	2	8	
1200-1300	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	70	53		1	1	6	
	D	60	84		6	2	6	
HOUR TOTALS		130	137	0	7	3	12	
1300-1400	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	66	39		2	0	3	
	D	55	88		5	3	2	
HOUR TOTALS		121	127	0	7	3	5	
1400-1500	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	50	30		2	0	1	
	D	56	101		4	1	6	
HOUR TOTALS		106	131	0	6	1	7	
1500-1600	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	50	33		4	0	3	
	D	56	107		5	0	2	
HOUR TOTALS		106	140	0	9	0	5	
1600-1700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	41	33		3	0	3	
	D	70	106		17	2	7	
HOUR TOTALS		111	139	0	20	2	10	
1700-1800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	28	19		4	0	4	
	D	65	72		5	4	2	
HOUR TOTALS		93	91	0	9	4	6	
1800-1900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	23	26		1	0	0	
	D	38	79		5	1	2	
HOUR TOTALS		61	105	0	6	1	2	
1900-2000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	50	48		4	3	5	
	D	20	69		11	0	2	
HOUR TOTALS		70	117	0	15	3	7	
2000-2100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	0		0	0	0	
HOUR TOTALS		0	0	0	0	0	0	
2100-2200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	0		0	0	0	
HOUR TOTALS		0	0	0	0	0	0	

Eureka / Market	Summary	Ped Total: 1679
		Veh Total: 1207
AFTER	Weekday: 5-Day Total	Conflict Total 56
	Total Hrs: 70	Violation Total: 62
	Conditions:	Extra Push Total: 4

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	2	10		0	0	0	
	D	8	19		1	0	0	
HOUR TOTALS		10	29	0	1	0	0	
0700-0800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	46	31		0	0	5	
	D	41	51		0	0	0	
HOUR TOTALS		87	82	0	0	0	5	
0800-0900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	38	33		0	0	2	
	D	45	99		1	2	0	
HOUR TOTALS		83	132	0	1	2	2	
0900-1000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	27	27		0	0	3	
	D	81	116		0	0	3	
HOUR TOTALS		108	143	0	0	0	6	
1000-1100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	50	37		0	0	1	
	D	57	98		3	1	3	
HOUR TOTALS		107	135	0	3	1	4	
1100-1200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	64	36		2	0	5	
	D	44	101		1	0	4	
HOUR TOTALS		108	137	0	3	0	9	
1200-1300	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	53	40		4	0	5	
	D	63	112		2	0	2	
HOUR TOTALS		116	152	0	6	0	7	
1300-1400	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	48	34		4	0	2	
	D	40	90		5	0	1	
HOUR TOTALS		88	124	0	9	0	3	
1400-1500	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	34	32		3	0	2	
	D	50	100		6	0	1	
HOUR TOTALS		84	132	0	9	0	3	
1500-1600	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	27	27		2	0	4	
	D	90	130		0	0	1	
HOUR TOTALS		117	157	0	2	0	5	
1600-1700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	27	39		5	0	1	
	D	61	101		3	0	0	
HOUR TOTALS		88	140	0	8	0	1	
1700-1800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	32	32		2	0	3	
	D	45	54		4	0	0	
HOUR TOTALS		77	86	0	6	0	3	
1800-1900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	36	31		2	0	2	
	D	32	82		6	0	1	
HOUR TOTALS		68	113	0	8	0	3	
1900-2000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	43	35		2	1	1	
	D	23	82		4	0	4	
HOUR TOTALS		66	117	0	6	1	5	
2000-2100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	0		0	0	0	
HOUR TOTALS		0	0	0	0	0	0	
2100-2200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	0	0		0	0	0	
HOUR TOTALS		0	0	0	0	0	0	

Shasta / Market	Summary	Ped Total: 3504
		Veh Total: 412
BEFORE	Weekday: 7-Day Total	Conflict Total 27
	Total Hrs: 112	Violation Total: 130
	Conditions:	Extra Push Total: 68

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	2	8		0	0	1	
	D	5	17		0	0	0	
HOUR TOTALS		7	25	0	0	0	1	
0700-0800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	11	17		0	0	0	
	D	4	52		0	1	1	
HOUR TOTALS		15	69	0	0	1	1	
0800-0900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	9	25		5	0	0	
	D	11	86		2	1	1	
HOUR TOTALS		20	111	0	7	1	1	
0900-1000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	11	24		2	1	3	
	D	9	124		1	5	1	
HOUR TOTALS		20	148	0	3	6	4	
1000-1100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	15	48		1	1	0	
	D	6	144		4	1	1	
HOUR TOTALS		21	192	0	5	2	1	
1100-1200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	15	59		11	2	0	
	D	13	167		1	6	2	
HOUR TOTALS		28	226	0	12	8	2	
1200-1300	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	19	71		7	4	1	
	D	20	201		2	3	4	
HOUR TOTALS		39	272	0	9	7	5	
1300-1400	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	22	77		7	5	0	
	D	12	221		3	1	0	
HOUR TOTALS		34	298	0	10	6	0	
1400-1500	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	25	95		8	1	3	
	D	19	200		1	0	2	
HOUR TOTALS		44	295	0	9	1	5	
1500-1600	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	20	62		9	2	0	
	D	17	208		1	5	0	
HOUR TOTALS		37	270	0	10	7	0	
1600-1700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	12	57		9	0	1	
	D	19	193		0	6	0	
HOUR TOTALS		31	250	0	9	6	1	
1700-1800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	15	63		4	0	1	
	D	23	218		1	2	1	
HOUR TOTALS		38	281	0	5	2	2	
1800-1900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	12	97		14	5	1	
	D	22	260		2	6	1	
HOUR TOTALS		34	357	0	16	11	2	
1900-2000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	16	92		8	3	1	
	D	9	227		2	4	0	
HOUR TOTALS		25	319	0	10	7	1	
2000-2100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	5	45		10	0	0	
	D	5	172		1	1	1	
HOUR TOTALS		10	217	0	11	1	1	
2100-2200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	6	63		14	1	0	
	D	3	111		0	1	0	
HOUR TOTALS		9	174	0	14	2	0	

Shasta / Market	Summary	Ped Total: 3823
		Veh Total: 494
AFTER	Weekday: 7-Day Total	Conflict Total 27
	Total Hrs: 112	Violation Total: 199
	Conditions:	Extra Push Total: 39

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	3	9		1	0	0	
	D	6	16		0	0	0	
HOUR TOTALS		9	25	0	1	0	0	
0700-0800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	8	18		3	0	0	
	D	7	53		5	0	1	
HOUR TOTALS		15	71	0	8	0	1	
0800-0900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	7	19		4	1	0	
	D	7	64		5	0	0	
HOUR TOTALS		14	83	0	9	1	0	
0900-1000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	16	36		5	0	0	
	D	9	148		4	5	0	
HOUR TOTALS		25	184	0	9	5	0	
1000-1100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	18	42		3	0	0	
	D	11	106		2	1	2	
HOUR TOTALS		29	148	0	5	1	2	
1100-1200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	27	63		7	1	1	
	D	27	182		3	3	2	
HOUR TOTALS		54	245	0	10	4	3	
1200-1300	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	17	90		8	2	0	
	D	29	281		5	0	2	
HOUR TOTALS		46	371	0	13	2	2	
1300-1400	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	26	69		5	4	2	
	D	13	273		12	4	4	
HOUR TOTALS		39	342	0	17	8	6	
1400-1500	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	21	48		3	2	0	
	D	23	284		7	2	4	
HOUR TOTALS		44	332	0	10	4	4	
1500-1600	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	19	54		5	0	0	
	D	17	207		5	1	2	
HOUR TOTALS		36	261	0	10	1	2	
1600-1700	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	12	58		11	1	0	
	D	18	200		8	0	1	
HOUR TOTALS		30	258	0	19	1	1	
1700-1800	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	31	91		3	2	0	
	D	17	253		7	3	4	
HOUR TOTALS		48	344	0	10	5	4	
1800-1900	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	21	88		13	0	0	
	D	20	319		9	1	2	
HOUR TOTALS		41	407	0	22	1	2	
1900-2000	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	13	93		22	0	0	
	D	17	288		8	2	0	
HOUR TOTALS		30	381	0	30	2	0	
2000-2100	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	3	46		6	0	0	
	D	10	152		6	3	0	
HOUR TOTALS		13	198	0	12	3	0	
2100-2200	A	0	0		0	0	0	
	B	0	0		0	0	0	
	C	10	45		10	0	0	
	D	11	128		4	1	0	
HOUR TOTALS		21	173	0	14	1	0	

Tehama / Market	Summary	Ped Total: 4224
		Veh Total: 3174
BEFORE	Weekday: 5-Day Total	Conflict Total 307
	Total Hrs: 80	Violation Total: 338
	Conditions:	Extra Push Total: 188

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	11		6	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	16	23		4	0	1	
HOUR TOTALS		16	34	0	10	1	1	
0700-0800	A	0	16		5	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	96	73		7	5	12	
HOUR TOTALS		96	89	0	12	5	12	
0800-0900	A	0	39		10	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	105	99		11	7	7	
HOUR TOTALS		105	138	0	21	7	7	
0900-1000	A	0	31		8	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	154	158		14	10	18	
HOUR TOTALS		154	189	0	22	13	18	
1000-1100	A	0	52		9	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	186	162		11	6	15	
HOUR TOTALS		186	214	0	20	9	15	
1100-1200	A	0	81		11	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	268	280		17	12	25	
HOUR TOTALS		268	361	0	28	15	25	
1200-1300	A	0	119		14	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	370	384		23	35	37	
HOUR TOTALS		370	503	0	37	37	37	
1300-1400	A	0	105		16	6	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	320	348		19	18	36	
HOUR TOTALS		320	453	0	35	24	36	
1400-1500	A	0	78		7	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	255	289		25	17	29	
HOUR TOTALS		255	367	0	32	18	29	
1500-1600	A	0	69		12	6	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	262	290		18	11	27	
HOUR TOTALS		262	359	0	30	17	27	
1600-1700	A	0	65		6	4	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	256	290		22	15	26	
HOUR TOTALS		256	355	0	28	19	26	
1700-1800	A	0	83		10	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	262	347		23	16	21	
HOUR TOTALS		262	430	0	33	18	21	
1800-1900	A	0	53		8	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	217	427		26	10	15	
HOUR TOTALS		217	480	0	34	10	15	
1900-2000	A	0	78		11	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	200	466		43	11	18	
HOUR TOTALS		200	544	0	54	12	18	
2000-2100	A	0	66		11	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	122	376		36	7	11	
HOUR TOTALS		122	442	0	47	10	11	
2100-2200	A	0	40		11	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	85	212		39	8	9	
HOUR TOTALS		85	252	0	50	8	9	

Tehama / Market	Summary	Ped Total: 3971
		Veh Total: 3163
AFTER	Weekday: 5-Day Total	Conflict Total 225
	Total Hrs: 80	Violation Total: 209
	Conditions:	Extra Push Total: 100

HOUR	CROSSWALK	# VEH.	# PED.	# PED ACTIVATIONS	# PED VIOLATIONS	EXTRA BUTTON PUSHES	# CONFLICT	COMMENTS
0600-0700	A	0	6		1	0	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	13	21		4	0	1	
HOUR TOTALS		13	27	0	5	0	1	
0700-0800	A	0	10		4	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	85	50		4	4	7	
HOUR TOTALS		85	60	0	8	5	7	
0800-0900	A	0	29		3	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	121	85		7	4	5	
HOUR TOTALS		121	114	0	10	7	5	
0900-1000	A	0	41		7	4	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	131	151		15	9	9	
HOUR TOTALS		131	192	0	22	13	9	
1000-1100	A	0	43		4	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	173	180		11	11	13	
HOUR TOTALS		173	223	0	15	13	13	
1100-1200	A	0	78		5	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	270	321		11	6	18	
HOUR TOTALS		270	399	0	16	8	18	
1200-1300	A	0	146		13	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	326	408		19	11	24	
HOUR TOTALS		326	554	0	32	13	24	
1300-1400	A	0	126		5	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	360	362		9	8	31	
HOUR TOTALS		360	488	0	14	10	31	
1400-1500	A	0	71		7	3	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	294	292		14	11	27	
HOUR TOTALS		294	363	0	21	14	27	
1500-1600	A	0	106		5	4	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	328	343		18	10	28	
HOUR TOTALS		328	449	0	23	14	28	
1600-1700	A	0	50		5	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	260	269		15	8	19	
HOUR TOTALS		260	319	0	20	9	19	
1700-1800	A	0	59		8	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	254	268		10	6	20	
HOUR TOTALS		254	327	0	18	7	20	
1800-1900	A	0	91		8	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	214	367		17	2	9	
HOUR TOTALS		214	458	0	25	4	9	
1900-2000	A	0	84		10	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	180	361		14	7	5	
HOUR TOTALS		180	445	0	24	8	5	
2000-2100	A	0	17		4	2	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	83	242		23	2	3	
HOUR TOTALS		83	259	0	27	4	3	
2100-2200	A	0	66		8	1	0	
	B	0	0		0	0	0	
	C	0	0		0	0	0	
	D	71	251		18	1	6	
HOUR TOTALS		71	317	0	26	2	6	