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Long-Term Effect of Photo Enforcement-Based Education on Vehicle Driver Behavior at a Highway-Rail Grade Crossing

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13. ABSTRACT (Maximum 200 words)

The Volpe Center evaluated the long-term effectiveness of the use of photo enforcement for driver education at the East Princeton Street grade crossing in Orlando, FL (Crossing ID 622173H). The goal of the photo enforcement-based driver education program is to reduce the number of vehicles that commit grade crossing warning device violations, thus reducing the possibility of getting struck by an oncoming train. A before-and-after design was used to evaluate the effectiveness of the photo enforcement program on drivers' compliance of the grade crossing warning devices. Grade crossing warning device violations were collected for 14 continuous days before the implementation of the photo enforcement program from April 14, 2016 to April 27, 2016. The signage and photo enforcement system were installed on August 8, 2016, and the city of Orlando started issuing violation notices on August 11, 2016. Twenty months after the implementation of the photo enforcement system, grade crossing warning device violations were then again collected for 14 continuous days from April 12, 2018 to April 25, 2018. The average hourly rate of violations per activation decreased from 6.0296 before to 4.9916, resulting in a 17.2 percent reduction, after the photo enforcement program was implemented.

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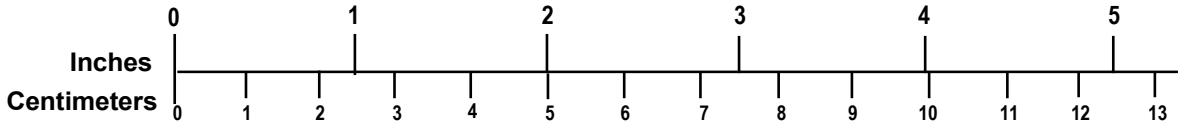

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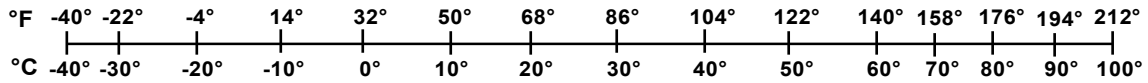

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Executive Summary

The John A. Volpe National Transportation Systems Center (Volpe Center) was tasked by the Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T) with evaluating the effectiveness of the use of photo enforcement for driver education at the East Princeton Street grade crossing in Orlando, FL (Crossing ID 622173H). The photo enforcement-based driver education program was centered on the City of Orlando sending warning notices to registered owners of vehicles who violate grade crossing active warning devices. The goal of this program was to reduce the number of vehicles that commit grade crossing active warning device violations, thus reducing the possibility of getting struck by an oncoming train. Although using photo enforcement technology, this is ultimately a grade crossing safety driver education program.

The Volpe Center demonstrated this pilot program, using photo enforcement technology, at the East Princeton Street grade crossing. The automated photo enforcement system at that crossing was a turnkey portable system that consisted of a battery bank in a lower enclosure, a pole, and an upper enclosure housing all of the cameras and sensors. The system detected violations from the time gates started to descend. The crossing was also fitted with photo enforcement signage.

The Volpe Center evaluated the short-term effectiveness 8 months after the implementation of the photo enforcement-based driver education program. The results from that research study were detailed in a technical report titled "Effects of Photo Enforcement-Based Education on Vehicle Driver Behavior at a Highway-Rail Grade Crossing." [1] According to that study, the photo enforcement-based driver education program was successful in reducing number of vehicles that violate grade crossing active warning devices.

The Volpe Center wanted to determine if the photo enforcement–based driver education program was still effective in reducing the number of vehicles that commit grade crossing active warning devices 20 months after the implementation. Results indicated that the photo enforcement-based driver education program was still effective in reducing number of vehicles that violate grade crossing active warning devices.

The Volpe Center used a before-and-after design to evaluate the effectiveness of the photo enforcement program on drivers' compliance of the grade crossing warning devices. Researchers collected grade crossing warning device violations for 14 continuous days before the implementation of the photo enforcement program, from April 14, 2016 to April 27, 2016. The City of Orlando installed the signage and the photo enforcement system on August 8, 2016 and started issuing violation notices on August 11, 2016. For the short-term evaluation, the Center collected grade crossing warning device violations eight months after the implementation for 14 continuous days, from April 13, 2017 to April 26, 2017. For the long-term evaluation, grade crossing warning device violations were collected 20 months after the implementation for 14 continuous days, from April 12, 2018 to April 25, 2018. Vehicles that violated grade crossing warning devices were coded as having committed one of four violation types: entering the crossing during flashing lights phase (Type I), entering the crossing during descending gate phase (Type II), entering the crossing during horizontal gate phase (Type III), and entering the crossing during gate ascend phase (Type IV).

Results indicate that the implementation of the photo enforcement-based education program reduced the overall violation rate by 17.2 percent during the long-term (Phase 3) and by 15.4 percent during the short-term (Phase 2) evaluation period. Additionally, all four violation types also experienced a reduction in violation rate during both the short- and long-term evaluation periods after the implementation. Type I violation rate was reduced by 10.7 percent during long-term compared to 13.9 percent during short-term, Type II violation rate was reduced by 8.8 percent during long-term compared to 13.5 percent during short-term, and Type IV violation rate was reduced by 20.3 percent during long-term compared to 16.1 percent during short-term. A total of two Type III violations took place over all three phases, one each during Phase 1 and Phase 2 and none during Phase 3.

Part of this research study included analyzing information about driver behavior at the crossing (e.g., human factors contributing to the failure to yield at the crossing). The City, in collaboration with FRA and the Volpe Center, created and distributed a survey to gather this information. Out of the total 2,958 violation notices sent out, the City received 333 (11.3 percent) survey responses back. The respondents ranged in age from 16 to 88 years old and consisted of 53.8 percent male, 39.0 percent female, and 7.2 percent that did not provide gender data. The survey results show that 40 percent of the responding violators understood the photo enforcement sign at the crossing while 53 percent indicated that they did not see the sign. In response to why they drove through the crossing when the warning devices were activated, a significant number of the respondents (42 percent) indicated that they did not see the activated signals. The full results of the survey responses are contained in Appendix D and Appendix E.

1. Introduction

The U.S. Department of Transportation DOT) John A. Volpe National Transportation Systems Center (Volpe Center) provides technical support to Federal Railroad Administration's (FRA) Office of Research, Development and Technology (RD&T) in the area of railroad infrastructure research. This support includes key research associated with all aspects of highway-rail grade crossing safety and rail right-of-way (ROW) trespass prevention. One major effort is to develop a more precise understanding of the risks presented by highway-rail grade crossings and then determine how best to mitigate (i.e., decrease or eliminate) the risks. This report presents the findings of a study on the long-term impact of a photo enforcement-based driver education program on driver compliance with active warning devices at highway-rail grade crossings.

1.1 Background

According to the FRA Highway-Rail Grade Crossing Inventory database, nearly 54 percent of all public at-grade crossings are equipped with active warning devices (gates and/or flashing lights). Incidents at active crossings make up a significant percentage of the overall number of grade crossing incidents, despite being protected by active warning devices alerting motorists to the presence of oncoming trains. Of the total 1,838 incidents at public grade crossing in 2017, approximately 70 percent (1,272) occurred at crossings equipped with active warning devices. [2]

In order to improve motorists' compliance of grade crossing warning devices, the City of Orlando initiated a driver education program centered on sending warning notices to registered owners of vehicles who violate grade crossing warning devices. This pilot program, using photo enforcement technology, was demonstrated at the East Princeton Street grade crossing (Crossing ID 622173H). The Volpe Center, in support of FRA RD&T, evaluated the short-term effectiveness of the photo enforcement-based education in reducing the number of vehicles that violate grade crossing warning devices, thus reducing the possibility of getting struck by an oncoming train. The short-term effectiveness was evaluated 8 months after the implementation of the photo enforcement system. The results from that research study are documented in a technical report titled "Effect of Photo Enforcement-Based Education on Vehicle Driver Behavior at a Highway-Rail Grade Crossing" [1]. The focus of this report is the analysis of photo enforcement-based education in reducing the number of vehicles that violate grade crossing active warning devices 20 months after the implementation of the program.

1.2 Objectives

This second study on the photo enforcement-based driver education program had two objectives. The first was to determine whether the photo enforcement-based driver education program was still successful in reducing the number of vehicles that violate grade crossing active warning devices 20 months after implementation. The second was to compare the results of the long-term evaluation to the results of the short-term evaluation.

1.3 Overall Approach

To understand the long-term effectiveness of the photo enforcement-based driver education program, the Volpe Center collected violations of the grade crossing active warning devices

before and 20 months after implementation. Four different types of violations were coded for 14 continuous days before the installation and then again approximately 20 months after the installation and operation of the photo enforcement system. The Center then analyzed the violations to measure the long-term effectiveness of the program. Data collection and analysis methods employed in this research study were the same as those used during the original study.

1.4 Scope

The scope of this study was for the Volpe Center to monitor the East Princeton Street grade crossing for violations of grade crossing active warning devices involving motor vehicles. The project team analyzed the violations data to evaluate the effectiveness of the photo enforcement-based driver education program at the crossing. The team installed photo enforcement signage on both directions of traffic but only the westbound direction was monitored with the photo enforcement system.

1.5 Organization of the Report

This report is organized as follows:

- Section 2 provides an overview of the test site location, data collection activities, Orlando Photo Enforcement-Based Education program, and results from the original study.
- Section 3 presents descriptive statistics of the violation notices, including results of survey questions.
- Section 4 presents findings of the long-term evaluation.
- Section 5 presents the conclusion of the study.

2. Previous Work

FRA RD&T tasked the Volpe Center with evaluating the effectiveness of the use of photo enforcement for driver education at the East Princeton Street grade crossing in Orlando, FL (Crossing ID 622173H). This research study was initiated in April 2016. Results of the initial part of the study, which contain a comparative analysis of driver behavior before and shortly after the implementation of the photo enforcement program, are documented in a technical report titled "Effect of Photo Enforcement-Based Education on Vehicle Driver Behavior at a Highway-Rail Grade Crossing" [1]. The results are also summarized below.

2.1 Photo Enforcement Program

Orlando has implemented a red light camera enforcement system, Orlando STOPS, at many of its most dangerous signalized intersections to help prevent motor vehicle collision due to red light-running violations. [3] Currently the City has 24 intersections fitted with red light camera systems.

To improve compliance with the grade crossing warning devices, Orlando also decided to install photo enforcement systems at up to six grade crossings. The goal of the photo enforcement-based driver education program was to reduce the number of vehicles that commit grade crossing active warning device violations, thus reducing the possibility of getting struck by an oncoming train.

The six crossings considered for photo enforcement are listed below:

- W. Central Blvd. between Orange Ave. and Garland Ave. – Crossing ID 622189E
- W. Colonial Dr. between Orange Ave. and Garland Ave. – Crossing ID 622181A
- W. South St. between Garland Ave. and Boon St. – Crossing ID 622192M
- E. Princeton St. between Orange Ave. and Alden Rd. – Crossing ID 622173H
- W. Michigan St. between Division Ave. and Kunze Ave. – Crossing ID 622307E
- W. Robinson St. between Orange Ave. and State Ln. – Crossing ID 622186J

This pilot program, using photo enforcement technology, was demonstrated at the East Princeton Street grade crossing. Unlike red light violators, who receive actual citations with fines, the City decided to send out warning notices along with education materials and survey questions to registered owners of the vehicles that violated the grade crossing warning devices. This program, although using photo enforcement technology, is ultimately a grade crossing safety driver education program.

2.2 Test Site Location Characteristics

The site chosen by the City for this effort was the grade crossing on East Princeton Street in Orlando, FL (Crossing ID 622173H). The SunRail Florida Hospital Health Village station is adjacent to the crossing on the north side of the crossing, as shown in Figure 1.

The East Princeton Street grade crossing is located at milepost 787.99 of the Sanford subdivision. There are two active railroad tracks that intersect East Princeton Street and run in a north/south direction. According to DOT Grade Crossing Inventory data, the estimated annual average daily traffic (AADT) at this crossing was 7,800 in 2008, with a posted speed limit of 30 mph. The crossing is on the SunRail commuter rail line and has both passenger (SunRail and Amtrak) and freight (CSX) trains that pass through the crossing at speeds ranging from 20 to 25 mph. During the three data collection periods for this study, an average of 42 trains passed though the crossing daily on weekdays and 9 trains passed through the crossing daily on weekends. (SunRail does not operate on weekends.) The crossing is equipped with two long vehicle gates, four pedestrian gates, seven sets of mast-mounted flashers and four sets of cantilever-mounted flashers.

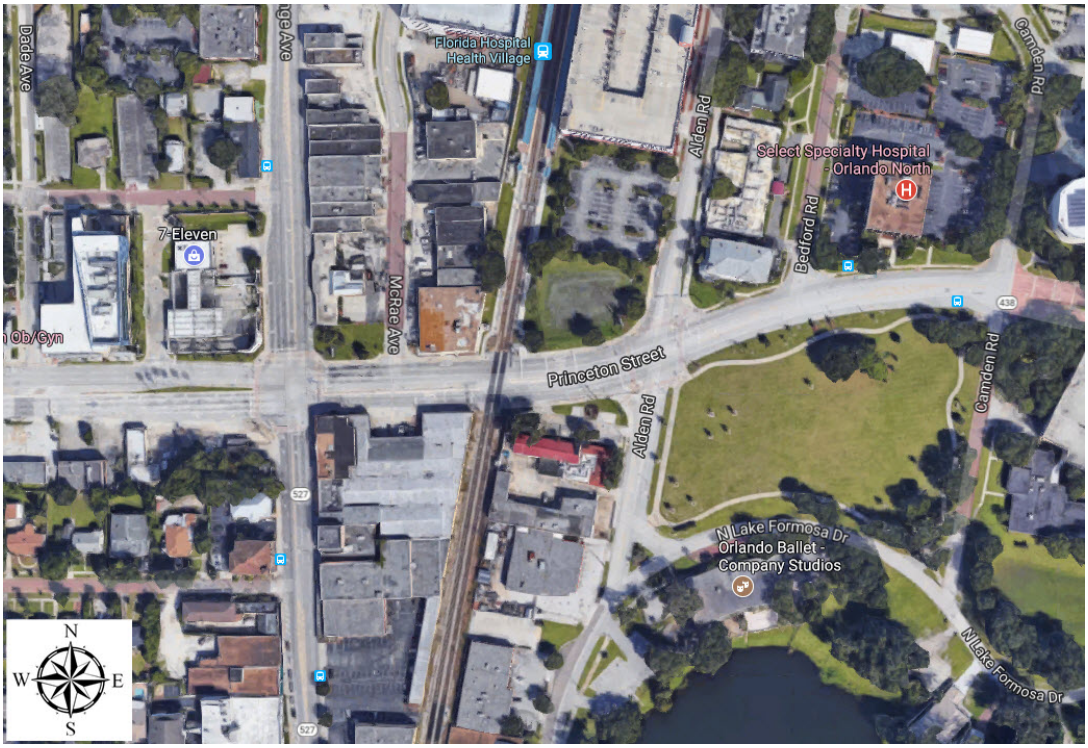


Figure 1. East Princeton Street Grade Crossing Satellite Image

2.2.1 Westbound

There are three lanes of traffic that intersect the crossing in the westbound direction. The innermost lane (lane 3) splits into two lanes immediately after the crossing with the innermost lane becoming a left-turn-only lane onto North Orange Avenue. The signalized intersection at North Orange Avenue is located approximately 260 feet west of the crossing. The traffic lights at the intersection are interconnected (advanced preemption) with the crossing signals allowing

traffic to clear the crossing during an activation. Figure 2 shows the five lanes that intersect with the crossing and Figure 3 shows a Google street view on approach to the crossing in the westbound direction.

Figure 2. Lane Coding Scheme for East Princeton Street Grade Crossing

Figure 3. A Google Street View of the Crossing in the Westbound Direction

2.2.2 Eastbound

There are two lanes of traffic that intersect the crossing in the eastbound direction. Figure 4 shows Google street view on approach to the crossing in the eastbound direction. The innermost lane (lane 2) splits into two lanes immediately after the crossing, with one lane becoming a left-turn-only lane onto Alden Road. This road is the entrance to the SunRail Florida hospital located adjacent to the crossing on the northeast corner. The signalized intersection at Alden Road is located approximately 185 feet east of the crossing. The traffic lights at the intersection are interconnected (advanced preemption) with the crossing signals allowing traffic to clear the crossing during an activation.

Figure 4. A Google Street View of the Crossing in the Eastbound Direction

2.3 Data Collection

A video-based data collection system consisting of a solar panel, a camera, and a digital video recorder along with supporting hardware contained in a utility box was used to collect video of vehicles travelling in both directions at the East Princeton Street grade crossing. Figure 5 shows pictures of the data collection system installed at the East Princeton Street grade crossing.

Figure 5. Video Data Collection System at East Princeton Street

The video data collection equipment was mounted on a street light pole along East Princeton Street on the southeast side of the crossing, as shown in Figure 6 below. As can be seen, a single data collection system monitored both directions of vehicle traffic at the crossing. The data collection system was installed on April 14, 2016 and remains operational as of the date of this report.

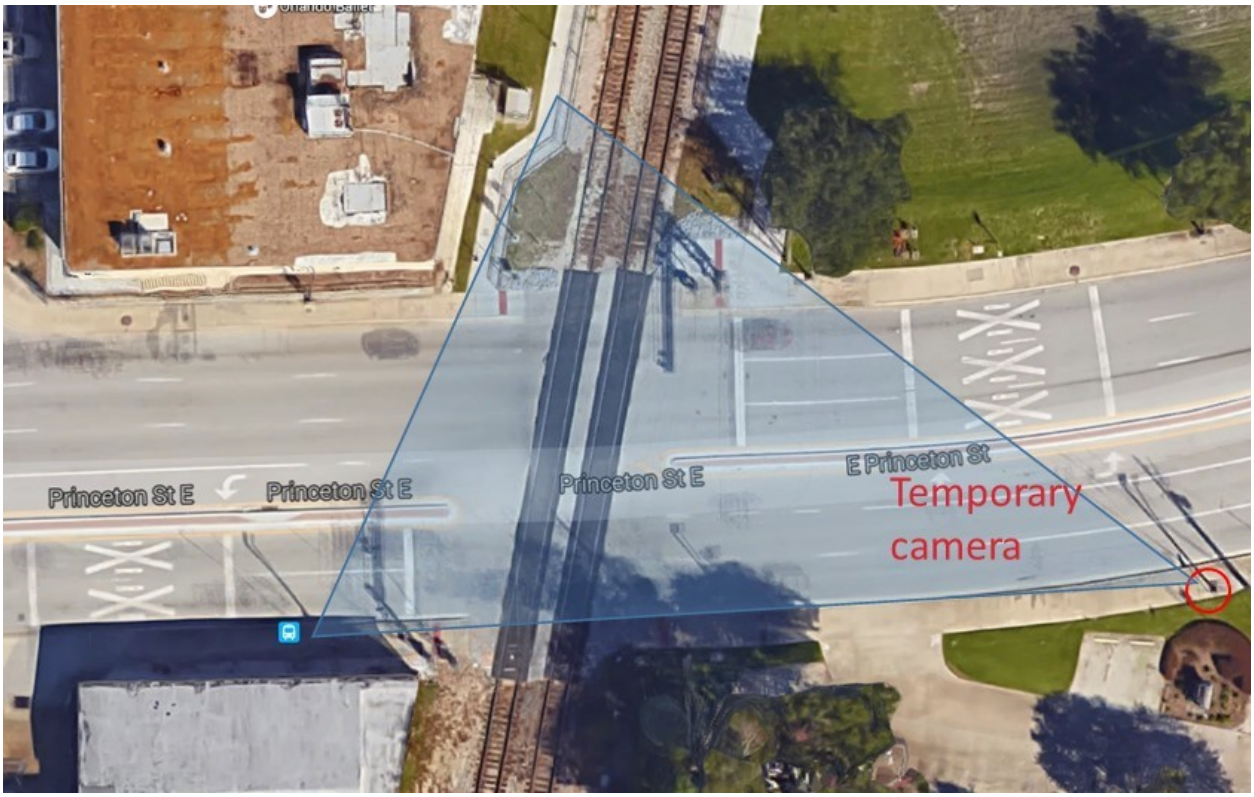


Figure 6. Camera Placement at East Princeton Street Grade Crossing

2.4 Overview of the East Princeton Street Photo Enforcement System

The system used for automated photo enforcement at the East Princeton street grade crossing was installed and operated by Sensys America, Inc. The system sits adjacent to the East Princeton Street sidewalk before the crossing in the westbound direction, approximately 130 feet from the crossing stop line. It is a turnkey portable system that consists of a battery bank in a lower enclosure, a pole, and an upper enclosure housing all of the cameras and sensors. The whole system weighs approximately 514 lbs and is approximately 44 inches tall. It was designed to be a self-contained and stand-alone system, not connected to the railroad signaling system, and temporarily installed off the roadway. The system was installed on August 8, 2016 and became operational on August 11, 2016.

The photo enforcement system captured violations for westbound traffic only. However, signage alerting drivers of the photo enforcement was installed for both directions of traffic. The signage for the westbound traffic was placed on an existing pole on the sidewalk located approximately 65 feet before the crossing stop line, and the signage for the eastbound traffic was placed on a pole on the sidewalk located approximately 45 feet before the crossing stop line. The signage was developed in collaboration with the City, FRA, and the Volpe Center. Images of the Sensys photo enforcement system and signage installation are shown in Figure 7 and Figure 8, respectively.

Figure 7. Photo Enforcement System at East Princeton Street

Figure 8. Photo Enforcement Signage at East Princeton Street

There are four types of violations a motorist can commit at a highway-rail grade crossing equipped with gates. These include:

- Type I: Vehicle traversed a crossing while lights were flashing but before gates started descending.
- Type II: Vehicle traversed a crossing while gates were descending.
- Type III: Vehicle traversed a crossing while gates were fully horizontal.
- Type IV: Vehicle traversed a crossing while gates were ascending.

Type III violations are the most risky, followed by Type II, Type I, and then Type IV. In Florida, all four types of violations are illegal. However, Orlando decided to only issue warning notices to registered owners of the vehicles that committed Type II violations. Type I and Type IV violations were not enforced because it would require a substantial amount of effort to include those types of violations. The project team's analysis of the East Princeton Street crossing showed that approximately 87 percent of the vehicles that arrive at the crossing during the flashing lights period committed a Type I violation, and approximately 90 percent of the lead vehicles that had stopped at the crossing during an activation committed ascending gate (Type IV) violations. Type III violations at this crossing are almost impossible as it would require a driver to break the horizontal gate which covers the entire roadway. The median separating the direction of traffic also makes it difficult to go around the horizontal gates.

The photo enforcement system at the East Princeton street grade crossing is activated when a vehicle fails to stop before traversing the crossing during the gate-descend phase, resulting in a Type II violation. Several photos and video recordings of the violation are captured by the system and uploaded onto a secure password-protected website. A City staffer then reviews the video and determines whether to issue a warning notice to the vehicle owner. The warning notice looks very similar to an actual citation sent out by the City for red light violations but states very clearly that it is just a warning notice, and the owner is not required to pay any fines or go to court. The warning notice is accompanied by education materials about safe driving tips at grade crossings and a short survey. A copy of the warning notice, education materials, and survey questions are shown in Appendix A, Appendix B, and Appendix C, respectively.

2.5 Short-Term Results

The Volpe Center used a before-and-after design to evaluate the effectiveness of the photo enforcement program on drivers' compliance. Grade crossing warning device violations were collected for 14 continuous days before the implementation of the photo enforcement program from April 14, 2016 to April 27, 2016 (Phase 1). The signage and the photo enforcement system were installed on August 8, 2016 and the City of Orlando started issuing violation notices on August 11, 2016. Eight months after the implementation of the photo enforcement system, grade crossing warning device violations were again collected for 14 continuous days from April 13, 2017 to April 26, 2017 (Phase 2).

A total of 1,310 activations (584 pre-installation and 726 post-installation) were recorded over the 4-week data collection period. From the 1,310 activations, a total of 8,060 violations were coded. A total of 3,941 were coded prior to the implementation and 4,119 were coded after the implementation of the photo enforcement-based education program.

The photo enforcement-based driver education program was effective at changing driver behavior around the East Princeton Street grade crossing. The average hourly rate of violations per activation decreased from 6.0296 before to 5.1004 after the photo enforcement program was implemented—a 15.4 percent reduction. The average hourly rate of violations per activation was calculated by dividing the violation counts for each one hour period by the associated number of activations. Additionally, all four violation types saw lower violation rates after implementation. The average hourly rate of violations per activation during the flashing lights phase decreased by 13.9 percent, from 1.473 to 1.269; the average hourly rate of violations per activation during the descending gate phase decreased by 13.5 percent, from 0.383 to 0.331; the average hourly rate of violations per activation during the horizontal gate phase decreased by 100 percent, from 0.001 to 0; and the average hourly rate of violations per activation during the ascending gate phase decreased by 16.1 percent, from 4.173 to 3.501. These changes in average hourly rate of violations per activation can be seen graphically in Figure 9.

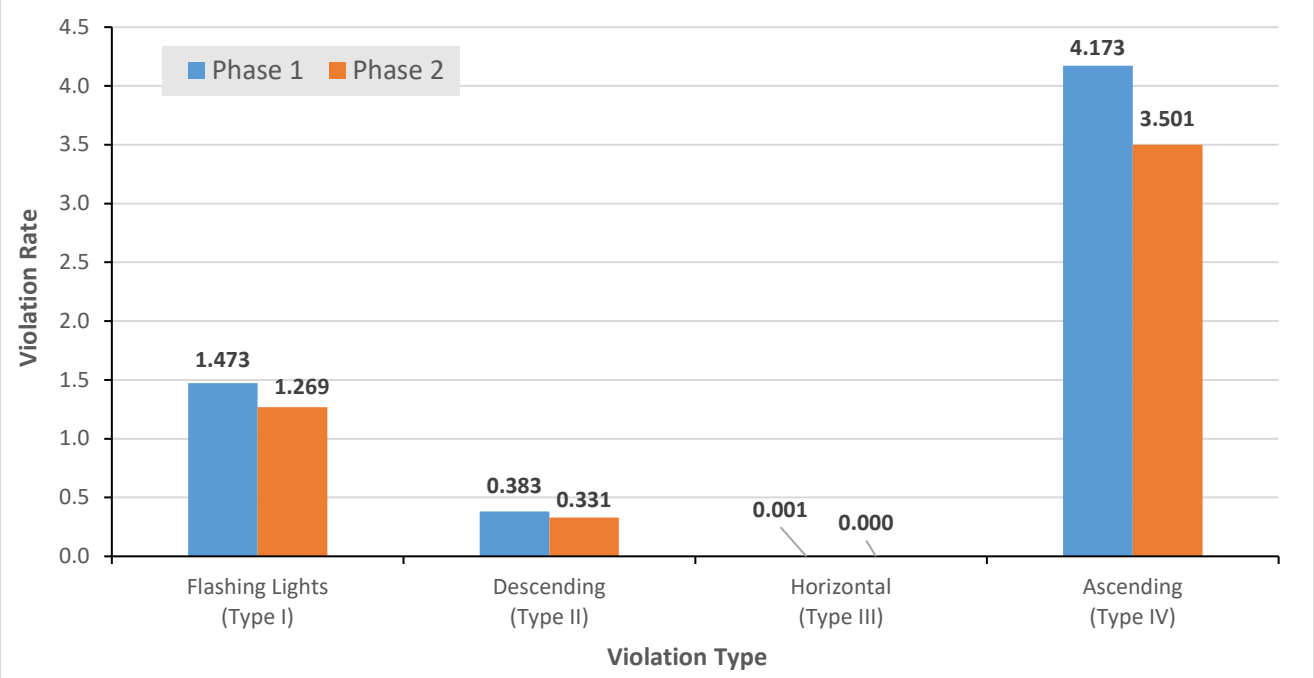


Figure 9. Violation Rate by Violation Type in Phase 1 and Phase 2

The short-term results are documented in the previously referenced technical report [1].

3. Analysis of Violation Notices

This section presents general statistics on 2,958 violation notices sent out by the City to vehicle owners who committed descending gate violations at the East Princeton Street grade crossing. The City started issuing the violation notices on August 11, 2016 and is still currently issuing violation notices at the same crossing at the time of this report. The 2,958 violation notices were issued over more than a 2-year period from August 11, 2016 to December 31, 2018. The following variables are included in each violation notice:

- Date and time when the violation occurred
- Citation number of the violation
- Plate number of the vehicle that committed the violation
- Vehicle speed at the time of the violation
- ZIP code of the registered owner of the vehicle that committed the violation
- Age of the registered owner of the vehicle that committed the violation
- Gender of the registered owner of the vehicle that committed the violation
- Name of the city employee that approved the violation
- Violation approval date

The City provided non-personally identifiable information (PII) data to the research staff for this analysis.

Violation by Month: Table 1 and Figure 10 show the distribution of 2,958 violation notices by month. As mentioned earlier, the City started issuing the violation notice on August 11, 2016, therefore the violation count for August 2016 is only for part of that month starting from August 11 to August 31, 2016. As can be seen, the number of violation notices issued per month ranged from 46 in December 2018 to 202 in August 2018.

Table 1. Violation Notices Issued by Month (8/11/2016 to 12/31/2018)

Month	2016	2017	2018	Average
January	***	120	98	109.0
February	***	53	105	79.0
March	***	58	90	74.0
April	***	136	130	133.0
May	***	94	116	105.0
June	***	131	175	153.0
July	***	77	117	97.0

Month	2016	2017	2018	Average
August[1]	122	111	202	145.0
September	119	53	156	109.3
October	76	80	73	76.3
November	86	100	66	84.0
December	84	84	46	71.3

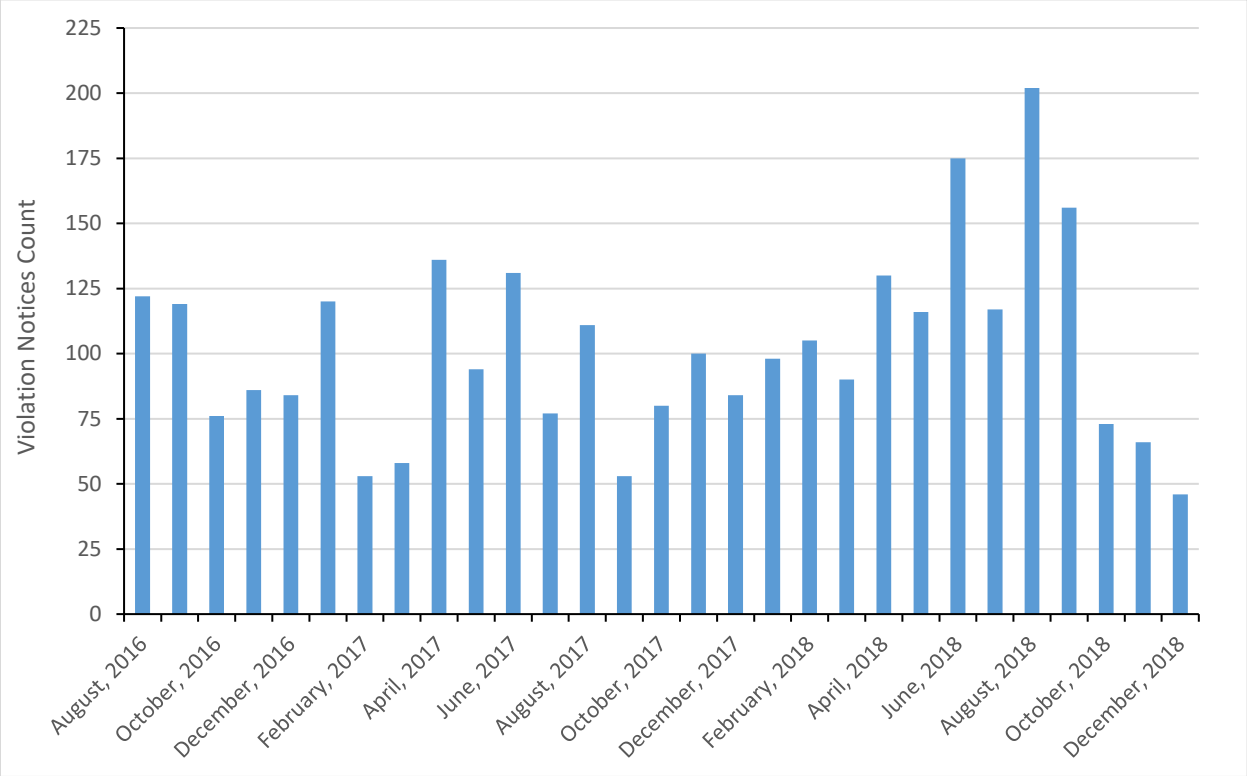


Figure 10. Violation Notices Issued by Month (8/11/2016 to 12/31/2018)

Repeat Crossing Warning Offenders: During the study period, 4.06 percent of the violation notices were issued to 58 repeat offenders. Fifty-four repeat offenders committed two violations and four repeat offender committed three violations during the study period. Repeat violators were determined by matching vehicle license plates. Table 2 shows the distribution of the repeat grade crossing warning device offenders. Of the 58 total repeat offenders, 25 were female, 24 were male, and 9 did not submit gender data. The repeat offender ages ranged from 23 to 78 years old with an average age of 45.67. The average speed at the time of violation for repeat offenders were slightly higher, at 23.09 mph, compared to 22.08 mph for all offenders.

[1] August, 2016 is only for partial month as the City started issuing the violation notice on August 11, 2016.

Table 2. Grade Crossing Warning Devices—Repeat Violators

No. of Repeated Offenses	No. of Repeat Offenders (via vehicle plate matching)	Repeat Offenders vs. Total No. of Violators	No. of Xing Violation Records	Repeat Violation Records vs. Total Violation Records
2	54	1.86%	108	3.65%
3	4	0.14%	12	0.41%
Total	58	2.00%	120	4.06%
Total Number of Crossing Violations				2,958
Number of Violators with 1 Crossing Violation				2,838
Total Number of Violators				2,896
Percent of Violators with 1 Crossing Violation				95.94%

3.1 Survey Results

Part of this research study included analyzing information about driver behavior at the crossing (e.g., human factors contributing to the failure to yield at the crossing). The City, in collaboration with FRA and the Volpe Center, created and distributed a survey to gather this information. A mail survey with a stamped return envelope was included with the violation notices sent out to the registered owners of the vehicles who committed violations at the East Princeton Street grade crossing. A link was also included with the violation notice in case the offender wanted to complete the survey online. The survey consisted of 10 multiple-choice questions, a question about the offender's gender and age, and a free form section for general comments. Appendix C shows the survey questions included with the violation notice.

Over more than two year period from August 11, 2016 to December 31, 2018, the City sent out 2,958 violation notices. It received 333 (11.3 percent) survey responses back; 330 via mail and 3 online. Of the total 333 survey respondents, 179 (53.8 percent) were male, 130 (39.0 percent) were female, and 24 (7.2 percent) did not provide gender data. The respondents ranged in age from 16 to 88 with an average age of 52.04.

One of the survey questions asked respondents to indicate whether they understood the photo enforcement sign at the railroad crossing. As discussed earlier, there was only one photo enforcement sign on the sidewalk side for each direction of traffic. The options for response included "Yes," "No," and "I did not see the sign." Of the 333 total respondents, 3 respondents did not provided any response, and 4 respondents selected more than one option. All four of them selected "No" and "I did not see the sign." Figure 11 shows the distribution of the responses to this survey question.

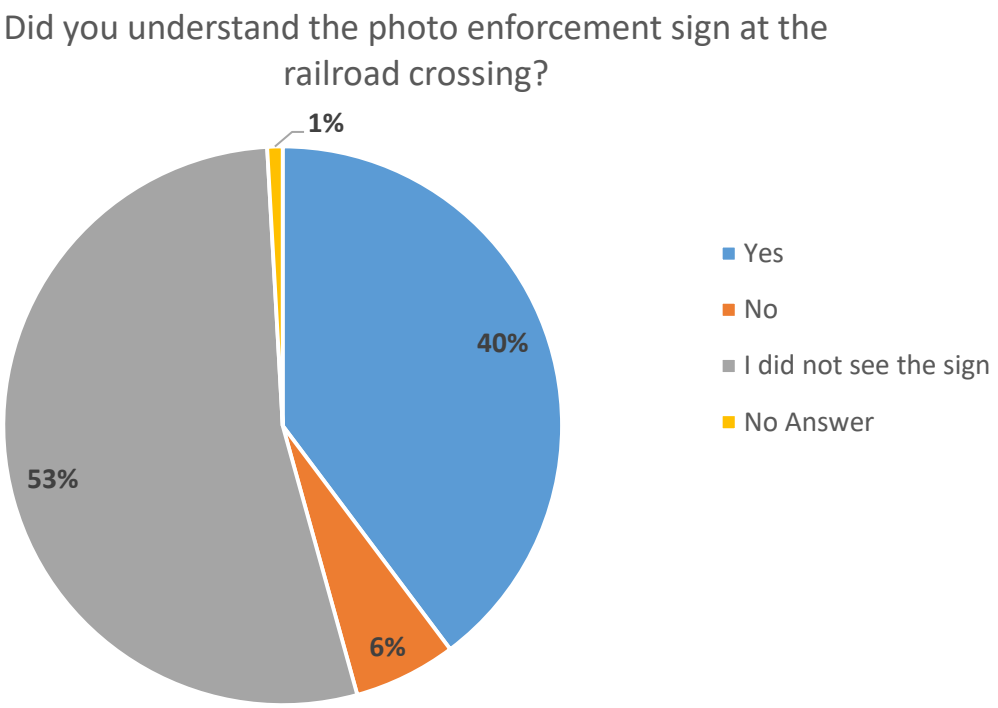


Figure 11. Survey Responses about the Photo Enforcement Sign at the Crossing

The respondents were also asked to indicate why they drove through the railroad crossing when the warning devices were activated. There were nine options for response and respondents were directed to select all options that applied. Of the 333 respondents, 7 did not provide any data and 63 selected at least 2 options. Table 3 shows the distribution of responses to this question.

Table 3. Survey Response for Why Offenders Drove through the Crossing during Activation

Response	Count	Percent of Total
I did not see the train	39	9%
I did not see the activated crossing signals (e.g., lights flashing, gate lowering)	139	42%
I felt I had enough time to get through	70	21%
I followed the car in front of me	27	8%
I felt the wait would be too long	7	2%
I was in a rush (e.g., late for an appointment)	17	5%
I was unfamiliar with the rules	28	8%

Response	Count	Percent of Total
Other	62	19%
I don't know	23	7%
No Answer	7	2%
Total	**419**	**100%**

The respondents were also asked to share any questions or comments about the East Princeton Street grade crossing or the survey. This was a free form question where respondents could write anything. Of the total 333 surveys received, 184 people provided comments. Most respondents expanded on a previous question about why they drove through the crossing during an activation. Responses were generally positive. Appendix D provides results of the remaining survey questions and Appendix E lists all 184 comments.

4. Long-Term Results

The goal of this research study was to determine whether the photo enforcement-based education program was still effective in increasing drivers' compliance of the grade crossing warning devices approximately 20 months after implementation.

The data analysis method employed in this research study was same as one used in the original research study. A before-and-after design was used to evaluate the effectiveness of the photo enforcement program on drivers' compliance with the grade crossing warning devices. Violations were collected for 14 continuous days before the implementation of the photo enforcement program from April 14, 2016 to April 27, 2016. The signage and the photo enforcement system were installed on August 8, 2016, and the City of Orlando started issuing violation notices on August 11, 2016. Twenty months after the implementation of the photo enforcement system, violations were again collected for 14 continuous days from April 12, 2018 to April 25, 2018. Since Orlando is a vacation destination and there is an influx of tourists during different times of the year, post-installation data was collected exactly 2 years apart to make sure that two data collection periods had exposure to a similar population set. Table 4 shows the data collection, photo enforcement system installation, and photo enforcement program schedule for the East Princeton Street grade crossing.

Table 4. Project Schedule

Phase	Description	Start Date	End Date	Total Days
Phase 1	Pre-installation	4/14/2016	4/27/2016	14 days
	Photo enforcement signage installation	8/8/2016	8/8/2016	1 day
	Photo enforcement system installation (westbound)	8/8/2016	8/8/2016	1 day
	Photo enforcement system operational (westbound)	8/11/2016	To date	
Phase 2	Eight months after installation	4/13/2017	4/26/2017	14 days
Phase 3	Twenty months after installation	4/12/2018	4/25/2018	14 days

A grade crossing warning device violation occurs when a motorist disregards an active warning device (flashing lights and gates) and traverses a grade crossing during an activation period. An activation period starts when the lights begin to flash and ends when the gates finish their ascent to a vertical position and the lights stop flashing. Violations were classified into four types: Type I, Type II, Type III, and Type IV. Descriptions of each violations are presented in Section 2.4.

Each activation was recorded as a unique event, regardless of whether or not a violation occurred. The time and lane of travel during a violation were recorded for Type I, II, and III violations. Almost all vehicles that were stopped behind the fully deployed gate committed Type IV violations. It would have been very time-consuming to record all Type IV violation details

(time, lane). Therefore, only the total number of vehicles that committed Type IV violations and the total number of lead vehicles that stopped during this phase were recorded.

4.1 Data Characteristics

A total of 1,994 activations (584 Phase 1, 726 Phase 2, and 684 Phase 3) were recorded over the 6-week data collection period. Figure 12 shows the distribution of activations by day of the week. As can be seen, the majority of the activations occurred during weekdays as opposed to weekends for all three phases (96 percent for Phase 1, 94 percent for Phase 2, and 92 percent for Phase 3). The SunRail commuter rail service, which accounts for the majority of the activations, does not operate on weekends.

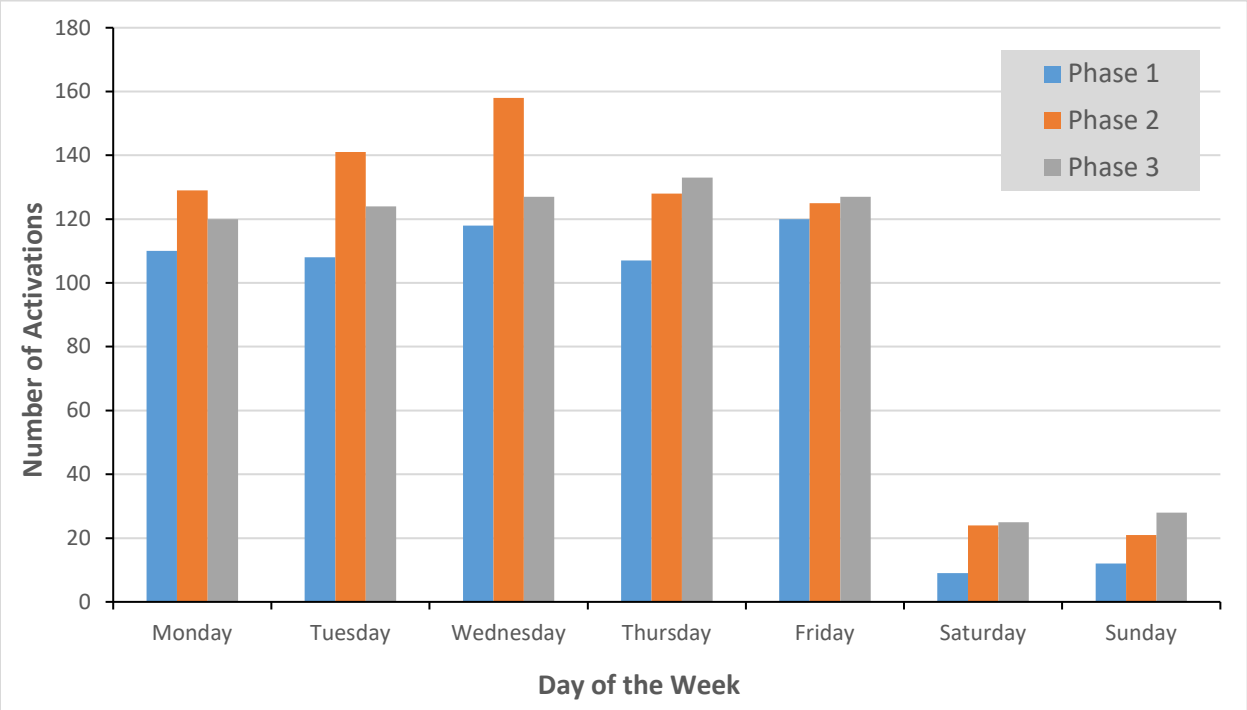


Figure 12. Distribution of Activations by Day of Week

Table 5 shows the distribution of activations by type of train for all three phases and for overall activations. Activations involving SunRail made up the majority of activations for all three phases (57.4 percent for Phase 1, 47.1 percent for Phase 2, and 55.1 percent for Phase 3), followed by activations with no train. A "no train" activation was defined as when the crossing warning devices are activated without train presence at the crossing. No train activations occurred most frequently immediately preceding activations for southbound SunRail trains. Southbound SunRail trains arriving at the nearby station (the Florida Hospital Health Village station) before traversing the crossing triggered a gate activation; however, this activation would "time out" after about 60 seconds if the train did not move.

Table 5. Distribution of Activations by Type of Train

	Phase 1	Phase 2	Phase 3	Total
SunRail	335 (57.4%)	342 (47.1%)	377 (55.1%)	1,054 (52.9%)
Amtrak	52 (8.9%)	52 (7.2%)	54 (7.9%)	158 (7.9%)
CSX	28 (4.8%)	60 (8.3%)	50 (7.3%)	138 (6.9%)
No Train	169 (28.9%)	255 (35.1%)	187 (27.3%)	611 (30.6%)
Maintenance	0 (0.0%)	17 (2.3%)	16 (2.3%)	33 (1.7%)
Total	584	726	684	1,994

4.2 Violation Counts and Rates

From the 1,994 activations, a total of 11,943 violations (all 4 types) were coded. A total of 3,941 were coded prior to the implementation, 4,119 were coded 8 months after the implementation, and 3,883 were coded 20 months after the implementation of the photo enforcement-based education program. Figure 13 shows the distribution of the 11,943 violations by day of the week for all 3 phases. As can be seen, there were generally more violations during the post-installation periods than during the pre-installation period. However when analyzed by violation rate, there were fewer violations per activation during the post-installation periods for all days of the week. Violation rates will be discussed later in this section.

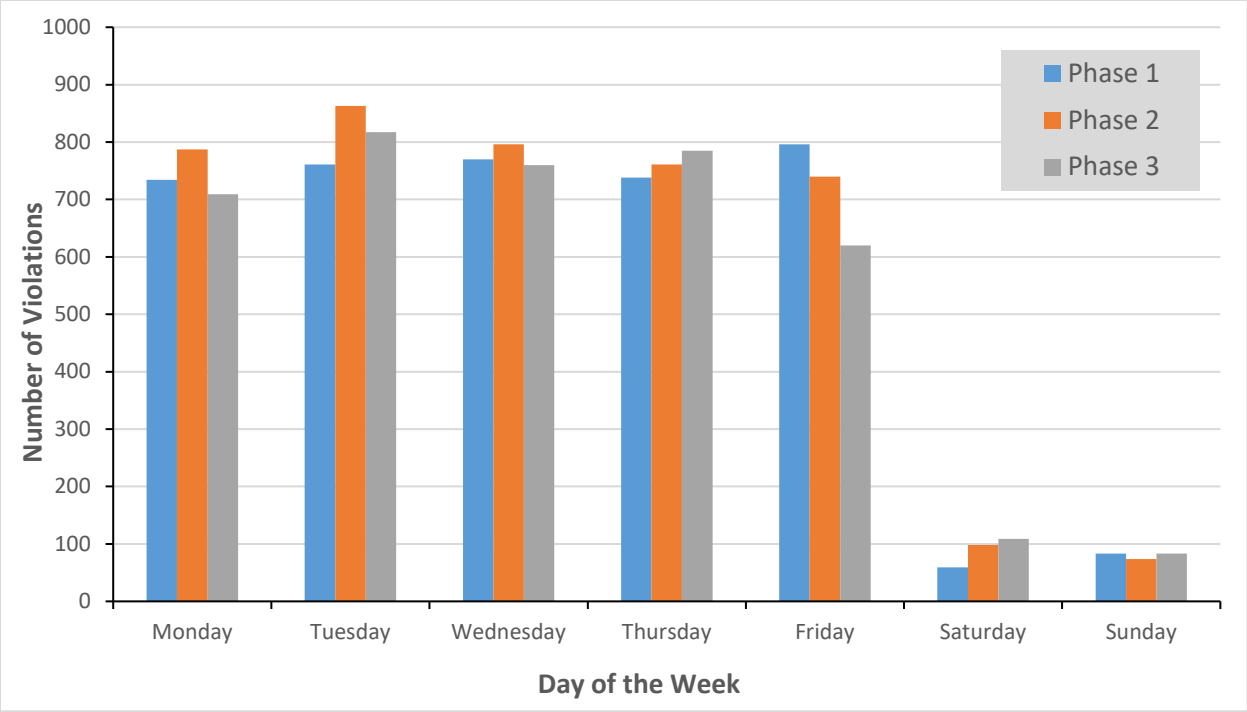


Figure 13. Distribution of Violations by Day of the Week

Figure 14 shows the distribution of the 11,943 violations by time of the day for all three phases. As expected, the trend showed that the violations occurred most during morning rush hours from 7:00 a.m. to 9:00 a.m. and during afternoon rush hours from 4:00 p.m. to 7:00 p.m.

To evaluate the effectiveness of the photo enforcement program on driver compliance of grade crossing warning devices, violation counts were normalized on an hour-by-hour basis over each data collection period. Activations and violations counts were summed for each 1-hour period for all three phases. This means the initial sample was 336 hours for each data collection period (14 days multiplied by 24 hours). Hours of the day with zero activations were treated as missing data. After removing hours with zero activations, the sample was 206 hours for Phase 1, 237 hours for Phase 2, and 245 hours for Phase 3.

The average hourly rate of violations per activation was calculated by dividing the violation counts for each 1-hour period by the associated number of activations. Table 6 shows violation counts and rates for all three phases along with the percent reduction for each category. The short-term effectiveness of the photo enforcement program showed a significant change (improvement) in driver compliance with the warning devices. A paired t-test showed a significant difference from Phase 1 to Phase 2 ($t(205) = 4.18$, $p<0.05$). The average hourly rate of violations per activation were reduced by 15.41 percent, from 6.0296 before (Phase 1) to 5.1004 8 months after the installation (Phase 2).

Approximately 20 months after the implementation of the photo enforcement program (Phase 3), it was still effective in changing driver compliance. A paired t-test showed a significant difference from Phase 1 to Phase 3 ($t(205) = 4.56$, $p<0.05$). The average hourly rate of violations per activation were reduced by 17.22 percent, from 6.0296 before (Phase 1) to 4.9916 20 months after the installation (Phase 3).

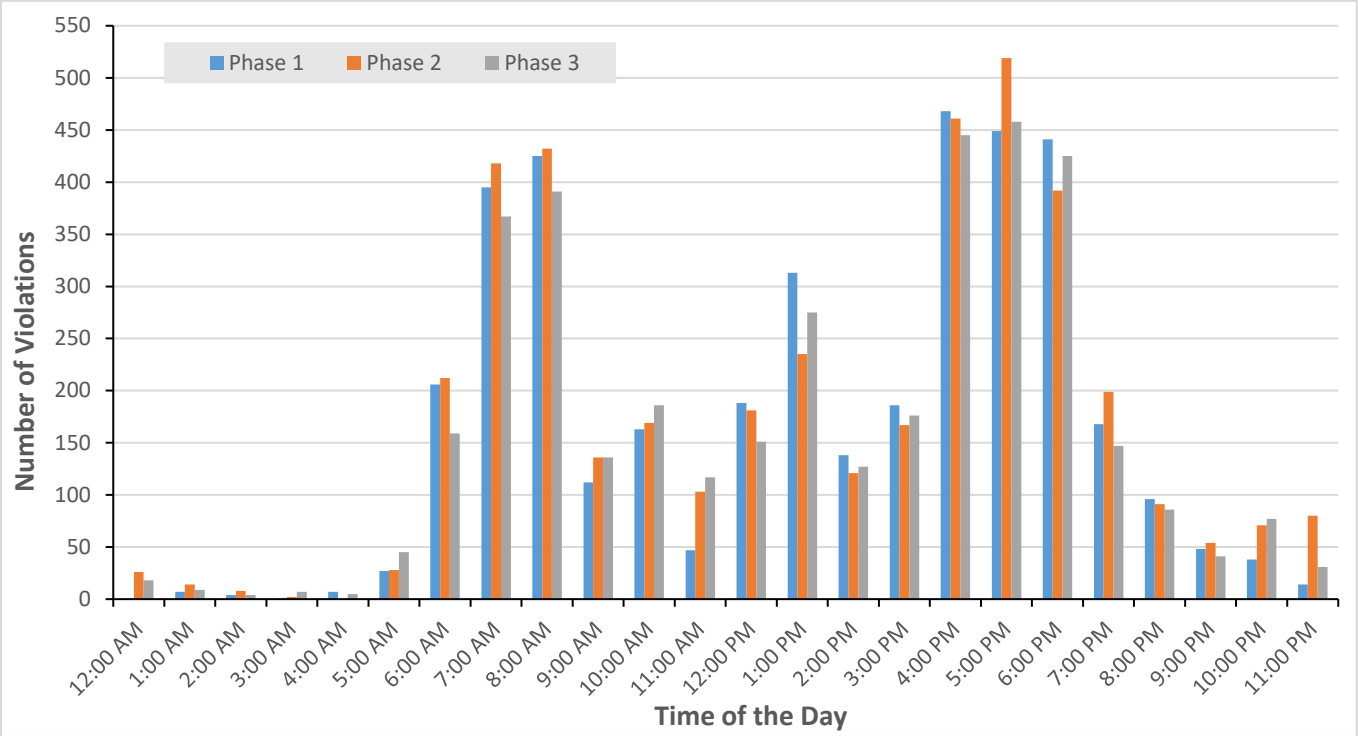


Figure 14. Distribution of Violations by Time of Day

Table 6. Violation Counts and Rates by Period (All Types)

	Phase 1	Phase 2	Phase 3	Percent Reduction from Phase 1 to Phase 2	Percent Reduction from Phase 1 to Phase 3
Violation Count	3,941	4,120	3,883	-4.54%	1.47%
Activations	584	726	684	-24.32%	-17.12%
Average Hourly Rate of Violation per Activation	6.0296	5.1004	4.9916	15.41%	17.22%

4.3 Violation Counts and Rates by Type of Violation

The violations observed were classified into four different types: Type I, Type II, Type III, and Type IV. As discussed earlier, Type III violations are the riskiest, followed by Type II, Type I, and Type IV.

Table 7 and Figure 15 show the distribution of violation rate by the type of violation and direction of traffic for all 3 phases.

Table 7. Distribution of Violation Counts and Rate by Type of Violation and Direction of Traffic

Violation Type	Period	Westbound		Eastbound		Both Directions	
		Number of Violations	Average Hourly Rate of Violation per Activation	Number of Violations	Average Hourly Rate of Violation per Activation	Number of Violations	Average Hourly Rate of Violation per Activation
Type I	Phase 1	480	0.7442	498	0.7291	978	1.4733
	Phase 2	467	0.5977	532	0.6710	999	1.2687
	Phase 3	464	0.6039	578	0.7119	1042	1.3158
Type II	Phase 1	162	0.2264	102	0.1563	264	0.3827
	Phase 2	156	0.1913	111	0.1397	267	0.3310
	Phase 3	168	0.2026	123	0.1466	291	0.3492
Type III	Phase 1	1	0.0010	0	0	1	0.0010
	Phase 2	1	0	0	0	1	0
	Phase 3	0	0	0	0	0	0
Type IV	Phase 1	***	***	***	***	2698	4.1727
	Phase 2	***	***	***	***	2852	3.5007
	Phase 3	***	***	***	***	2550	3.3266
Overall	Phase 1	***	***	***	***	3941	6.0296
	Phase 2	***	***	***	***	4119	5.1004
	Phase 3	***	***	***	***	3883	4.9916

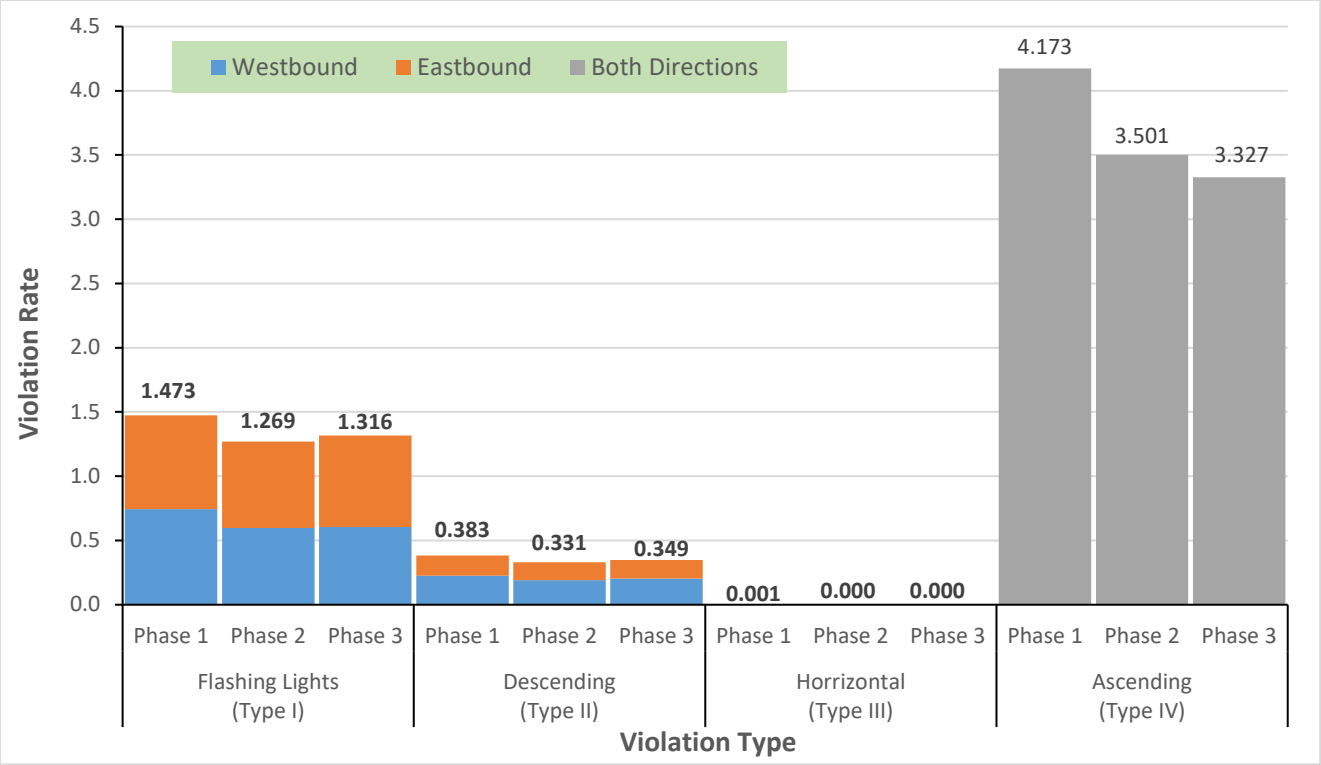


Figure 15. Violation Rate by Violation Type and Direction of Traffic

Type I Violations: Type I violations occur when vehicles traverse the crossing while the lights are flashing but before the gates start to descend. The average time of this phase at this crossing was 5 seconds. From Phase 1 to Phase 2 (short-term evaluation), a significant change in the Type I violation rate was observed after the installation of the photo enforcement system ($t(205) = 2.12$, $p<0.05$). However, from Phase 1 to Phase 3 (long-term evaluation), no significant change in Type I violation rate was observed after the installation of the photo enforcement system ($t(205) = 1.61$, $p>0.05$). The Type I violation rate was reduced by 13.9 percent from Phase 1 to Phase 2 and by 10.7 percent from Phase 1 to Phase 3.

As discussed earlier in the report, only westbound traffic was monitored by the system. For the westbound direction, the Type I violation rate was reduced by 19.7 percent from the Phase 1 to Phase 2 and by 18.9 percent from the Phase 1 to Phase 3. For the eastbound direction, the Type I violation rate was reduced by 8.0 percent from Phase 1 to Phase 2 and by 2.42 percent from Phase 1 to Phase 3.

Additionally, the research team also collected vehicles' action (violation or stop) during each of the four violation periods. A driver approaching an active grade crossing with warning devices activated can decide to either ignore the warning of an approaching train and traverse the crossing or stop at the crossing until the gates finish their ascent to a vertical position and the lights stop flashing. For this analysis, only lead vehicles that stopped were considered because following vehicles have no choice but to stop once the lead vehicle stops.

Figure 16 shows the distribution of vehicle actions during the flashing lights period for all 3 phases. Occurrences of lead vehicles stopped during this period increased from 124 (11 percent) in Phase 1 to 161 (14 percent) in Phase 2 and 172 (14 percent) to Phase 3.

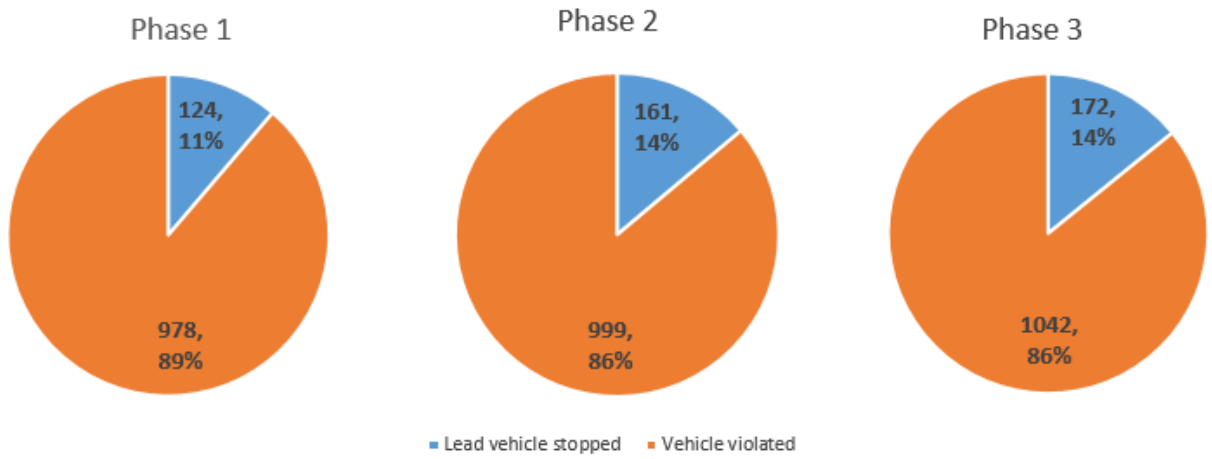


Figure 16. Vehicle Actions during Flashing Lights Phase

An example of Type I violations is shown in Figure 17. The two vehicles (circled in green) committed a Type I violation by traversing the crossing during the flashing lights phase at 06:42:35. The crossing activation occurred at 06:42:32.

Figure 17. Example of Type I Violations (Green Circles)

Type II Violations: Type II violations occur when vehicles traverse the crossing while the lights are flashing and gates are descending. The average time of this phase at this crossing was about 11.6 seconds. Similar to the short-term evaluation (from Phase 1 to Phase 2), the long-term evaluation (from Phase 1 to Phase 3) also did not experience significant change in the Type II violation rate after the installation of the photo enforcement system ($t(205) = 0.881$, $p>0.05$). The

Type II violation rate was reduced by 13.5 percent from Phase 1 to Phase 2 and by 8.75 percent from Phase 1 to Phase 3.

For the westbound direction, the Type II violation rate was reduced by 15.5 percent from Phase 1 to Phase 2 and by 10.51 percent from Phase 1 to Phase 3. For the eastbound direction, the Type II violation rate was reduced by 10.6 percent from Phase 1 to Phase 2 and by 6.2 percent from Phase 1 to Phase 3.

Figure 18 shows the distribution of vehicle actions during gate descend period for all three phases. Occurrences of lead vehicles stopped during this period increased from 1,058 (80 percent) to 1,181 (82 percent) from Phase 1 to Phase 2. But there was no change in proportion of vehicles stopped from Phase 1 (1,058; 80 percent) to Phase 3 (1,129; 80 percent).

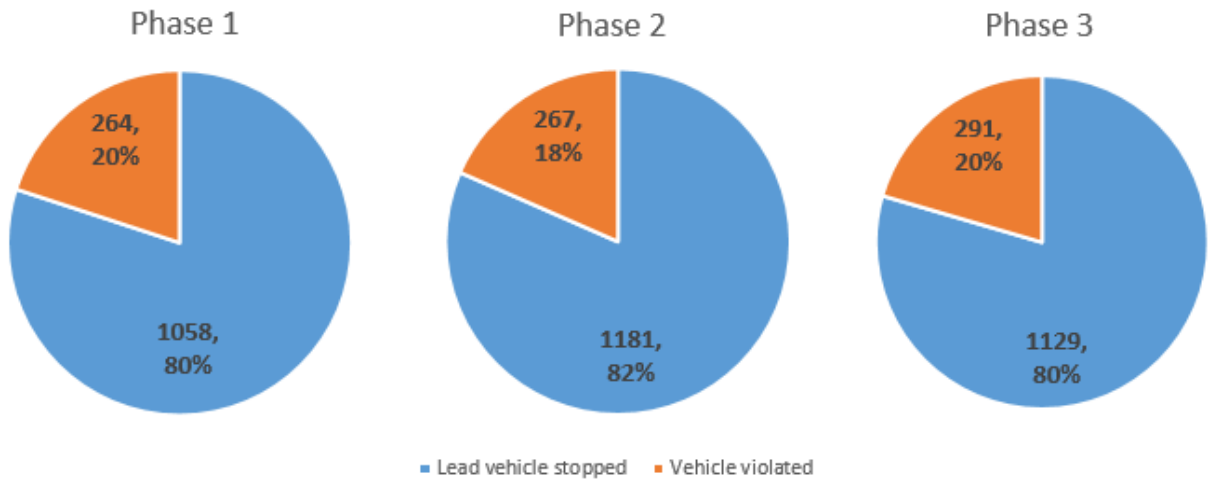


Figure 18. Vehicle Actions during Gate Descend Phase

An example of a Type II violation is shown in Figure 19. The vehicle (circled in yellow) committed a Type II violation by traversing the crossing during the gate descent phase at 17:12:56. The crossing activation occurred a full 10 seconds prior at 17:12:46.

Figure 19. Example of Type II Violation in Westbound Direction (Yellow Circle)

Type III Violations: Type III violations occur when vehicles traverse the crossing while the gates are in the horizontal position. There were total of two Type III violations over all three phases, one during Phase 1 and another during Phase 2.

The one violation recorded during Phase 1 consisted of a vehicle *attempting* to stop before the gate descended but actually coming to a stop under the gate. The driver then decided to drive across the tracks 3.2 seconds after the gates were down. A southbound SunRail train entered the crossing 16.2 seconds after the vehicle crossed the tracks.

The one violation recorded during Phase 2 consisted of a vehicle driving in the opposite direction of traffic and entering the parking lot just past the crossing in the eastbound direction. The vehicle entered the crossing 69 seconds after the gates were down. This was "no train" activation event. Figure 20 shows this vehicle (circled in red) traversing the crossing with the gates in a horizontal position.

Except for the two unique violations discussed above, all vehicles that arrived at the crossing after the gates were horizontal during all three phases stopped at the crossing. There were total of 716 lead vehicles stopped during the Phase 1, 834 lead vehicles stopped during the Phase 2, and 711 lead vehicles stopped during the Phase 3.

Figure 20. Example of Type III Violation in Eastbound Direction (Red Circle)

Type IV Violations: Type IV violations occur when vehicles traverse the crossing while the gates are ascending and lights are still flashing. The average time of this phase at this crossing was about 8.4 seconds. Similar to the short-term evaluation (from Phase 1 to Phase 2), the long-term evaluation (from Phase 1 to Phase 3) also experienced significant change in the Type IV violation rate after the installation of the photo enforcement system ($t(205) = 4.971$, $p<0.05$). The Type IV violation rate was reduced by 16.1 percent from Phase 1 to Phase 2 and by 20.3 percent from Phase 1 to Phase 3. As discussed earlier, no detailed information (lane, time) was collected for Type IV violations. Therefore, an analysis of Type IV violations by direction of traffic was not performed.

Lead vehicles that had stopped in one of the previous violation periods totaled 1,898 vehicles during Phase 1, 2,176 during Phase 2, and 2,022 during Phase 3. Figure 21 shows the distribution of lead vehicle actions during the gate ascending phase. As can be seen, occurrences of lead vehicles stopped during this period increased from 166 (9 percent) in Phase 1 to 229 (11 percent) in Phase 2 and 243 (12 percent) in Phase 3.

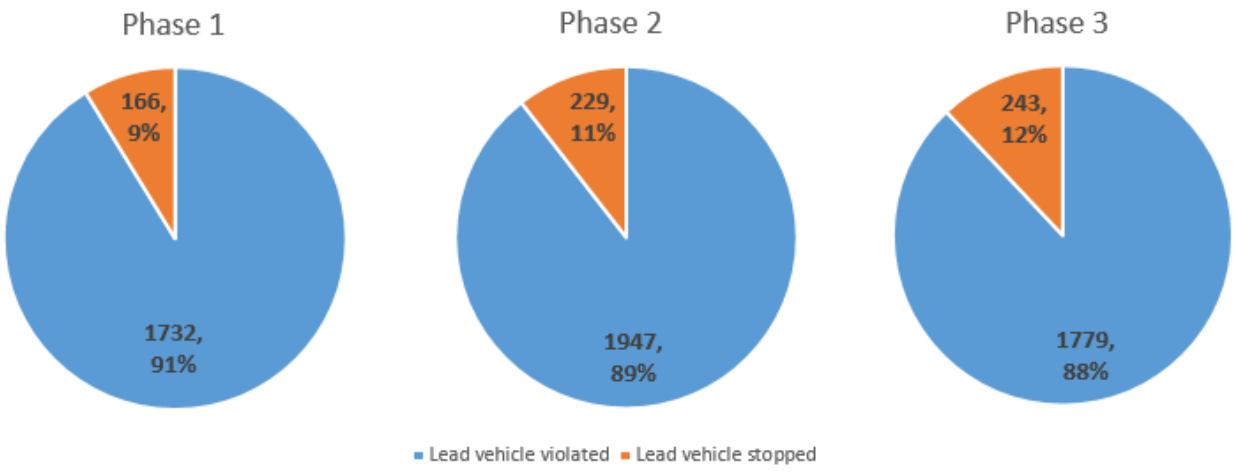


Figure 21. Lead Vehicle Actions during Gate Ascend Phase

In addition to lead vehicles that committed an ascending gate violation, following vehicles did as well. There were additional 966 following vehicles that committed ascending gate violations during the Phase 1, 905 during the Phase 2, and 771 during the Phase 3. That brought the total ascending gate violations to 2,698 (1,732 + 966) during Phase 1, 2,852 (1,947 + 905) during Phase 2, and 2,550 (1,779 + 771) during Phase 3.

An example of Type IV violations is shown in Figure 22, where 3 vehicles (circled in green) committed a Type IV violation by traversing the crossing during the gates ascent phase at 06:42:41. The crossing activation ended about 4 seconds later at 06:42:45.

Figure 22. Example of Type IV Violations (Green Circles)

4.4 Summary of Findings

The photo enforcement system and signage continue to have a positive impact on driver compliance with grade crossing active warning devices approximately 20 months after their implementation at the East Princeton Street grade crossing. The long-term study results are:

- **A reduction in number of vehicles that violated grade crossing active warning devices approximately 20 months after the installation of the photo enforcement system and signage.**

  Findings: The research team observed a 17.2 percent reduction in the overall violation rate from Phase 1 to Phase 3 (long-term evaluation), compared to a 15.4 percent reduction in the overall violation rate from Phase 1 to Phase 2 (short-term evaluation).

- **A reduction in Type I (flashing lights) violation rate approximately 20 months after the installation of the photo enforcement system and signage.**

  Findings: The flashing lights violation rate was reduced by 10.7 percent from Phase 1 to Phase 3 (long-term evaluation), compared to a 13.9 percent reduction from Phase 1 to Phase 2 (short-term evaluation).

- **A reduction in the Type II (descending gates) violation rate approximately 20 months after the installation of the photo enforcement system and signage.**

  Findings: The descending gate violation rate was reduced by 8.8 percent from Phase 1 to Phase 3 (long-term evaluation), compared to a 13.5 percent reduction from Phase 1 to Phase 2 (short-term evaluation).

- **No Type III (horizontal gate) violation was observed approximately 20 months after the installation of the photo enforcement system and signage.**

  Findings: No horizontal gate violations took place during Phase 3. One horizontal gate violation was observed during Phase 1 and another during Phase 2.

- **A reduction in the Type IV (ascending gates) violation rate approximately 20 months after the installation of the photo enforcement system and signage.**

  Findings: The ascending gate violation rate was reduced by 20.3 percent from Phase 1 to Phase 3 (long-term evaluation), compared to a 16.1 percent reduction from Phase 1 to Phase 2 (short-term evaluation).

5. Conclusion

The photo enforcement-based driver education program was still effective at changing driver behavior around the East Princeton Street grade crossing approximately 20 months after its implementation. The average hourly rate of violations per activation was reduced during both the short (Phase 2) and long-term (Phase 3) evaluation periods after the implementation of the photo enforcement program. The average hourly rate of violations per activation was reduced by 17.2 percent during the long-term evaluation period, compared to 15.4 percent during the short-term evaluation period.

Additionally, all four violation types also experienced a reduction in violation rate during both the short and long-term evaluation periods after the implementation of the photo enforcement-based driver education program. The average hourly rate of violations per activation during the flashing lights phase was reduced by 10.7 percent during the long-term evaluation, compared to 13.9 percent during the short term evaluation; the average hourly rate of violations per activation during the descending gate phase was reduced by 8.8 percent during the long-term evaluation, compared to 13.5 percent during the short-term evaluation; and the average hourly rate of violations per activation during the ascending gate phase was reduced by 20.3 percent during the long-term evaluation, compared to 16.1 percent during the short-term evaluation. These changes in average hourly rate of violations per activation can be seen graphically in Figure 23. A total of two horizontal gate violations took place over all three phases, one each during Phase 1 and Phase 2 and none during Phase 3.

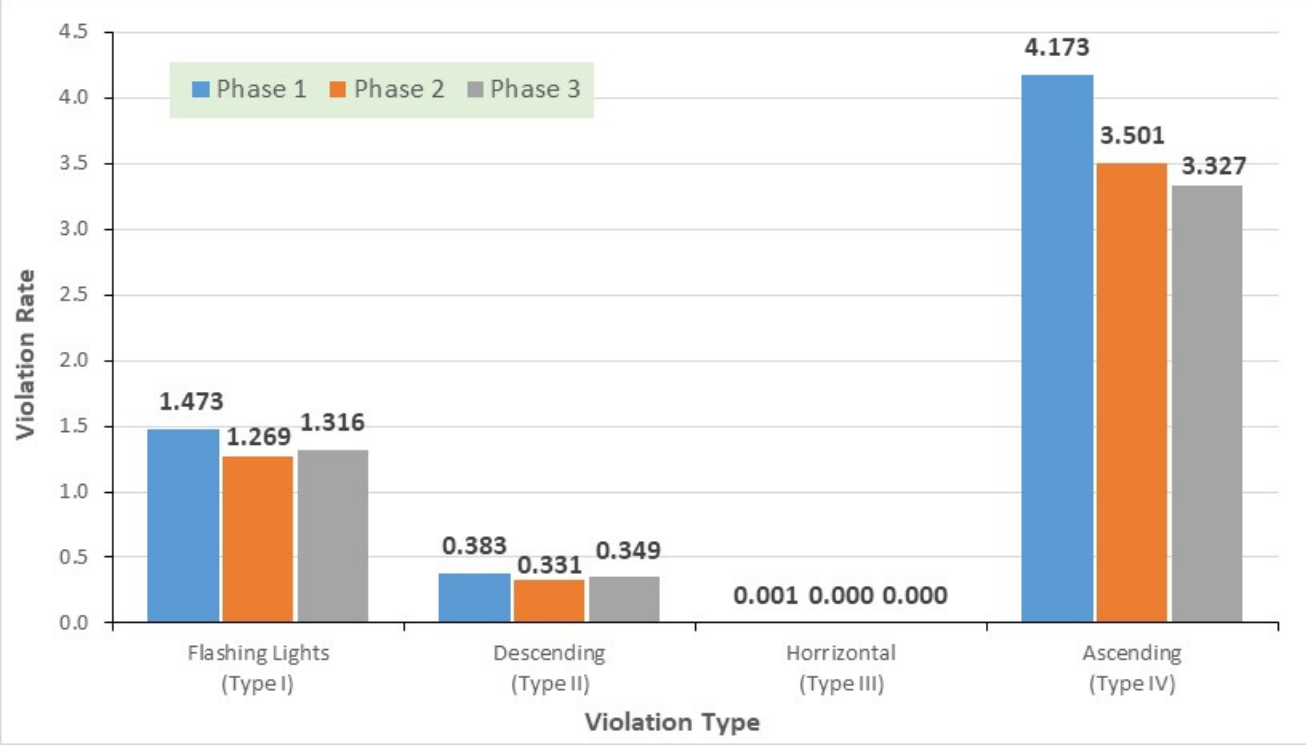


Figure 23. Violation Rate by Violation Type

Out of 2,958 violation notices that were sent out over the more than 2-year period from August 11, 2016 to December 31, 2018, the City received 333 (11.3 percent) of its survey responses

back. Survey results revealed that about 40 percent of the responding violators understood the photo enforcement signage at the crossing while 54 percent noted that they did not see the sign. When asked why they drove through the crossing when the warning devices were activated, 42 percent noted that they did not see the activated signals, 21 percent noted that they felt they had enough time to get through, and 9 percent noted that they did not see the train. Feedback on the overall program was generally positive.

5.1 Next Steps

The results presented in this report are from a before-and-after comparative analysis of driver actions at the East Princeton Street grade crossing during the implementation of a photo enforcement-based driver education program from April 2016 to April 2018. The following are potential next steps for this study:

- A 3-year analysis, where data from April 2019 would be compared to the previous data (April 2016, April 2017, April 2018). The City of Orlando continues to run the program at the East Princeton Street crossing, and analyzing April 2019 driver data at the crossing would provide information on the continuing effect of the program at this specific location. The program would have run for about 32 months as of April 2018.
- Installation and evaluation at another highway-rail grade crossing with different characteristics and comparing results. A comparison with another highway-rail grade crossing may provide understanding on how much crossing geometry and vehicular traffic patterns affect results. Both characteristics may affect the way vehicles react to active warning devices and signage. Testing similar implementations at other grade crossings may help to better understand if certain crossing characteristics are better-suited to this type of program.
- Evaluation of photo enforcement signage only at a highway-rail grade crossing and compare the results with the results of this study. The City had initially planned to install photo enforcement systems at up to six highway-rail grade crossings. Currently, only one crossing is equipped with the photo enforcement system but the City had installed photo enforcement signage on at least two additional highway-rail crossings (West Central Boulevard and West South Street). The Volpe Center had installed data collection equipment and collected video data before and after the installation of signage at both crossings in support of this program.

FRA continues to develop, deploy, and evaluate technologies and strategies to increase public safety at highway-rail grade crossings. Results and lessons learned from this study could assist local authorities implement similar driver education programs in their communities.

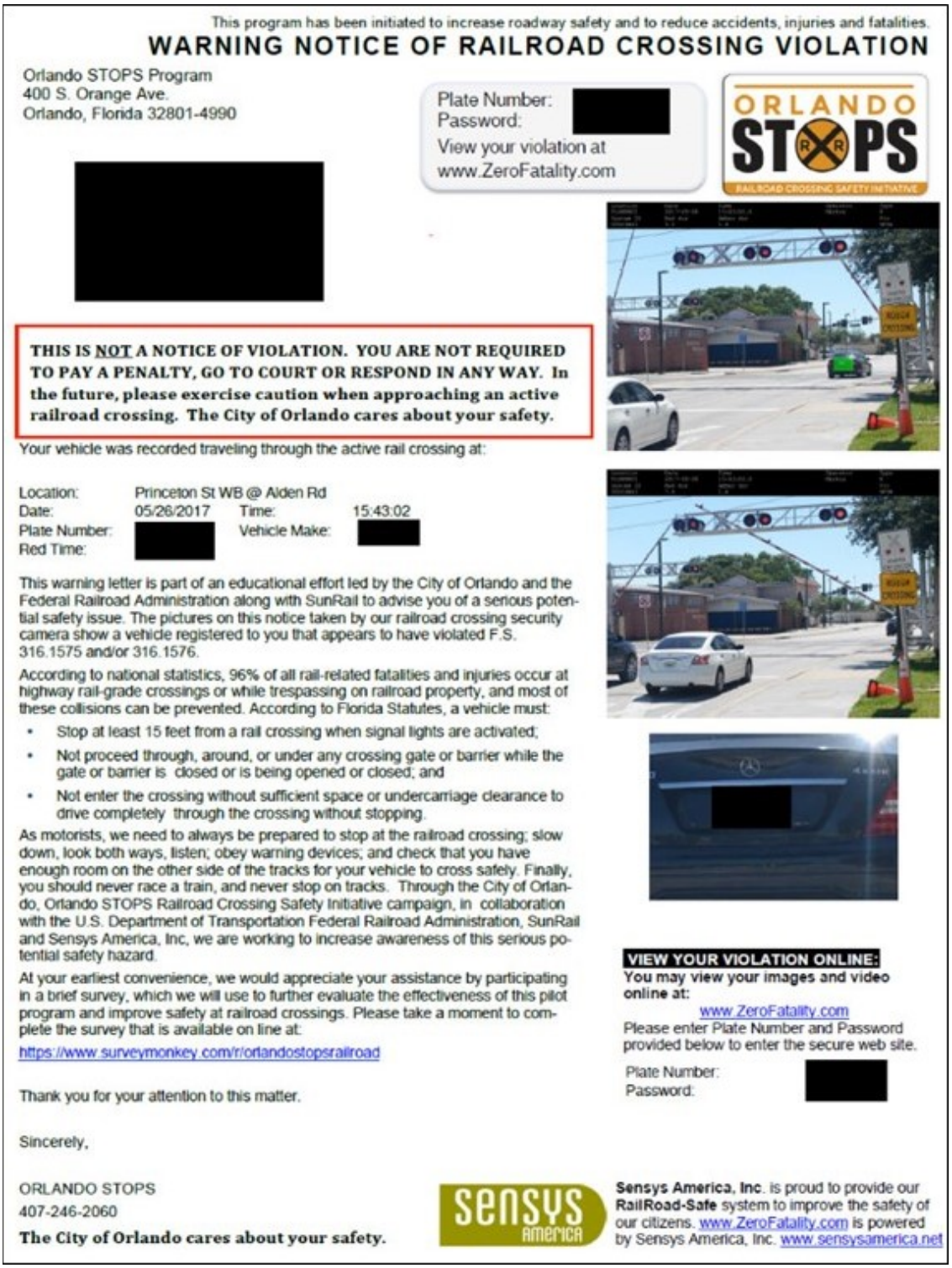
6. References

[1] Ngamdung, T., and daSilva, M. (2019). Effect of Photo Enforcement-Based Education on Vehicle Driver Behavior at a Highway-Rail Grade Crossing. Report No. DOT/FRA/ORD-19/17. Available at https://www.fra.dot.gov/eLib/Details/L20245. Washington, DC: Federal Railroad Administration.

[2] FRA Office of Safety Analysis Web site: http://safetydata.fra.dot.gov/OfficeofSafety/Default.aspx accessed on February 15, 2019.

[3] Orlando STOPS Red Light Enforcement Program: http://www.cityoforlando.net/transportation/orlando-stops/ accessed on February 22, 2018.

Appendix A.
Example of a Violation Notice



This program has been initiated to increase roadway safety and to reduce accidents, injuries and fatalities.

WARNING NOTICE OF RAILROAD CROSSING VIOLATION

Orlando STOPS Program
400 S. Orange Ave.
Orlando, Florida 32801-4990

Plate Number: [redacted]
Password:
View your violation at
www.ZeroFatality.com

ORLANDO STOPS
RAILROAD CROSSING SAFETY INITIATIVE

[redacted]

THIS IS NOT A NOTICE OF VIOLATION. YOU ARE NOT REQUIRED TO PAY A PENALTY, GO TO COURT OR RESPOND IN ANY WAY. In the future, please exercise caution when approaching an active railroad crossing. The City of Orlando cares about your safety.

Your vehicle was recorded traveling through the active rail crossing at:

Location: Princeton St WB @ Alden Rd
Date: 05/26/2017 Time: 15:43:02
Plate Number: [redacted] Vehicle Make: [redacted]
Red Time:

This warning letter is part of an educational effort led by the City of Orlando and the Federal Railroad Administration along with SunRail to advise you of a serious potential safety issue. The pictures on this notice taken by our railroad crossing security camera show a vehicle registered to you that appears to have violated F.S. 316.1575 and/or 316.1576.

According to national statistics, 96% of all rail-related fatalities and injuries occur at highway rail-grade crossings or while trespassing on railroad property, and most of these collisions can be prevented. According to Florida Statutes, a vehicle must:

- Stop at least 15 feet from a rail crossing when signal lights are activated;
- Not proceed through, around, or under any crossing gate or barrier while the gate or barrier is closed or is being opened or closed; and
- Not enter the crossing without sufficient space or undercarriage clearance to drive completely through the crossing without stopping.

As motorists, we need to always be prepared to stop at the railroad crossing; slow down, look both ways, listen; obey warning devices; and check that you have enough room on the other side of the tracks for your vehicle to cross safely. Finally, you should never race a train, and never stop on tracks. Through the City of Orlando, Orlando STOPS Railroad Crossing Safety Initiative campaign, in collaboration with the U.S. Department of Transportation Federal Railroad Administration, SunRail and Sensys America, Inc, we are working to increase awareness of this serious potential safety hazard.

At your earliest convenience, we would appreciate your assistance by participating in a brief survey, which we will use to further evaluate the effectiveness of this pilot program and improve safety at railroad crossings. Please take a moment to complete the survey that is available on line at:

https://www.surveymonkey.com/r/orlandostopsrailroad

Thank you for your attention to this matter.

Sincerely,

ORLANDO STOPS
407-246-2060
The City of Orlando cares about your safety.

VIEW YOUR VIOLATION ONLINE:
You may view your images and video online at:
www.ZeroFatality.com
Please enter Plate Number and Password provided below to enter the secure web site.
Plate Number:
Password: [redacted]

SENSYS AMERICA

Sensys America, Inc. is proud to provide our **RailRoad-Safe** system to improve the safety of our citizens. www.ZeroFatality.com is powered by Sensys America, Inc. www.sensysamerica.net

Figure A-1. Example of a Violation Notice

Appendix B.
Example of Educational Material

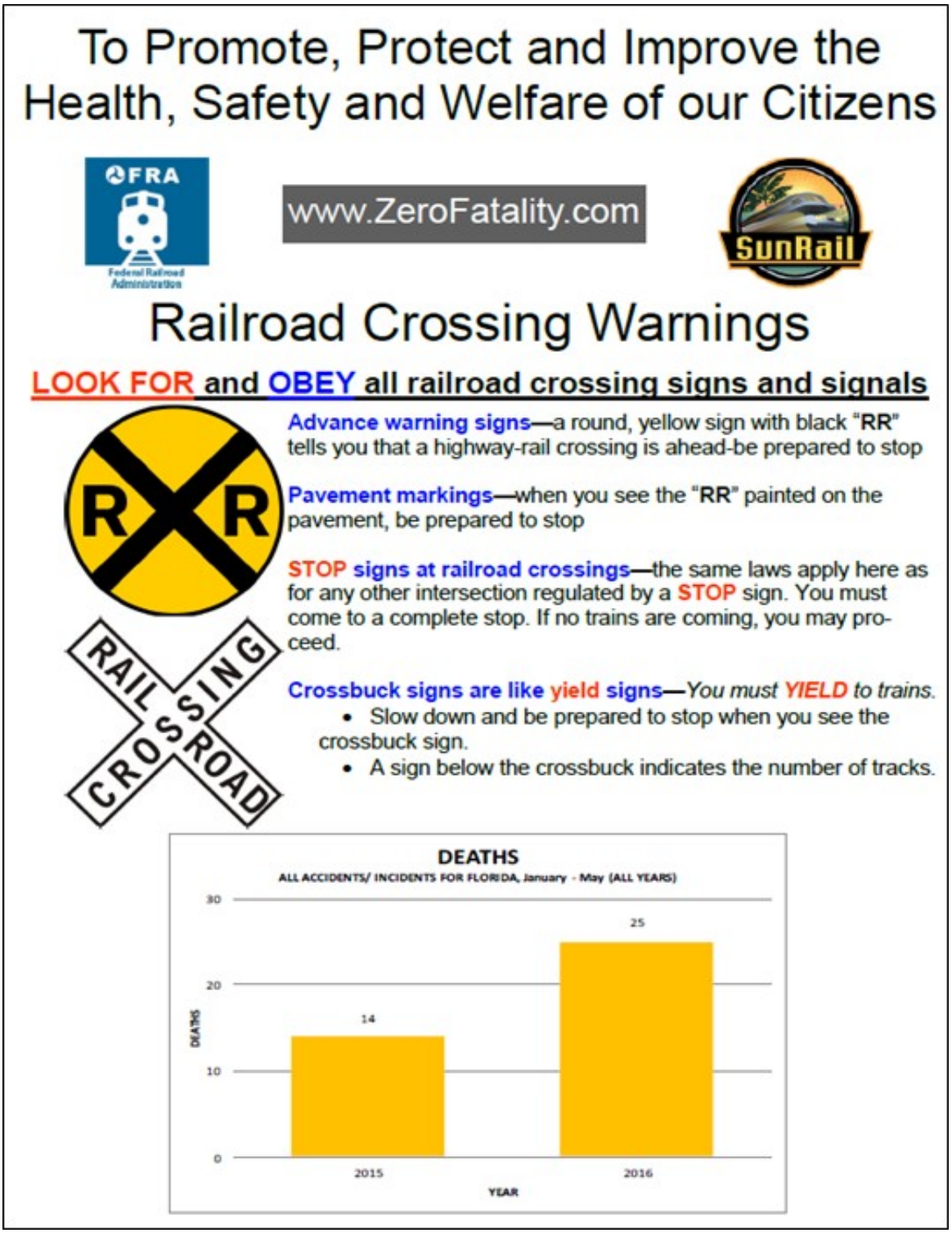


Figure B-1. Example of Educational Material

Appendix C.
Survey Questions

1. How often do you encounter this particular railroad crossing while driving a vehicle?

□ Every day
□ A few time a week
□ A few times a month
□ A few times a year
□ First time

2. How often do you see a train at this crossing?

□ Always
□ Often
□ Sometimes
□ Rarely
□ Never

3. How often do you encounter other railroad crossings while driving a vehicle?

□ Every day
□ A few time a week
□ A few times a month
□ A few times a year
□ First time

4. Did you understand the photo enforcement sign at the railroad crossing?

□ Yes
□ No
□ I did not see the sign

5. Were there other passengers in your vehicle?

□ Yes – adults only
□ Yes – children and/or adults
□ No

6. What were the weather conditions?

□ Sunny

□ Cloudy

□ Raining

7. Why did you drive through the railroad crossing when the warning devices were activated (e.g., lights flashing, crossing gates moving)? (check all that apply)

□ I did not see the train

□ I did not see the activated crossing signals (e.g., lights flashing, gate lowering)

□ I felt I had enough time to get through

□ I followed the car in front of me

□ I felt the wait would be too long

□ I was in a rush (e.g., late for an appointment)

□ I was unfamiliar with the rules

□ Other

□ I don't know

8. Were you using a mobile device?

□ Yes, texting

□ Yes, talking hands free

□ Yes, using a map

□ Yes, for another purpose

□ No

9. What time of day did you drive through the railroad crossing?

□ Morning (5am-12pm)

□ Afternoon (12pm-4pm)

□ Evening (4pm-8pm)

□ Night (8pm-12am)

□ Late Night (12am-5am)

10. What day of the week did this happen?

□ Weekday (Sunday – Thursday)

□ Weekend (Friday night – Saturday night)

11. About you

Age: _____

Gender:_____

12. Please share any questions or comments you have about this railroad crossing or this survey.

_____

_____

_____

_____

Appendix D.
Survey Responses

Note: Of the 12 total survey questions, only one question's response is "check all that apply" (#7). The rest were all one-answer questions. However, the total for some survey questions (besides survey question #7) add up to more than 333 because some respondents selected more than one option for answer responses.

1. **Table D-1. How often do you encounter <u>this particular</u> railroad crossing while driving a vehicle?**

Response	Count	Percentage
Every day	62	19%
A few times a week	63	19%
A few times a month	65	20%
A few times a year	86	26%
First time	57	17%
No Answer	0	0%
Total	333	100%

2. **Table D-2. How often do you see a train at this crossing?**

Response	Count	Percentage
Always	7	2%
Often	27	8%
Sometimes	98	29%
Rarely	127	38%
Never	72	22%
No Answer	3	1%
Total	334	100%

3. **Table D-3. How often do you encounter other railroad crossings while driving a vehicle?**

Response	Count	Percentage
Every day	65	20%
A few times a week	70	21%
A few times a month	88	26%
A few times a year	88	26%

Response	Count	Percentage
First time	22	7%
No Answer	2	1%
Total	335	100%

4. **Table D-4. Did you understand the photo enforcement sign at the railroad crossing?**

Response	Count	Percentage
Yes	134	40%
No	20	6%
I did not see the sign	180	54%
No Answer	3	1%
Total	337	100%

5. **Table D-5. Were there other passengers in your vehicle?**

Response	Count	Percentage
Yes - adults only	65	20%
Yes - children and/or adults	24	7%
No	243	73%
No Answer	3	1%
Total	335	100%

6. **Table D-6. What were the weather conditions?**

Response	Count	Percentage
Sunny	227	68%
Cloudy	70	21%
Raining	13	4%
No Answer	25	8%
Total	335	100%

7. **Table D-7. Why did you drive through the railroad crossing when the warning devices were activated (e.g., lights flashing, crossing gates moving)? (check all that apply)**

Response	Count	Percentage
I did not see the train	39	9%
I did not see the activated crossing signals (e.g., lights flashing, gate lowering)	139	42%
I felt I had enough time to get through	70	21%
I followed the car in front of me	27	8%
I felt the wait would be too long	7	2%
I was in a rush (e.g., late for an appointment)	17	5%
I was unfamiliar with the rules	28	8%
Other	62	19%
I don't know	23	7%
No Answer	7	2%
Total	419	100%

8. Table D-8. Were you using a mobile device?

Response	Count	Percentage
Yes, texting	0	0%
Yes, talking hands free	2	1%
Yes, using a map	4	1%
Yes, for another purpose	0	0%
No	326	98%
No Answer	1	0%
Total	333	100%

9. Table D-9. What time of day did you drive through the railroad crossing?

Response	Count	Percentage
Morning (5am-12pm)	110	33%
Afternoon (12pm-4pm)	120	36%
Evening (4pm-8pm)	93	28%
Night (8pm-12am)	5	2%
Late Night (12am-5am)	2	1%
No Answer	18	5%
Total	348	100%

10. Table D-10. What day of the week did this happen?

Response	Count	Percentage
Weekday (Sunday-Thursday)	259	78%
Weekend (Friday night - Saturday night)	35	11%
No Answer	39	12%
Total	333	100%

11. Table D-11. Age of survey respondent:

Age	Count	Percentage
<= 19	6	2%
20 to 29	32	10%
30 to 39	34	10%
40 to 49	58	17%
50 to 59	63	19%
60 to 69	77	23%
>= 70	39	12%
No Answer	24	7%
Total	333	100%

12. Table D-12. Gender of survey respondent:

Response	Count	Percentage
Male	179	53.8%
Female	130	39.0%
No Answer	24	7.2%
Total	333	100%

Appendix E.
Comments from Survey Responses

Table E-1. Comments from Survey Responses

Number	Comment
1	I was driving the speed limit. The lights and crossing arms began as I was approximately 30 ft. from the tracks. It was safer to avoid slamming the brakes and continue through since I did not see a train. I appreciate the warning instead of a ticket! Thank you!
2	I am past the while line when lights flashing was activated, no crossing gates lowering at the time. Not familiar with the railroad crossing.
3	Will not happen again I will keep my distance and be more aware
4	Thank you for notice. My grandson was operated on for over 8 hours - No excuse - I left hospital happy because of being successful - did not notice sign (RR) or arms starting to drop - again thank you for making me aware
5	I don't recall running this.
6	I did not feel I was far enough in back of rail crossing gate and that gate would come down on my vehicle.
7	I am sure that this is not a good procedure, but it would be nice to have more sign specifically at night. To know not to make a right turn.
8	My vehicle was directly under the railroad crossing lights when the lights became active. The traffic photo clearly shows that. I will be more careful in the future. Thank you
9	Would never knowingly cross against the flashing lights. Believe they started as I was just at or on the tracks.
10	It was a stupid, foolish choice! Thank you for not fining me - which I deserve! It won't happen again
11	I was waiting for a train and it never came.
12	This particular railroad crossing equipment has malfunctioned before! When I approached the crossing, I looked both ways to see if a train was coming. There was no train so I proceeded through. Other cars did the same but that is not why I went through the crossing. I did not hear a train warning either.
13	Signal started as I was approaching. I did not have enough time to break. When I went back the following week I made sure to watch for train signals. In fact, I was actually at the stopped signal arm when the train went by last week.
14	I appreciate the warning notice as it has caused me to take extra care.
15	The reason I did not stop was because the speed I was traveling had placed me too close to the train tracks by the time the crossing gate were coming down.
16	I was already going across when the gates lowered
17	I was behind several cars behind the STOP line. The light at the intersection turned green, I began to follow the vehicles in front of me. As I approached the tracks an ambulance with lights and sirens came rapidly down Orlando Ave causing the line of cars I was in to stop suddenly. I found myself under the gate when the lights and alarm started. I felt my safest route was to get off the track area as the cars in front of me started up as the ambulance passed.
18	Thanks for the education and awareness
19	I think it's an excellent idea to remind us that we were not completely aware of our surroundings especially after a long day at work. This warning will definitely make me more aware of railroad crossings in general. Thanks for the reminder.
20	Not from Orlando. Traffic was heavy. Thought I had enough space to get across the track before the rails came down. Sorry my mistake!
21	I will be more careful! Thanks!
22	The crossing lights & bars had come down with no train and then came back up. I started through and the lights and bars started to move. I kept going to avoid the bars hitting my car.

Number	Comment
23	The signal changed just as I got to the crossing
24	I was already at a point where crossing through safely (I could see no train and I know I had time to make it across before bars lowered) was a better option than screeching to a halt and stopping on the tracks, then trying to back up off of them. I didn't have enough forewarning to stop in time once the system activated. I wasn't speeding either.
25	I did not do this on purpose. The only thing I can think is that I had spent the night at the hospital where my son was seriously ill, and I was not thinking straight.
26	Thank you for the warning and the education. :)
27	I went to check the signs, and they are on the right side by the pavement, none on the island where I always stays I make a left into the ramp to join I-4. And going back to my place in the evening, there is none on the island. And I position myself on the left-most to make a left into Alden going to the hospital. So unless I am on the right-most lane, I won't see the sign. I had to go and check on these signs, I had to take the right-most lane to be able to see them. And the top yellow light, if I am far enough, I would see it. But coming from Alden road making a right into Princeton heading west and staying to the left to get to I-4, it is not low enough for me to see clearly well. And there's no sign at all on the island that says so like the one on the right side by the pavement.
28	Thank you for this survey, it makes thing about what I did.
29	I was taking this route to work because of traffic on John Young parkway. I have no drive this way before. I do not think the safety gates were moving in this photo. Thank you
30	I was accelerating after waiting at a red light. The lights just began to flash as I started to cross the tracks.
31	The crossing signals came down and no train cross in front of me. Then the crossing signals went up and the cars behind me follow
32	The signals began after I crossed the painted roadway warning. Before crossing the marks, it was all clear. Thanks, Keep the train. Give transportation dedicated funding!
33	I have space and time to cross
34	Two trains came back to back, the rails went up and almost immediately went back down and I was caught in the middle and had to make quick decision.
35	The lights did not start flashing until I was too close to stop and the bar did not come down until after I was over the tracks. I had just made right turn onto Princeton and did not see the lights due to the …..
36	When I cross the railroad the train had already pass.
37	The gate comes down rather quickly possibly because of the sun rail station nearby at Florida Hospital. Had traffic behind me and didn't want to slam on my brakes.
38	Heavy traffic caused me to stop near to the tracks, but me car was under the gate, when the crossing lights/arm went off. I moved forward to the other side of the tracks.
39	The signal came on, activated, late. I was crossing the tracks when it initiated.
40	The trees block the lights hard to see
41	The train had already passed and the bats were going up. I started driving across the tracks before the bats were completely up.
42	I honestly did not see the lights/hear any sounds. Brighter lights and maybe an alarm would be helpful.
43	It's dangerous if a train hits a car or a person. I try to follow railroad working (?) instruction
44	My guess is I didn't see the lights due to the sun, and red/green lights are the best colors to use
45	Sorry, the lights came on as I was driving through - I didn't see them. I know to stop and always do when lights flashing and bells sound.
46	I was not avoiding the warning. I was already near the crossing when lights came on. If I would have stopped I would have been on the tracks. I didn't have time to stop. I will make sure though that I will follow all safety precautions at all railroad crossings in the future.

Number	Comment
47	This particular crossing at Princeton/Alden is in need of "smoothing". It hurts to drive over it. Otherwise, I am very sympathetic to the goals of this survey, feel properly chagrinned, and my loved one that takes SunRail yelled at me and told me not to make her train the one that kills me! Great Job FRA - Please keep up the great work.
48	Thank you for only giving a warning. I saw the picture of this incident and do not think I am at fault. I was far beyond the tracks when the arms came down. It was very similar to driving through a yellow light. It would have been more dangerous to break hard and risk getting hit by the car behind me. I had momentum and cleared the tracks when the lights first started. Thank you for what you do though. I have seen other cars run tracks much later than me.
49	Signal started just as I was entering zone. There was no way to stop other than on the tracks. The vehicle in the second 2 pictures is not of my vehicle. He on the other hand had plenty of time to stop but I can see how you would mistake a black mini cooper for a black SUV.
50	I apologize what I did. I will be more careful when crossing a railroad interception.
51	Thank you for a warning as opposed to a ticket. This educational effort works, because I will be a lot more aware at railroad crossings and will never drive through a lowering gate again. Again, thank you for not ticketing me.
52	My husband (64 yrs) and I never observed light signal before we cross. I'll never put my family in danger - Thanks for the warning letter and your concern!!!
53	I was already passing through when the crossing activated and I proceeded as I was in the crossing. I am not from Orlando and not familiar with area. Was taking my husband home from Florida Hospital. The will never happen again
54	I think this survey is an excellent idea. I was following the Uhal truck in front of me and never saw the signal. Should have allowed more space between. A good wakeup call
55	Thank you
56	Didn't see it, Maybe more lights and a siren!
57	The crossing signal were not activated and not train around in sight. That could be a malfunction of the system. I always follow signs on the road. But thanks anyway for the taking care of the situation. I hope that you can correct the malfunction of this crossing.
58	Cars in front of me blocked my path to move forward, had no choice but to try to get through the crossing
59	This particular railroad crossing constantly malfunctioning for some reason, it activates itself even when no train is approaching. Thanks for your attention
60	The first time, I had a mistake. I am sorry. I try , I never make again. Thanks
61	All cars and trucks going through-no train see photo
62	went through and the warning signs got activated
63	Thanks for this notice.
64	Your records are incorrect. I did not cross the railroad with warning activated. It appears that I was on the other side when the warning was activated. There was traffic ahead of me and slowed down once I crossed the railroad tracks. I would not cross an activated crossing. I was driving the car, my name is Pedro J Acosta. Track maintenance crew was operating the sign and it came one for the second time once we crossed.*
65	I had already begun crossing the tracks when the arm came down and lights began flashing. I wasn't going to stop on the tracks.
66	Lights did not begin or bars lowering until after I went through. Clearly the lights should flash some and bars lower at a quicker rate of speed if the train is coming that quickly.
67	I realized when I had done after it was too late to stop!
68	I was near the railroad track when the signal activated, I had to move forward quickly
69	No comments, should have been paying more attention. Definitely, the will not happen again.
70	First time lights flashings stop, gate upering. I followed the car in front of me keep distance not to close and didn't pay attention so I did not see the lights flashing second time at this time that's why I did make a big mistake, thanks for warning notice. (not legible)

Number	Comment
71	The lights did not start flashing until I didn't have enough time to stop. More warning needed!!! I was very scared
72	I do not know if this was me or my wife. Although it does not change the seriousness of what was done. I appreciate the warning instead of a fine. We will pay attention to this and all railroad crossings in the future.
73	Appreciate you bring to my attention, will do better in future.
74	The railroad crossing way down for a good period of time with no train approaching. The crossing arm rose and cars proceeded. When I approached the track the lights engaged and as I crossed the arms came down. I thought it was malfunctioning.
75	I would not have driven through lowering crossing gates. It looks like in the picture that the lights and gates were on and lowering after I drove through.
76	I was not aware of impending signal I do not enter an intersection when light turns yellow - nor enter or cross a railroad crossing when I see lights flashings on cars crossing.
77	Really I think the signal went on just when I was crossing.
78	I didn't intentionally meant to cross the rail, I was already crossing when the lights went on
79	The respondent wrote not sure for question number 6
80	I can hardly remember about this situation. What I remembered is that I was on my way to see my mom at the Florida Hospital, she was in intensive care, I'm sorry about it. I'll be careful next time.
81	I was shocked I got this letter. I don't see any activated. I always very careful.
82	FYI: The lights at Princeton and Orange are become crazy messed up when a train is near Florida Hospital stop.
83	This was not me. My neighbor borrowed my truck that day. Apparently, I need to be more selective of who borrows my truck.
84	I had crossed the tracks before any warning lights or any movement of gate. A second traffic light just over the tracks caused me to stop then turned green just as warning light came on. Shows clearly on video
85	Thanks! Didn't know this was a system that was in place. While I appreciate this as a "warning:, I would strongly disagree with this, it if were a "ticket" with a fine attached. Nobody cares about my safety more than I do.
86	The lights has no preemptive signal. When the light turned on, my position had insufficient distance to break before the drop arm - An earlier pre signal would alert to the pending red light. I was not speeding.
87	I went through the crossing after the train had passed, and the gates were opening up.
88	As you can see in the photo, I was already on the tracks when the lights started flashing and the bars started lowering - it was very unnerving
89	I would not have crossed if lights and gates went on at the same time. I thought there was just a stopped train sitting somewhere up the tracks. The gates were not down when I went through, I thought it was ok.
90	This crossing stop traffic at Princeton while the train is stopped in the stations - poorly designed - plus I had a lot of time as the gate were just beginning to lower and I could not see or hear a train with good visibility
91	I am went through tracks before the arm came down, not sure it's a violation.
92	My husband was in hospital, we are from out of town. I stop at railroad crossing when lights are blinking, bars coming down. If bars are on the way up after train has passed I sometimes go through. It would have caught me off guard or sudden and I was already in crossway. - The train went through, gates were going up.
93	Thanks you for bringing this to my attention. I will be more careful.
94	We all must carefully respect the warning of the railroad crossings to protect lives.
95	I didn't see a damn thing until the gates were coming down on my car

Number	Comment
96	I remember going through the crossing and only hearing the signals after I was through it. Also, with music on (normal level), I believe that it is hard to hear the signals. Is it lower for the hospital? This was at Princeton and Orange. I was already through the crossing
97	The railroad gate is often down at this time and they will often raise back up when no train has gone through. This is very distracting and confusing and frankly I don't trust either the gates or the lights at this particular intersection.
98	Stop lines should be further from crossings arms and lights so you aren't so close to tracks. Car was already moving through as lights started
99	I did not see the activated crossing signals until I was already on the tracks
100	I believe the railroad crossing came down after I pass over the track. I did not run it or would not run it knowing.
101	Drivers need more training about railroads. Do not stop on tracks!
102	While this never happen to me before, I did not see the guard coming down at first, when I finally did, I panicked and press the gas pedal out of fear. Sorry
103	This crossing malfunctions ALL THE TIME! There is no trains it will repeatedly go up down.
104	I promise not to do it again - Thanks for making this a warning.
105	The bar went up. The lights had began on but stopped. Before I crossed the tracks I looked both way and saw the train at Florida hospital. I saw the bar come down after I had crossed the tracks. I will be more cautious at this crossing - The lights were not flashing.
106	Very good survey
107	Thanks for sending this survey, it’s really informative.
108	Not reliable, gate came down without warning while cars were crossing railroad. It’s not the first time crossing doesn’t warn you in time. Workers always working on the gates!!
109	I didn’t cross, probably was my friend. I respect railroad crossing, and I see well. Thanks
110	One more signal lights
111	The gates were opening not closing. I knew the train had already passed and I was rushed so I thought it was safe to pass. Had they been closing I would have known better
112	I had no idea the gate was lowering or that the lights were flashing until I was already going through. Totally caught me by surprise when I noticed the crossing signals were activated, as I am usually very attentive while driving. I had never been to Orlando before so this part of the city was unfamiliar to me
113	I don’t usually do things of this nature. Will be more careful next time.
114	Mother was driving my car
115	I grew up in Orlando, very near to the downtown gates around lake Ivanhoe, with the advent of sunrail, the gates going down, time was increased dramatically and the time AFTER the train passes too. That only encourages one to get past the gates before they are fully down. Those long gate times are a huge waste of time for thousands of people every day, waiting for all those trains. The few number of people riding those trains versus those driving and having to wait at crossings doesn't even compare. One can easily see that few ride those trains by seeing inside the cars, people waiting to get on the trains and the empty parking lots at the stations. Its gigantic waste of time for drivers stuck at gates versus time "saved" by the few riders. In Longwood with 2 crossings by each other 434 & 427 it's a disaster, especially at morning and evening rush hours. Sunrail causes traffic jams every day. The situation would be improved with minimal gate times. Typical government planning here. So many more folks delayed and time wasted for the versus the few who ride those trains.
116	Appreciate effort by the city for education and awareness of safety issues
117	I'm sorry
118	When the barriers are down drivers cannot pass through in the truly safe way for everyone
119	It is important to pay close attention to train crossing times to avoid accidents. I feel very sorry this occurred and will be more responsible in the future

Number	Comment
120	I'm sorry for what I did, but at the same time I'm thankful for the survey because it made me realize what I have done at to be more aware in the future and to pay attention at the railroad crossing. Thank you
121	Thank you for the warning.
122	Could signage blink? Maybe helpful to see blinking sign before crossing triggers
123	Regarding question #7 I did not drive through when the lights were flashing and the cross gates were moving. I drove through when it was all clear. My vehicle was sitting at the red light ahead of the railroad crossing for some time before it was unsafe to drive through. I do not believe that my car was at all on the track or in the way of the gates
124	I don't remember trying to run this crossing. I thought by this pictures, I was under it when it started coming down.
125	I am crossing the railroad crossing here for the first time. And I have not even seen the signals as it was really cloudy and the storm is …… I am driving in the downtown Orlando for the first time.
126	This episode scared the living daylights out of me! Honestly did not hear the warning bells/signal + either the lights went on late or?? I never use my phone in car nor did I have the radio on. I have never see a RR crossing w/ such late/nonexistent warning. check the bells on this one!
127	Nice reminder. Thanks
128	This is compared to entering on intersection as the light turns yellow. At what point do you stop and what point do you "safely" proceed
129	Since this is my daily route I looked especially for the sign you mentioned. The permanent one at that crossing is the one for the crossing with no horn
130	The gates started to flash and come down as I was already entering the RR crossing. As you can tell by the photograph I was already completely clear of the entire RR crossing by the time that this gate was halfway down. This is simply a case of unfortunate timing.
131	I was raised where there were lots of trains and tracks. Normally very cautious but honestly did not see the lights flashing. I am so sorry about this.
132	I am very sorry I will be more careful in the future
133	The train had already passed and the guard rails were going up. Unless a train can reverse at an immense speed, this warning is futile and more irritating than helpful. At the very least, make sure the car is attempting to cross the railroad with an approaching train and not one that already passed.
134	Thanks for the education
135	I think this is fantastic. Really makes me be more alert
136	I am going to be more careful on my own all driving. Thank you for the notice.
137	Apologies - I did not allow enough time to stop safely
138	This railroad crossing at Florida Hospital Orlando (Princeton) is terribly timed. The crossing stays down for several minutes even when the train is not coming. This is a safety concern as it is located right at the largest hospital in the state
139	NONE. Did not know the photo rule at the crossing
140	Sunrail crossing is too close to station @ FLA hospital and also too close to intersection of I-4 and Orange avenue.
141	I was lost and trying to find my way
142	Totally my wrong. However there are frequent false crossing warning at this location (Orange and Princeton).
143	I wasn't working near this address on June 26. I think it was probably July. I have no idea the circumstances but I was looking for parking - my first day at Florida Hospital. Probably too focused on how lost I was
144	I did not see this at all until I was already through. The pictures show me going through right as the gates first start.
145	I would never endanger myself or my children in rushing through a railroad crossing

Number	Comment
146	Looking at the video I went through before arms came down, did not hear a train, had plenty of time to go through, was comfortable with the decision. Sorry?!
147	I am very sorry if I broke any rules. I don't live in Orlando
148	Thank you so much for the break. You have no idea how bad I needed that. I do need to know if I did that , I don't understand, why you didn't show picture going or gone over tracks like other cars in picture? However I do need to see what I did so I don't make same mistake. If you look at the picture, the cars going through "not my car", you did get a pic of my tags, nothing else. The car near the tracks not my car (the Kia). I am not Evil Knievel, I wouldn't have the nerve to play with a train.
149	For me its safety for everybody to respect the law. Railroad crossing when you driving and walking
150	I guess this survey can help me more because I did not know if the train already passed if that can cause a problem after the passing train even I need to …….. Because it almost late to go home and take my daughter to school. Now I have more idea about it. I can stay longer to wait for the sign to come on green and I worked overnight that day. Thank you.
151	I am so sorry. I think when I saw the lights flash that I would have to stop to short and hard and it was best to continue driving. Will not do that again
152	No gate was down didn't see flashing lights
153	Thank you for caring
154	I have averaged 250 miles per month on this car 17 months ago. No railroad tracks when I live. Cross this tracks once per year on way to ……. On 17-92. I drove a school bus many years, had CDL licenses so know rules. Just did not see sign or lights.
155	The lights started flashing and the gate lowered almost immediately I was part way on the track so I moved forward to clear
156	The lights weren't flashing as I was ready to approach railroad tracks. They must have started to flash as I was passing. Otherwise I would've made a complete stop and would've let the banners come down all the way
157	I wasn't driving the vehicle at this time. I am contacting the person who was
158	I was unfamiliar with this and I thank you for bring my attention to this safety issue
159	I was in no hurry. I do not have a cell phone. I did not see flashing lights. I crossed the tracks before the crossing gates came down. I was going to a committee meeting at church on the drive, formerly college park Baptist church - RICHARD L ATKINS
160	I started through the railroad crossings, just as the lights started flashing. I was traveling at about 35 MPH. I would have had to slam on my brakes to stop and probably would have ended up on the tracks!
161	Basically I approached the warning as "yellow" light. Gates had started to move but I had plenty of clearance. I know trains will not cross while gates are moving.
162	I will be more careful in the future - thank you!
163	I follow every rule so I was very surprised at getting this warning. I thought I had followed the law so be more vigilant at further crossings.
164	Probably too close to large truck in front of me. Didn't see cross bar move but too far under to stop. Will be more careful next time thanks
165	Seldom used
166	I feel terrible that this happened! I will try my best to not let this happen again
167	The train had passed< was parked at the station (I could see it), the gates were opening so I went through. If you don't want people to cross the tracks while the lights are on you should keep the gates down until the lights go off. There was no safety issue!
168	It will help in future to prevent this kind RR incident from happening again
169	I was talking to the passenger when this happen
170	Sun shields were down in my car (sun and sun glare), gate started down as I was going across tracks - did not see red flashing lights. Suggestion: Also have red flashing lights lower and/or a little ways before the tracks.

Number	Comment
171	Out of town visitor to FL hospital. Unfamiliar with area.
172	Sorry but when I cross the safety lines starting to go up
173	This was my first time passing through this area. Thank you for making me aware of this. I will be more cautious in the future.
174	I was too close when the gate was moving.
175	It won't happen again. Thank you.
176	I am a very good driver, I just didn't notice the signal until it was too late to safely stop. I was enroute to home after my wife had been take to ER by ambulance. In the video I can see where I hit my brakes and decided it was too late to safely stop.
177	I passed through the railway intersection then the car in front of me unexpectedly stopped short and although my rear bumper may have been closed than I'd like, I had fully cleared the actual rail crossing.
178	When I noticed the lights and gate moving, I was too late to brake and had to accelerate to avoid the gate/train.
179	I don’t recall this incident at all.
180	Apologies, will never happen again.
181	Thank you
182	I'll definitely slow down sooner at RR crossings.
183	I really thought I had enough time to cross. But in future I guess I will wait for the train to cross. My life comes 1st. Thank you.
184	I saw a car get hit by a fast moving train when I was a young adult. That sight has never left me and I am especially careful at RR crossings. I feel I must have been crossing under when the lights were activated.

Appendix F.
Paired T-test Results

Table F-1. Violation Rate Descriptive Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Phase1 All Violations/Activation	6.0296	206	3.35613	.23383
	Phase3 All Violations/Activation	4.9916	206	3.04469	.21213
Pair 2	Phase1_Type1Vio/Activation	1.4733	206	1.23210	.08584
	Phase3_Type1Vio/Activation	1.3158	206	1.21850	.08490
Pair 3	Phase1_Type2Vio/Activation	.3827	206	.53466	.03725
	Phase3_Type2Vio/Activation	.3492	206	.47272	.03294
Pair 4	Phase1_Type3Vio/Activation	.0010	206	.01393	.00097
	Phase3_Type3Vio/Activation	.0000	206	.00000	.00000
Pair 5	Phase1_Type4AllVio/Activation	4.1727	206	2.26185	.15759
	Phase3_Type4AllVio/Activation	3.3266	206	1.93211	.13462

Table F-2. Violation Rate Paired Samples T-Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
1	Phase1 – Phase3 All Violations/Activation	1.03807	3.26964	.22781	.58893	1.48722	4.557	205	.000
2	Phase1 – Phase3 Type1 Violations/Activation	.15757	1.40907	.09817	-.03599	.35113	1.605	205	.110
3	Phase1 – Phase3 Type2 Violations/Activation	.03344	.54474	.03795	-.04139	.10827	.881	205	.379
4	Phase1 – Phase3 Type3 Violations/Activation	.00097	.01393	.00097	-.00094	.00289	1.000	205	.318
5	Phase1 – Phase3 Type4 Violations/Activation	.84609	2.44315	.17022	.51048	1.18170	4.971	205	.000

Abbreviations and Acronyms

Abbreviation or Acronym	Name
AADT	Average Annual Daily Traffic
FRA	Federal Railroad Administration
PII	Personally Identifiable Information
RD&T	Research, Development and Technology
ROW	Right-of-Way
DOT	U.S. Department of Transportation
Volpe Center	John A. Volpe National Transportation Systems Center