CUTR

CENTER for URBAN TRANSPORTATION RESEARCH

BDV25-977-11

Final Report

A Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

PREPARED FOR

Florida Department of Transportation

FDOT

December 2017

Center for Urban Transportation Research
University of South Florida
4202 E. Fowler Ave., CUT100, Tampa, FL 33620-5375

A Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

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Florida Department of Transportation

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December 2017

DISCLAIMER

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

METRIC CONVERSION CHART

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
AREA				
in^2	squareinches	645.2	square millimeters	mm^2
ft^2	squarefeet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

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Incorrect turns at highway-rail grade crossings are a serious issue in traffic safety management. According to previous studies, there are five major contributing causes of incorrect turns onto railroad tracks. Among them, potentially misleading signs and pavement markings near highway-rail crossings could confuse some drivers and lead them to make incorrect turns onto railroad tracks instead of turning at nearby downstream signalized intersections. This study proposes countermeasures aimed at providing clear guidance for drivers who are approaching at-grade crossings to continue their driving and prevent incorrect turns onto railroad tracks. The proposed low-cost countermeasures include (1) elimination of potentially misleading pavement markings and signs, (2) implementation of pavement markings with guidance information, (3) extension of edge lines at highway-rail grade crossings, and (4) implementation of Qwick Kurb to prevent drivers from turning around at railroad crossings. CUTR coordinated with Florida Department of Transportation (FDOT) Central Office, Districts 1, 4, and 7 to finalize the low-cost countermeasures and select pilot study sites for a pilot implementation and evaluation. Ten at-grade railroad crossings were identified for this pilot implementation of the proposed countermeasures and performance evaluation. A detailed deployment and evaluation plan, including pilot study sites, proposed countermeasures, estimated costs, data collection plan, and data analysis methodology were provided in this report. The evaluation results and findings from the pilot implementation could provide the support and guidelines for future widespread implementation of these low-cost countermeasures at identified crossings in Florida to prevent incorrect turns of vehicles onto railroad tracks.</td></tr>
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- FDOT District 4: Jonathan Overton, Melissa Ackert, Yujing Xie, Jonathan Ford
- FDOT District 7: Steve Love, Kevin Dunn, Peter Hsu

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EXECUTIVE SUMMARY

Problem Statement

Preventing incorrect turns at highway-rail grade crossings has received considerable attention in an effort to decrease fatalities and injuries for both road users and rail users/operators. To mitigate serious injuries and fatal collisions due to incorrect turns at highway-rail grade crossings, a previous National Center for Transit Research (NCTR) research project titled, "Improved Traffic Control Measures to Prevent Incorrect Turns at Highway-Rail Grade Crossings," successfully identified five major contributing causes of incorrect turns onto railroad tracks: (1) potentially misleading signs and pavement markings near highway-rail crossings, (2) darkness and low visibility near or at highway-rail crossings, (3) following inaccurate turn instructions from a GPS device onto railroad tracks, (4) skewed highway-rail grade crossings, and (5) driver distraction. Researchers found that right-turn arrow pavement markings in front of railroad grade crossings could cause the most confusion for drivers who turn onto the railroad tracks.

Proposed Countermeasures

To address the confusion of drivers who turn onto railroad tracks, safety countermeasures were proposed based on the following criteria:

- Effective reductions in driver confusion at highway-rail crossings.
- Successful FDOT experience on similar safety issues (e.g., wrong-way driving).
- Low cost for implementation.
- Compatibility with *Manual on Uniform Traffic Control Devices* (MUTCD) standards or proposals.

Based on these criteria, four countermeasures were recommended for preventing incorrect turns at highway-rail grade crossings, as shown in the following table.

Recommended Countermeasures to Prevent Incorrect Turns at Rail Crossings

Countermeasure	Sources
I. Elimination of potentially misleading pavement markings and signs	NCUTCD* proposal to MUTCD (2010)
II. Implementation of pavement markings with guidance information	MUTCD and successful FDOT experience on wrong-way driving
III. Extension of edge lines at highway-rail grade crossings	NCUTCD* proposal to MUTCD (2015)
IV. Implementation of Qwick Kurb	MUTCD (2009) 2C.64

*National Committee on Uniform Traffic Control Devices

Deployment and Evaluation Plan

CUTR coordinated and communicated with Florida Department of Transportation (FDOT) Central Office, Districts 1, 4, and 7 to develop a deployment and evaluation plan for a future pilot implementation project. The plan identified study sites of railroad crossings with potential incorrect turn issues, proposed counteremasures, estimated costs, a data collection plan, and data analysis methodology. Ten sites were identified in three FDOT Districts as summarized in the following table.

Selected Sites with Proposed Countermeasures

Site	FDOT District	Countermeasures
1. Combee Rd @ US 92, Lakeland, FL	1	• Remove continuous turn arrows on turn lanes before at-grade crossing • Add straight arrows with text information of direction and target road name • Extend edge lines over at-grade crossings • Add Qwick Kurb at hatched-out median area (US 41 @ US 301)
2. US 41 @ US 301, Bradenton, FL		
3. Hollywood Blvd @ I-95, Hollywood, FL	4	• Remove continuous turn arrows on turn lanes before at-grade crossings • Add straight arrows with direction text and I-95 shields • Extend edge-lines over at-grade crossings
4. Forest Hill Blvd @ I-95, Lake Clarke Shores, FL		
5. W Hallandale Beach Blvd @ I-95, Pembroke Park, FL		
6. W Commercial Blvd @ I-95, Oakland Park, FL		
7. W Pembroke Rd @ I-95, Hollywood		
8. Busch Blvd @ N Boulevard St, Tampa, FL	7	• Remove continuous turn arrows on turn lanes before at-grade crossings • Add straight arrows with text information of direction and target road name • Extend edge lines over at-grade crossings
9. E Adamo Dr @ N 39th St, Tampa, FL		
10. Tampa Road @ State St W, Oldsmar, FL		

A before-after study was designed to evaluate the performance of the proposed countermeasures to prevent incorrect turns at highway-rail crossings. Two-stage data will be collected at each candidate site: “before,” with existing pavement markings, and “after,” after implementing the proposed countermeasures. A Wavetronix SmartSensor (available from CUTR) with video

cameras will be installed to collect speed profiles and counts of turning vehicles as drivers approach the at-grade crossing for a total of two days at each site (one day in "before" stage, one day in "after" stage). For each day, data collection will be conducted in the daytime (10:00 AM–2:00 PM) and nighttime (7:00 PM–11:00 PM).

A statistical analysis will be conducted to compare hesitation rates between the "before" and "after" stages. If the hesitation rates are significantly reduced after implementing the countermeasures, it could indicate that the proposed countermeasures can reduce the risk of incorrect turns at highway-rail grade crossings.

Potential Benefits of Future Deployment

Replacing continuous turn arrows with straight arrows before at-grade crossings, in conjunction with guidance information and the addition of edge lines, is a low-cost solution to reduce driver confusion in selecting proper turning points as they approach an at-grade crossing, which has been identified a serious safety risk in traffic management. Understanding the effectiveness of the proposed countermeasures obtained from the before-after study will be beneficial for future implementation of this low-cost solution at identified crossings of incorrect turns in Florida and provide a guideline for future implementation.

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1.1 Introduction

Preventing incorrect turns at highway-rail grade crossings has received considerable attention in an effort to decrease fatalities and injuries for both road users and rail users/operators. To mitigate serious injuries and fatal collisions due to incorrect turns at highway-rail grade crossings, a previous National Center for Transit Research (NCTR) research project titled, "Improved Traffic Control Measures to Prevent Incorrect Turns at Highway-Rail Grade Crossings," successfully identified five major contributing causes of incorrect turns onto railroad tracks: (1) potentially misleading signs and pavement markings near highway-rail crossings, (2) darkness and low visibility near or at highway-rail crossings, (3) following inaccurate turn instructions from a GPS device onto railroad tracks, (4) skewed highway-rail grade crossings, and (5) driver distraction. Right-turn arrow pavement markings in front of a railroad grade crossing could cause the most confusion for drivers who turn onto the railroad tracks, as illustrated in Figure 1-1 [1].

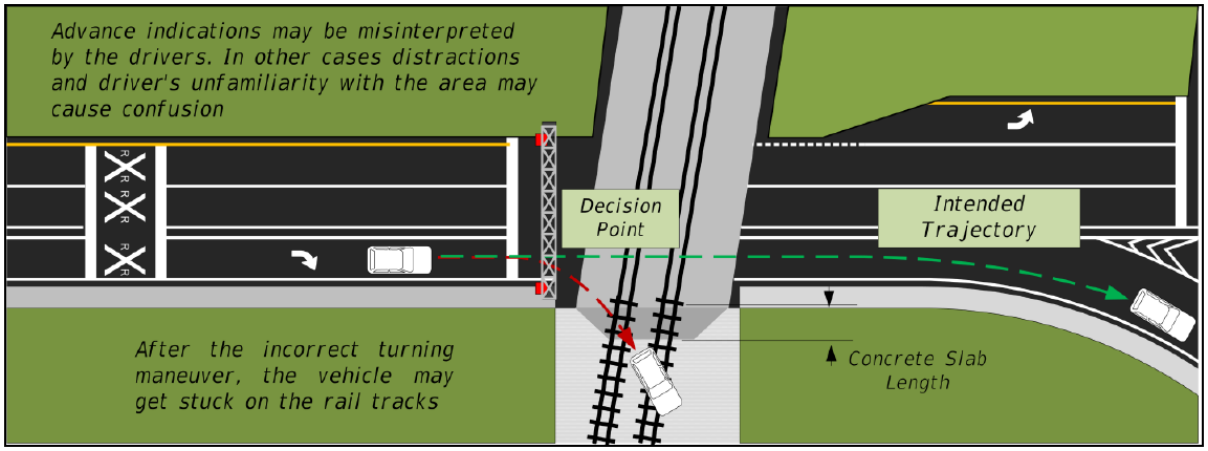


Figure 1-1 Sketch of incorrect turning maneuver near an interstate ramp [1].

Based on the identified causes, a set of practical countermeasures was developed to prevent incorrect turns at grade crossings in the previous NCTR study [1]. The major recommended countermeasures for upstream of a highway-rail grade crossing include advance direction signage, striping, and elimination of potentially misleading pavement markings and signs. Recommended downstream countermeasures consist of guide signs and striping. For critical zones, countermeasures such as striping, pavement gate markings, bollards, and illumination were recommended. The study also recommended a cost-effective method to evaluate the effectiveness of any implemented countermeasures to prevent incorrect turns onto railroad tracks.

Among the many recommended countermeasures by NCTR [1], one potentially cost-effective way to prevent incorrect turns onto railroad tracks is through proper pavement markings, which communicate to drivers where to position their vehicles and warn about upcoming conditions. Pavement markings can efficiently guide drivers by providing important regulatory, warning, or guidance messages without requiring diversion of the road user's attention from the roadway surface. Conversely, the absence of proper pavement markings and/or the presence of improper

markings, such as turning arrows in front of a railroad grade crossing, could lead to driver confusion or hesitation when approaching an incorrect turning point [2].

CUTR explored emerging traffic control countermeasures for preventing incorrect turns at railroad crossings, in particular, pavement markings with guidance information. The research team reviewed recent recommended changes from the National Committee on Uniform Traffic Control Devices (NCUTCD) to the *Manual on Uniform Traffic Control Devices* (MUTCD) to address incidents that resulted in incorrect turns at highway-rail grade crossings. A summary of successful Florida Department of Transportation (FDOT) experience to prevent wrong-way driving was also compiled. The performance and specifications of the proposed changes to MUTCD and the FDOT countermeasures were reviewed and identified for potential implementation at railroad grade crossings in selected sites in Florida.

Based on the previous NCTR study, recent recommended changes from NCUTCD to address the incidents due to incorrect turns at highway rail grade crossings, and successful FDOT countermeasure implementation to prevent wrong-way driving, four promising low-cost countermeasures are recommended for preventing incorrect turns at highway-rail grade crossings, as listed in Table 1-1.

Table 1-1 Recommended Countermeasures to Prevent Incorrect Turns

Countermeasure	Sources
I. Elimination of potentially misleading pavement markings and signs	NCUTCD* proposal to MUTCD (2010)
II. Implementation of pavement markings with guidance information	MUTCD and successful FDOT experience on wrong-way driving
III. Extension of edge lines at highway-rail grade crossings	NCUTCD* proposal to MUTCD (2015)
IV. Implementation of Qwick Kurb	MUTCD (2009) 2C.64

*National Committee on Uniform Traffic Control Devices

1.1.1 Countermeasure I: Elimination of Potentially Misleading Pavement Markings and Signs

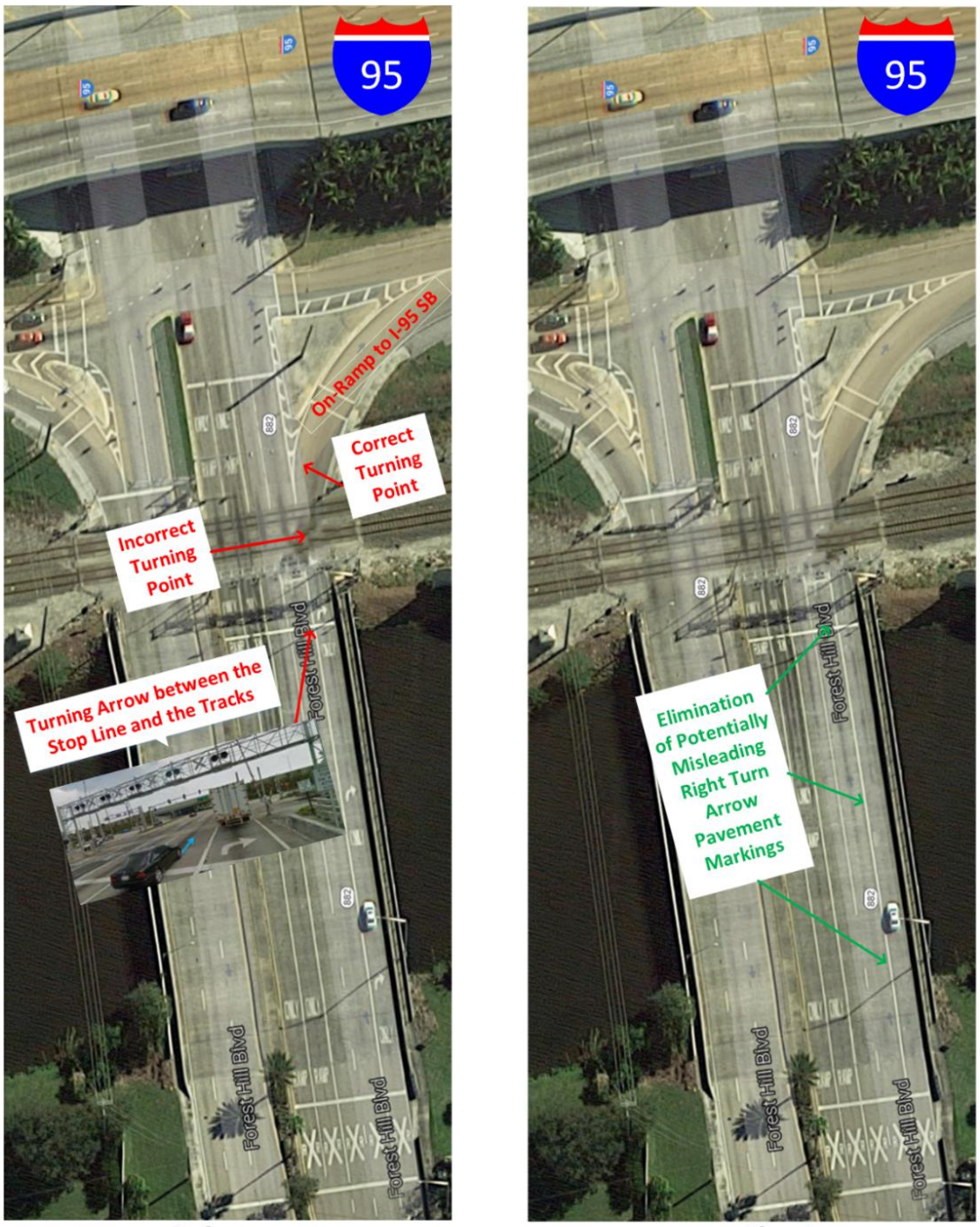
According to the previous NCTR study, the most recognized regulatory signs and pavement markings in front of a railroad grade crossing that may confuse drivers are “Right Lane Must Turn Right,” “Left Lane Must Turn Left,” right turn only, and/or left turn only pavement markings [1]. Figure 1-2 shows an example of these signs and markings before a railroad crossing on W Commercial Blvd near I-95 in Oakland Park, Florida. To eliminate this potential confusion, the national NCUTCD Technical Committee suggests placing them a minimum of 100 ft in advance of the stop line for a highway-rail grade crossing. The specific recommendation was proposed in NCUTCD Technical Committee Railroad/Light Rail Transit Technical Committee (RRLRT) Item No. 1 [3]. The proposed changes were supported by the Association of American Railroads (AAR) in a letter to the Federal Highway Administration (FHWA) recommending adoption of the changes into MUTCD.

Figure 1-2 Example of potentially misleading right-turn sign and pavement markings.

The purpose of the change proposed by NCUTCD [3] was to address several train-auto crashes that occurred several years before the proposal. In all of those incidents, a roadway user made an improper turn onto the tracks rather than at an adjacent intersection immediately beyond the grade crossing. It is believed that some additional language may be beneficial to guide roadway users at grade crossings. In many of the incidents, an arrow pavement marking denoting an exclusive drop lane was located on the roadway between the stop line for the grade crossing and the track area was causing drivers to misinterpret the curb-cut at the railroad crossing as the location at which they were to turn. It is believed that the proposed change will lead road users to more clearly understand where the turn is to be made, even under adverse conditions [3].

> *Proposed Section 8B.23 Arrow Markings*
>
> *Standard:* Arrow pavement markings for turn lanes shall not be placed between the stop line for the highway-rail grade crossing and the tracks.
>
> *Guidance:* Arrow pavement markings, if used, should be placed a minimum of 100 ft in advance of the stop line for the highway-rail grade crossing when sufficient turn lane storage length exists. Arrow pavement markings, if used, should be placed no less than 20 ft beyond the far rail.

Figure 1-3 shows an example of the before-after comparison of proposed Countermeasure I in front of a grade crossing on Forest Hills Blvd near I-95 in Lake Clarke Shores, Florida. In this case, an arrow pavement marking denoting an exclusive lane was located on the roadway between the stop line for the grade crossing and the track area. According to the proposal by NCUTCD [3], the arrow pavement marking between the stop line and rail crossing and those within 100 ft before the stop line is suggested to be eliminated. CUTR also suggests eliminating arrow pavement markings before a grade crossing, as shown in Figure 1-3. In this case, the "Right Lane Must Turn Right" sign before the grade crossing will also be eliminated to avoid confusion.



Before

Potentially Misleading Pavement Markings

After I

Elimination of Potentially Misleading Pavement Markings

Figure 1-3 Countermeasure I: Elimination of potentially misleading arrow pavement markings and signs before a grade crossing.

1.1.2 Countermeasure II: Implementation of Pavement Markings with Guidance Information

Pavement words, symbols, and arrow markings are used for the purpose of guiding, warning, or regulating traffic. According to MUTCD, symbol messages are preferable to word messages (MUTCD, 2009) [4]. In particular, route shield pavement markings are available for use in accordance with the MUTCD Section 3B and FDOT's *Traffic Engineering Manual* (TEM), Section 4.2. One example is the route shield lane pavement markings used on Bearss Avenue at I-75, shown in Figure 1-4. These pavement markings are used to reduce a spate of wrong-way driving incidents in which drivers were incorrectly attempting to enter I-275 using its exit ramps. Incorrect turning by drivers at highway-rail grade crossings is also a type of wrong-way driving. This pilot study recommends the use of similar pavement markings with guidance information to deter and prevent future incidents of incorrect turns at highway rail grade crossings near interchange ramps or at-grade signalized intersections with exclusive turn lanes.

Figure 1-4 Pavement markings with guidance information at I-275 NB off-ramp at Bearss Ave, Tampa, Florida.

To adopt the suggestion from MUTCD and apply successful FDOT experience on preventing wrong-way driving, CUTR explored two types of designs, including through arrow pavement markings with target roadway information (name and direction) to replace the turning arrow pavement markings on the upstream of the railroad crossing, as illustrated in Figure 1-5.

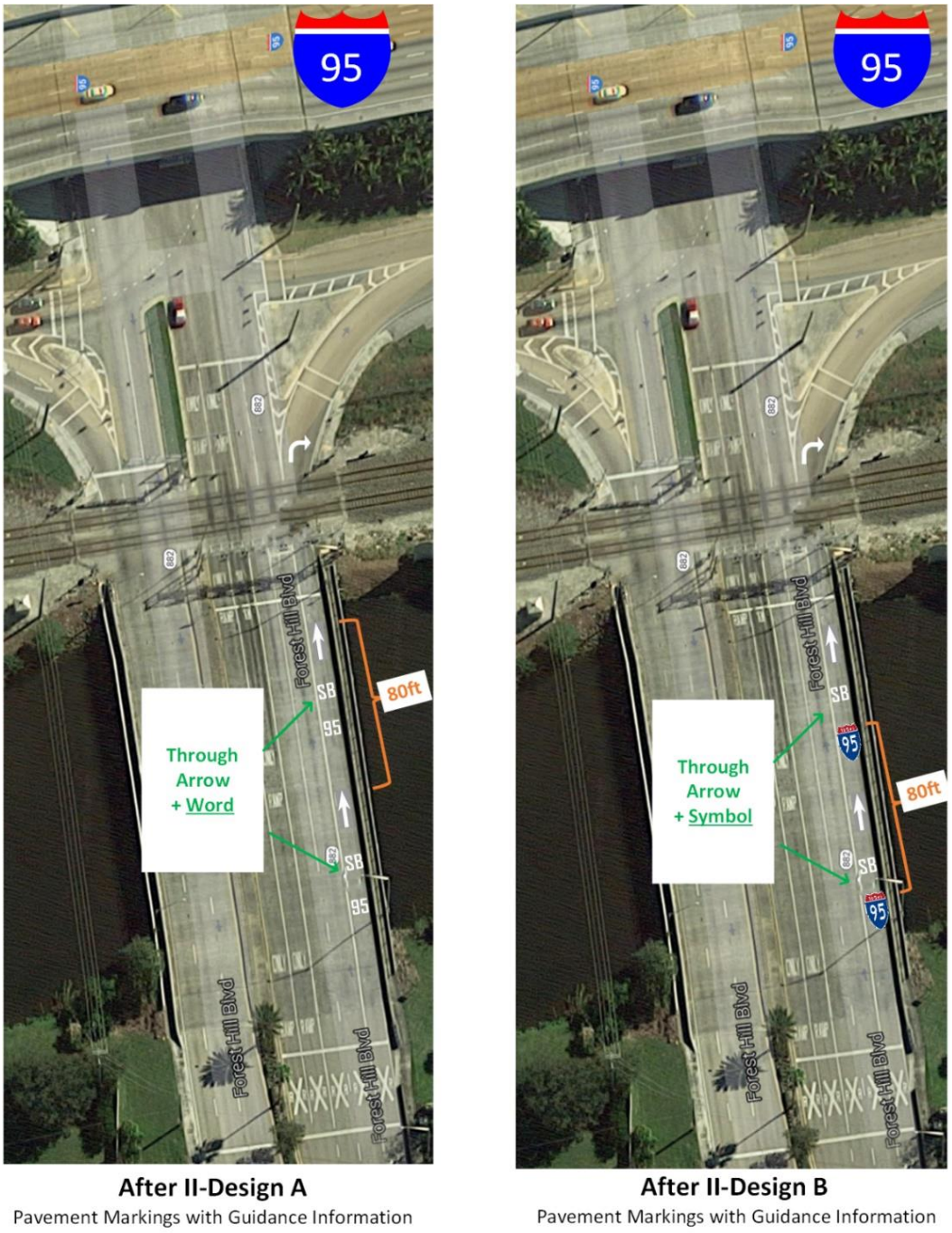


Figure 1-5 Countermeasure II: Implementation of pavement markings.

Design type A uses a combination of word message, cardinal direction, and straight arrow in front of a grade crossing, and design type B uses a combination of a route or interstate shield, cardinal direction, and straight arrow in front of a grade crossing. A word message (Design A) will cost less, but a symbol message (Design B) can provide better visibility. Both can provide guidance information for preventing incorrect turns at highway-rail grade crossings. If used, route shield pavement markings must be installed as follows, according to FDOT'S TEM Sections 4.2.3 and 4.2.4 (FDOT, 2012 and revised 2016) [5]:

- All route shields shall be pre-formed thermoplastic.
- All route shield pavement markings shall be 15 ft in length.
- US route shields shall have contrast for both asphalt and concrete pavement
- Align the symbol in the center of the lane.
- Install the route shields in a single line across the roadway. Do not stagger.
- Arrows and/or messages (To, Left, Right, North, and South) may be used to supplement route shields and shall follow the route shield.

Use an 80 ft gap between markings. However, cardinal directions (if used) may be 40 ft from a route shield marking.

1.1.3 Countermeasure III: Extension of Edge Lines at Highway-Rail Grade Crossings

Another issue associated with incorrect turns and train-vehicle crashes is that a roadway edge line may stop near the stop line for the grade crossing and does not continue across the track area. In 2011, the Railroad and Light Rail Technical (RRLRT) Committee recommended the addition of new Section 8B.31 to address the optional inclusion of edge line markings across a grade crossing. The National Transportation Safety Board (NTSB) made a preliminary safety recommendation to allow the use of tubular delineators to further supplement the edge line markings (NCUTCD, 2015) [6]. The RRLRT Committee, FHWA, and AAR support this recommendation and have proposed the following changes to Section 8B.31.

Proposed Section 8B.31 Edge Lines and Lane Lines at Grade Crossings

Guidance:

- When used, edge lines (see MUTCD Section 3B.06) and lane lines (see MUTCD Section 3B.04) should extend to and across the track(s) at a grade crossing to delineate the edge of the traveled way and the separation of traffic lanes across the track(s).
- When used, tubular delineators should not be installed within 6 ft of any rail.

Option:

- The edge lines and lane lines may be omitted from the crossing surface if the surface cannot retain the application of the marking.
- Raised pavement markers or tubular delineators may be used to supplement the edge lines to delineate the edge of the traveled way across the track(s).

Support:

- This delineation is desirable where the crossing is in close proximity to a highway intersection.
- Where used, raised pavement markers or tubular delineators placed along the edge line of the traveled way shall be white or yellow in color to match the color of edge lines stipulated in MUTCD Section 3B.06.

Figure 1-6 shows an example of a before-after comparison of Countermeasure III in front of a railroad crossing on Forest Hills Blvd near I-95 in Lake Clarke Shores, Florida. Extending edge

lines markings to and across grade crossings will increase the visibility of the edge of the travel lane for road users and emphasize the message the crossing curb cut is not a place to turn.

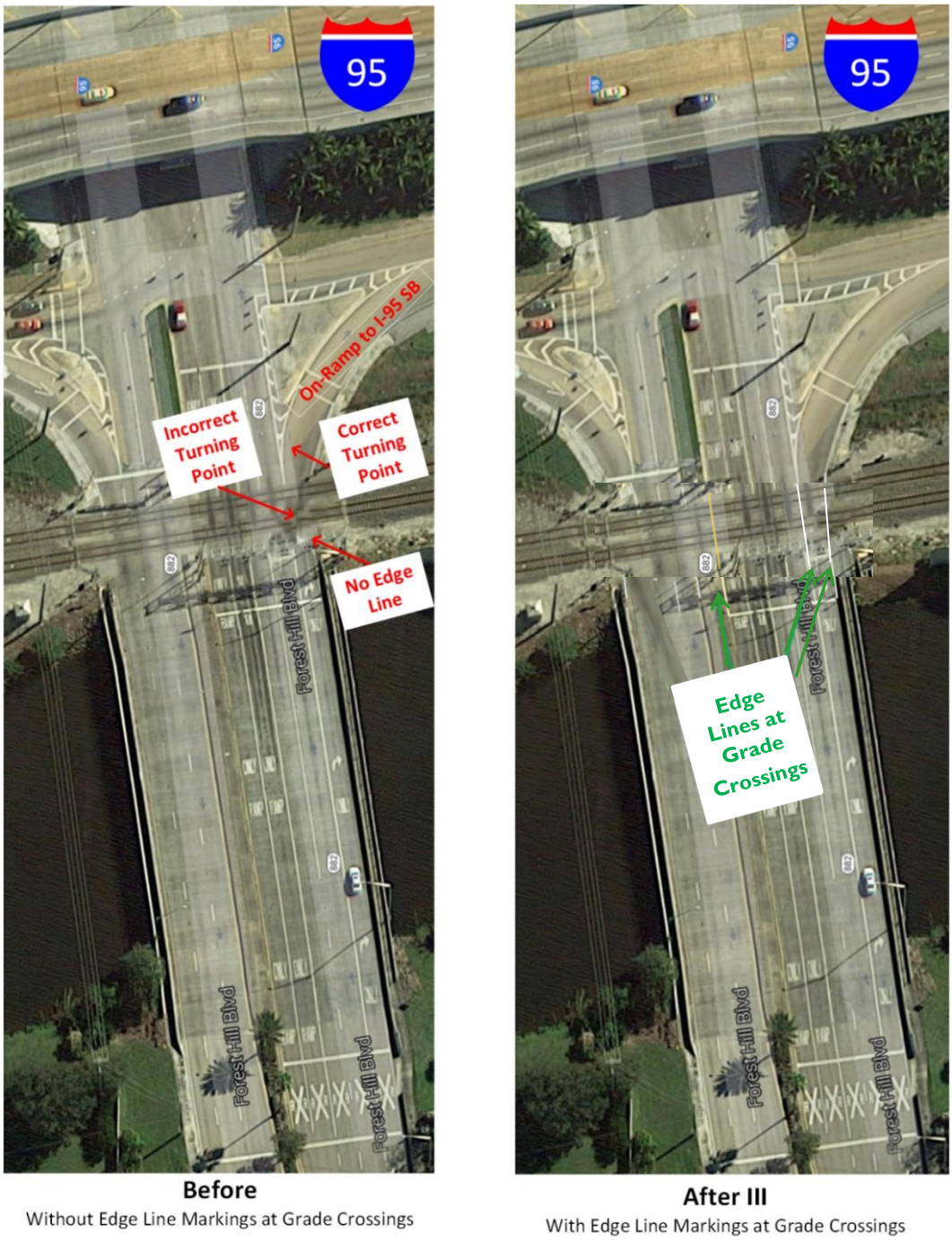


Figure 1-6 Countermeasure III: Extension of edge lines.

The combination of the above three recommended countermeasures, as illustrated in Figure 1-7, could be a holistic treatment to prevent incorrect turns onto railroad tracks.

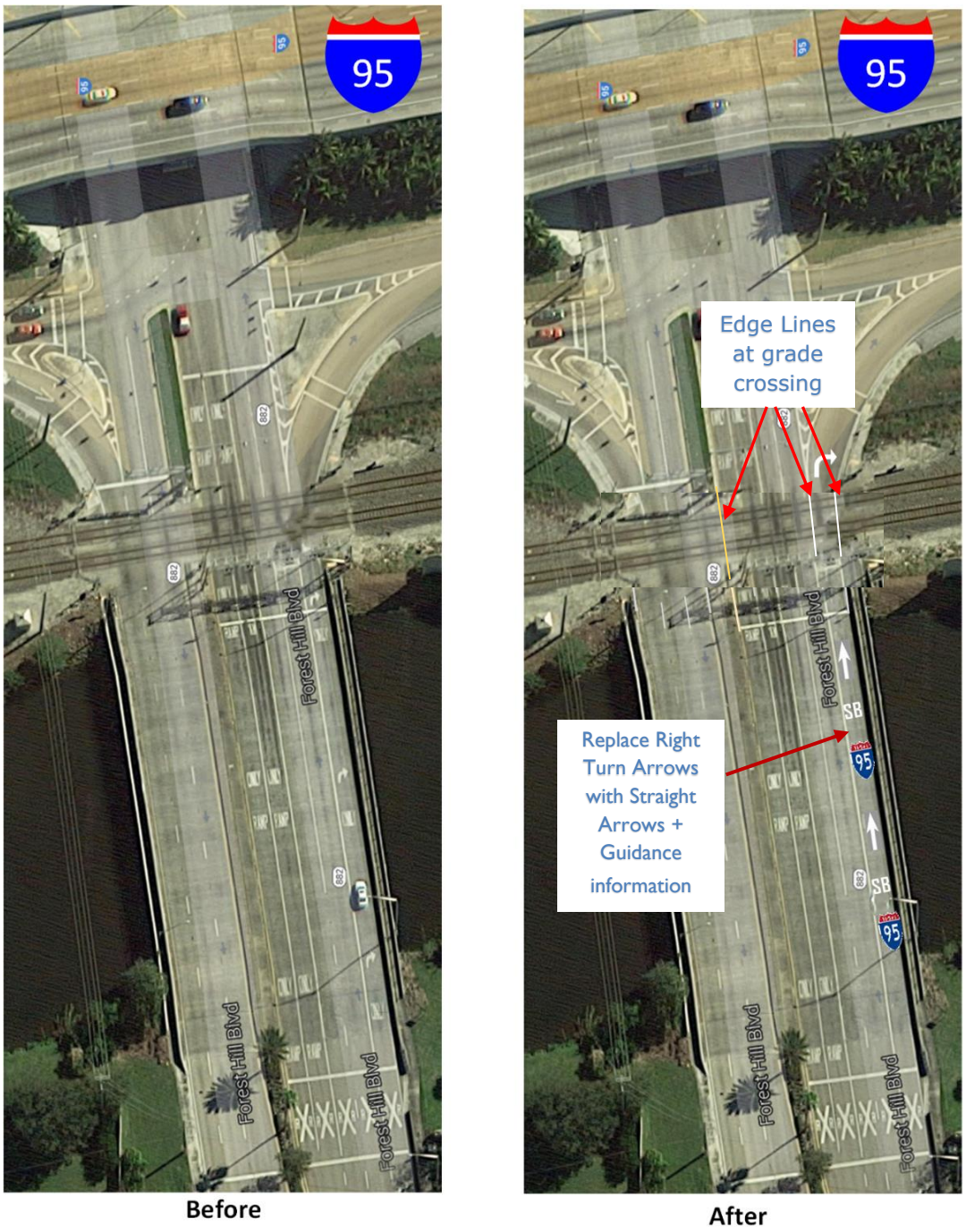


Figure 1-7 Combination of Countermeasures I, II and III.

1.1.4 Countermeasure IV: Implementation of Qwick Kurb

At some rail crossings, there is a potential risk of drivers turning around (making a U-turn) using railroad tracks. An example of an incorrect U-turn is shown in Figure 1-8.

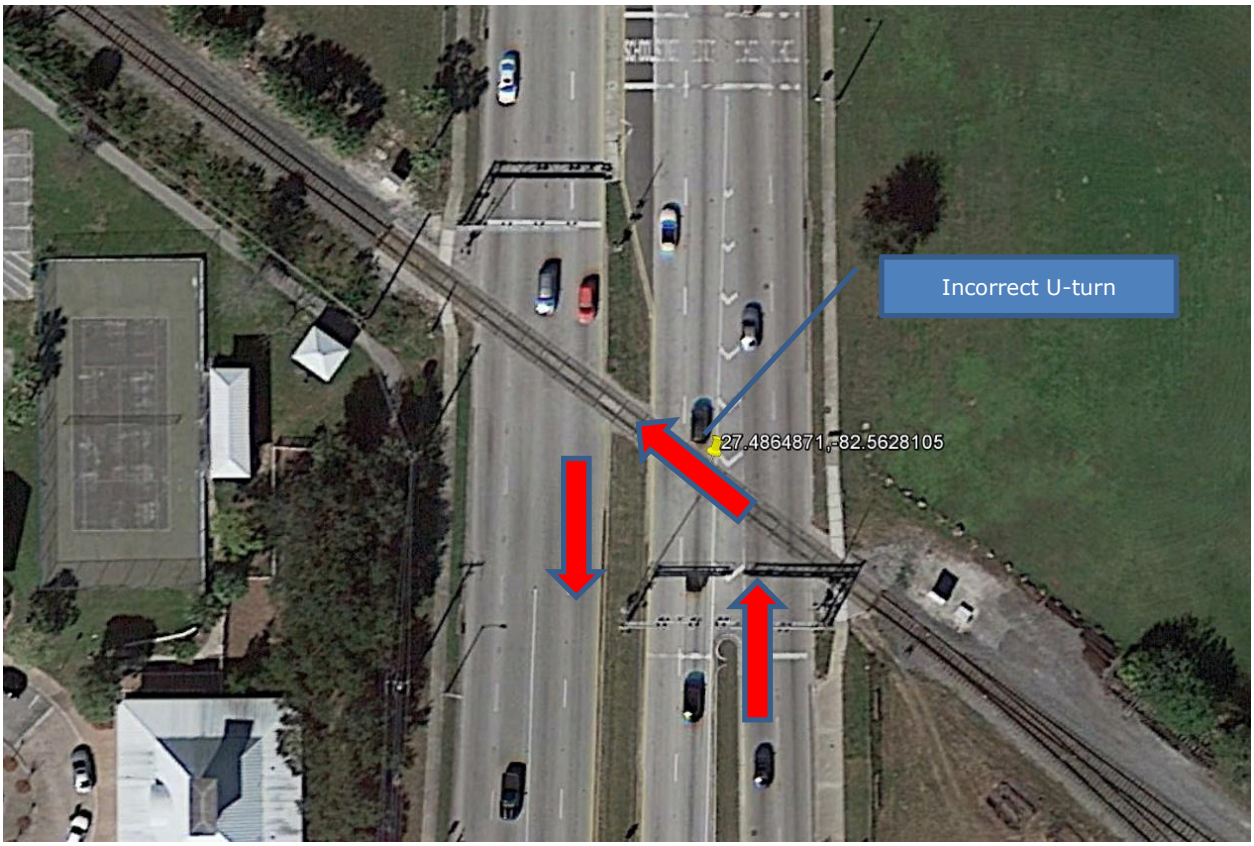


Figure 1-8 Example of incorrect U-turn at railroad crossing.

Qwick Kurb can deter motorists from turning around before or at railroad crossings, consequently preventing incorrect U-turns. The U.S. Department of Transportation (DOT) Federal Railroad Administration (FRA) promotes the use of traffic channelization devices (e.g., Qwick Kurb) at highway-rail grade crossings with active warning devices, where applicable. These traffic channelization devices provide a proven safety benefit. A previous study [7] was conducted at locations where driver violations occurred at highway-rail grade crossings and after installation of channelization devices at these locations, resulting in a significant reduction in driver violations. Figure 1-9 shows an example of Qwick Kurb at a railroad crossing.

Figure 1-9 Example of Qwick Kurb at railroad crossing *(photo courtesy of NCDOT).*

1.2 Effectiveness of Pavement Marking Countermeasures for Wrong-Way Driving

FDOT's Traffic Engineering and Operations office has made a statewide effort to address wrong-way driving problems that were especially prevalent in 2014. Guidance in a *Roadway Design Bulletin* notes changes that recommended straight arrow and route interstate shield pavement markings in left-turn lanes at off-ramp intersections. These route shield pavement markings have been actively implemented in FDOT District 7, where crash data show a significant reduction in wrong-way driving fatalities in 2015. In FDOT District 4, by the summer of 2016, approximately 25% of interchanges will feature the signs and markings.

Many studies have been conducted to evaluate the effectiveness of countermeasures for wrong-way driving. Table 1-2 provides a summary of previous studies on pavement marking-related countermeasures to prevent wrong-way driving.

1.3 Effectiveness of Qwick Kurb to Deter Drivers from Turning around at Railroad Crossings

Studies [7] have been conducted to evaluate the effectiveness of Qwick Kurb for discouraging motorists from violating the warning gates, as shown in Table 1-3.

Table 1-2 Summary of Previous Studies on Pavement Marking-Related Countermeasures to Prevent Wrong-Way Driving

Reference	Treatments	Notes/Findings
NTTA, 2013 **[8]**	• Pavement marking modifications at westbound US 380 at Dallas North Tollway (DNT) northbound exit ramp	• Reduction from 5 incidents in 6 months before change to 3 in 6 months after treatment (40% reduction) • $1,104 – roadway pavement marking modifications
Chrysler & Schrock, 2005 **[9]**	• Pavement marking – pair of 9-ft, through lane-use arrows • Located 120 ft from gore of exit ramp	• 90% reduction in number of wrong-way maneuvers (incorrect movements dropped from 7.4% of correct movements before to 0.7% after)
Pour-Rouholamin et al., 2015 **[2]**	• Survey questionnaire designed to collect data concerning current practices of wrong-way driving countermeasures • Included pavement markings	• Roughly 70% of respondents use wrong-way arrows as described in 2009 MUTCD • Majority of agencies place these arrows on exit ramp near intersections with crossroads (71.4%) and at middle of exit ramps (64.3%) • More than half (56.3%) of states have equipped pavement markings at problematic roads with red retroreflective raised pavement markers
Campbell & Middlebrooks, 1988 **[10]**	• Studied effect of package of countermeasures for wrong-way driving at exit ramp in Atlanta • Included treatments to improve visibility of longitudinal pavement markings	• Rate of wrong-way maneuvers decreased from 88.6/month to 2.0/month after countermeasure applications, 97% reduction
Kaminski & Leduc, 2008 **[11]**	• Guideline – existing left-side exit ramps on freeways must have reflectorized wrong-way pavement arrows installed	• 24% of DOTs responding to TTI survey use wrong-way pavement arrows on all exit ramps • 28% use them on known or suspected problem areas
Morena & Leix, 2012 **[12]**	• MDOT assembled package of multiple low-cost countermeasures by providing more extensive and comprehensive visual cues • Included pavement marking extensions	• MDOT estimated average cost of implementing countermeasure package at approximately $6,500 per treated exit ramp

Table 1-3 Summary of Previous Studies on Qwick Kurb to Deter Drivers from Turning around at Railroad Crossings

References	Treatments	Notes/Findings
The Transpo Group, Inc., 2000 **[13]**	• Studied effectiveness of median separators implemented at specific at-grade rail crossing location • Data collected for 60 days before and after installation of median separators	• Vehicle violation rates averaged 1.8 incidents per week before installation of separators • Vehicle violation rates averaged 0.4 incidents per week after installation on the separators
Sneed, 1998 **[14]**	• Evaluation of 20 trains performed using video camera before and after installation of countermeasure	• Pre-evaluation observed 8 vehicles crossing violations • Post evaluation observed 2 vehicles coming around crossing guards
Ko, Courage & Willis, 2003) **[15]**	• Surveillance system used to collect video data at crossing sites • Data used to evaluate effectiveness of separator in discouraging motorists from violating warning gates before train arrives and after train departs	• 4004 hours of video recorded • 2624 train crossing events observed manually to assess effectiveness of traffic separators • 25 vehicles drove around gate when the separators not installed. Only one vehicle was observed after separators installed
Horton, 2010 **[16]**	• Survey of types of traffic channelization devices with discussion on effectiveness of types of devices	• Installation of traffic channelization devices at highway-rail grade crossing discussed; risky behavior reduced by 68%
Goodell Grivas, Inc., 2000 **[17]**	• Study of before and after installing Qwick Kurb made at different sites with video camera and observer	• Flexible median barriers used in study effective in reducing driver violation
McKnight & Khattak, 2007 **[18]**	• Data collected for 4 months at intersection to observe driving behavior when gates close at railroad crossing	• Rubber plastic barrier installed to study driving actions. • Total number of unsafe driving actions decreased after installation of barriers

1.4 Combination of Countermeasures

Based on the previous NCTR study, recent recommended changes from NCUTCD to address incidents due to incorrect turns at highway-rail grade crossings, and successful FDOT experience to prevent wrong-way driving countermeasure implementation, four promising low-cost countermeasures described above are recommended for preventing incorrect turns at highway-rail grade crossings:

1. Elimination of potentially misleading pavement markings and signs
2. Implementation of pavement markings with guidance information
3. Extension of edge lines at highway-rail grade crossings
4. Implementation of Qwick Kurb to deter and prevent incorrect U-turns

To provide better guidance for road users, it is recommended to consider combining different countermeasures for preventing incorrect turns onto railroad tracks.

2 Development of Incorrect-turn Incident History Inventory for Florida

2.1 Overview

An inventory for incorrect turns of vehicles onto railroad tracks in Florida could help FDOT and practitioners identify problem areas and locations for future improvements to reduce incidents of incorrect turns onto railroad tracks.

CUTR developed an inventory of incidents caused by incorrect turns at highway-rail grade crossings onto railroad tracks in Florida. The research team coordinated with FDOT using three major data sources: FDOT Crash Analysis Reporting System (CARS), FRA accident/ incident database, and news reports. The research team also coordinated with FDOT to contact railroad companies to obtain records of events of vehicles stuck on rail tracks that were not available in the FRA and FDOT databases. Statewide incident data were analyzed to gain insights on the occurrence of incidents pertaining to incorrect turns of vehicles onto railroad tracks. The time frame for the data collection was from 2010 to 2014.

It should be noted that events involving incorrect turns onto railroad tracks were difficult to be determined based on existing fields in the FRA and FDOT databases. When a vehicle is removed from rail tracks and no damage occurred at the crossing, the incident may not be reported to FRA. Also noteworthy is that the FDOT database provides crash information that includes both trains and cars in the same event.

2.2 Development of Incorrect Turn Incident History Inventory

CUTR adopted five steps to collect information on incidents caused by incorrect turns onto railroad tracks.

2.2.1 Step 1: Identify Crashes Due to Incorrect Turns from CARS

CUTR reviewed the historical crash data in FDOT CARS and identified incorrect turn-caused crashes based on the following criteria:

- Crash occurred between 2010 and 2014
- Crash occurred at a railroad crossing
- Vehicle-train crashes or single-vehicle crashes only
- Before crash occurrence, vehicle was turning (left turn or right turn)

To filter incorrect turn-caused crashes from the millions of historical crash data, a GIS-based procedure was developed, as shown in Figure 2-1. In total, 14 crashes were identified from the FDOT CARS, as shown in Table 2-1.

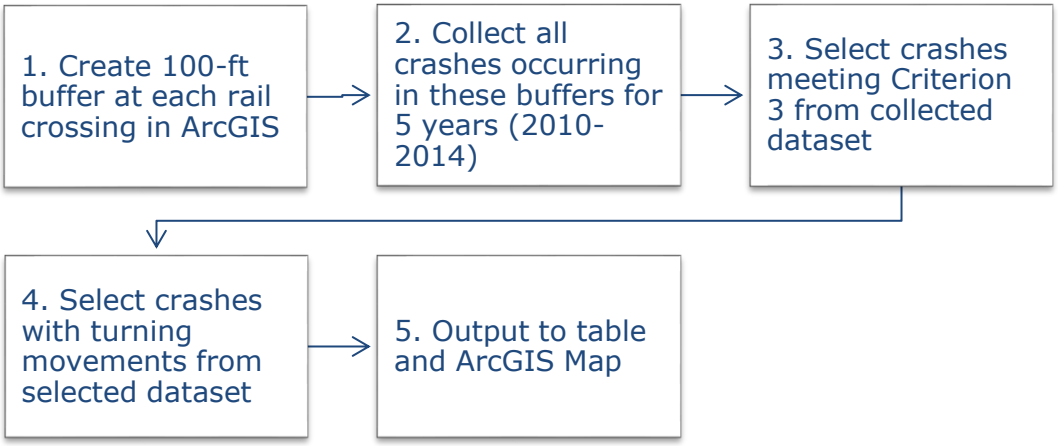


Figure 2-1 Procedure to filter crashes due to incorrect turns at highway-rail grade crossings from FDOT CARS.

2.2.2 Step 2: Identify Crashes/Incidents Caused by Incorrect Turns from the FRA Database

CUTR searched the FRA database to collect incident events, including crash events and non-crash events, occurring in Florida from 2010–2014. The data review procedure is shown in Figure 2-2. In total, six crash events were identified from the FRA database, as shown in Table 2-1.

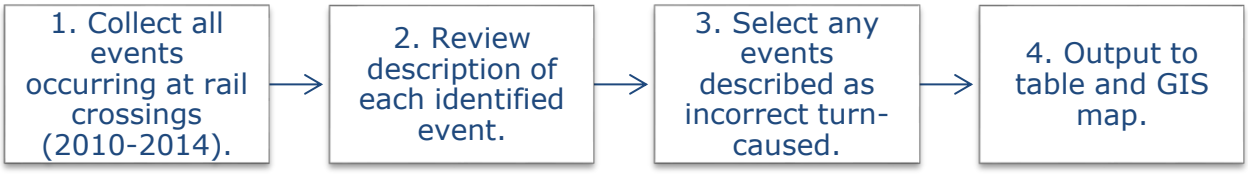


Figure 2-2 Procedure to filter events caused by incorrect turns at highway-rail grade crossings from the FRA database.

2.2.3 Step 3: Identify Crashes/Incidents Caused by Incorrect Turns from News Reports

CUTR searched news reports that recorded events caused by incorrect turns at highway-rail grade crossing that occurred in Florida from 2010–2014. Based on descriptions in the reports, the research team identified any event involving incorrect turns at railroad crossings and matched the event to the FDOT CARS to determine if the events were crashes. The procedure is shown in Figure 2-3. In total, eight events were identified from the news reports, as shown in Table 2-1.

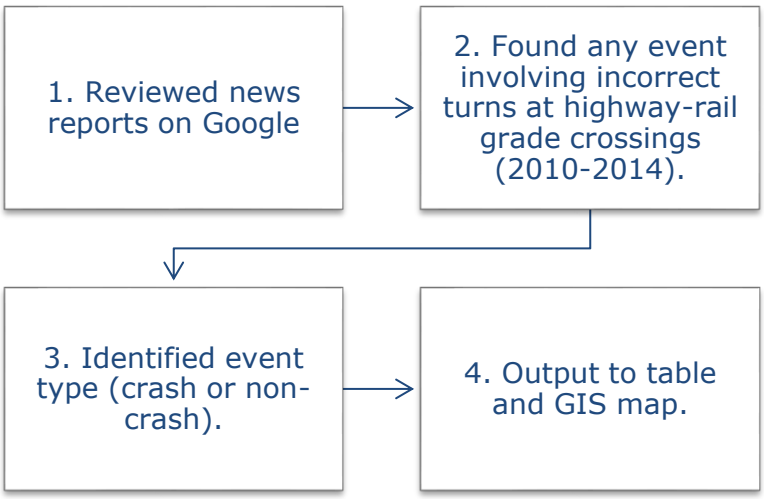


Figure 2-3 Procedure to filter events caused by incorrect turns at highway-rail grade crossings from news reports.

2.2.4 Step 4: Merge Identified Crashes and Incidents Caused by Incorrect Turns

The research team matched the incidents identified from the three data resources to exclude duplicated events. Finally, no duplicated events were found and 28 events (26 crashes and 2 non-crash events) were merged into a GIS map, as shown in Table 2-1.

2.2.5 Step 5: Collect Events of Vehicle Stuck on Tracks from Railroad Companies

In addition to incidents identified from the three data sources, CUTR also collected information on events of vehicles stuck on railroad tracks caused by incorrect turns at railroad crossings from CSX in Florida in 2012. If a vehicle was stuck on a railroad track, unless an incorrect turn was clearly excluded as the cause (for example, accident on a nearby track), it was most likely caused by an incorrect turn at a highway-rail grade crossing. The research team reviewed all events in the CSX reports and retained all events in which the cause could not be excluded from incorrect turns. The summary of events in which vehicles were stuck on tracks, arranged by city, are given in Table 2-2. Tampa and Jacksonville are among the top two cities with many incidents.

Table 2-1 Identified Crashes/Incidents Caused by Incorrect Turns at Highway-Rail Crossings in Florida (2010-2014).

CROSSING	YEAR	ROAD1	ROAD2	CITY	DISTRICT	CRASH	SOURCE
624151p	2014	Combee Rd	US 92	Lakeland	1	Yes	FDOT
624151p	2010	Combee Rd	US 92	Lakeland	1	Yes	FDOT
624151p	2003	Combee Rd	US 92	Lakeland	1	Yes	FDOT
624151p	1987	Combee Rd	US 92	Lakeland	1	Yes	FDOT
628281a	1998	Hollywood Blvd	I-95	Hollywood	4	Yes	FDOT
628281a	1989	Hollywood Blvd	I-95	Hollywood	4	Yes	FDOT
628139w	2014	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	2008	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	2006	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	2001	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	1991	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	1991	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
628139w	1988	Forest Hill Blvd	I-95	West Palm Beach	4	Yes	FDOT
626890u	1987	North Blvd	Busch Blvd	Tampa	7	Yes	FDOT
624820x	2010	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	2002	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	2001	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	2001	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	1999	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	1994	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	1991	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
624820x	1987	Adamo Dr	N 39th St	Tampa	7	Yes	FDOT
626845a	2010	Tampa Road	State St W	Tampa	7	Yes	FDOT
621216	2010	Mcduff Ave	Post	Jacksonville	2	Yes	FRA
628186	2010	Commercial Blvd		Oakland Park	4	Yes	FRA
628290	2010	Hallendale Beach Blvd		Hollywood	4	Yes	FRA
N/A	2010	Blue Springs Ave	Magnolia Ave	Orange City	5	Yes	NEWS
641457	2010	12th St NW	87th Ave NW	Doral	6	Yes	CARS
N/A	2011	Allendale Rd		West Palm Beach	4	Yes	FRA
838210	2011	SR 20	SR 65	Hosford	3	No	NEWS

Table 2-1 Identified Crashes/Incidents Caused by Incorrect Turns at Highway-Rail Crossings in Florida (2010-2014) (Continued).

CROSSING	YEAR	ROAD1	ROAD2	CITY	DISTRICT	CRASH	SOURCE
628186	2011	Commercial Blvd	I9-5	Ft. Lauderdale	4	Yes	NEWS
621217	2011	Edgewood Ave	US 17	Jacksonville	2	No	NEWS
838210	2011	SR 20	SR 65	Unincorporated	3	Yes	CARS
339809	2011	SR 285	RR #339809N		3	Yes	CARS
272519	2011	Copans Rd	Dixie Hwy	Pompano Beach	4	Yes	CARS
272577	2011	Sheridan St	RR #272577K	Dania Beach	4	Yes	CARS
620891	2011	Timuquana Rd	RR #620891F	Jacksonville	2	Yes	CARS
339790	2012	Galliver Cut-Off		Crestview	3	Yes	FRA
272604	2012	163rd St NE	Biscayne Blvd	North Miami Beach	6	Yes	CARS
272550	2013	NE. 3rd Ave		Fort Lauderdale	4	Yes	FRA
273419	2013	St. Lucie Ave	Flagler Ave	Stuart	4	Yes	CARS
621216	2013	Mcduff Ave S		Jacksonville	2	Yes	CARS
272748	2013	W 8 Ave	W 21 Street	Hialeah	6	Yes	CARS
620619	2013	Lane Ave S	Beaver St W	Jacksonville	2	Yes	CARS
628146	2014	6th Ave	I-95	Lake Worth	4	Yes	NEWS
622188	2014	Washington St	Gertrude Ave	Orlando	5	Yes	NEWS
625087	2014	SE 80th St	US 301	Ocala	5	No	NEWS
622067	2014	N Ronald Reagan Blvd	Longwood Lake Mary Rd	Longwood	5	Yes	NEWS
622163	2014	S New York Ave	W Lyman Ave	Winter Park	5	Yes	CARS
272495	2014	SW 10th St	S Swinton Ave	Delray Beach	4	Yes	CARS
622164	2014	W Fairbanks Ave	Blake St	Winter Park	5	Yes	CARS

Table 2-2 Summary of Incidents of Vehicles on Rail Tracks in Florida, 2012.

City	# Incidents	City	# Incidents
Tampa	56	Barberville	1
Jacksonville	29	Bartow	1
Pensacola	20	Belleview	1
Plant City	19	Bostwick	1
Lakeland	12	Bowling Green	1
Hialeah	11	Boynton Beach	1
Pompano Beach	10	Bradley	1
Boca Raton	9	Bushnell	1
Hollywood	9	Chattahoochee	1
Clearwater	8	Chipley	1
Miami	8	Cypress	1
West Palm Beach	8	Dade City	1
Tallahassee	7	De Land	1
Mulberry	6	Deerfield Beach	1
Delray Beach	5	Dover	1
Homestead	5	Fort Lauderdale	1
Land O Lakes	5	Green Cove Springs	1
Largo	5	Holt	1
Palmetto	5	Holt (Holts)	1
Alachua	4	Homeland	1
Auburndale	4	Interlachen	1
De Funiak Springs	4	Lake Alfred	1
Indiantown	4	Lake Como	1
Oakland Park	4	Lake Wales	1
Ocala	4	Lawtey	1
Opa-Locka	4	Longwood	1
Orange Park	4	Lutz	1
Hawthorne	3	Macclenny	1
Lake Worth	3	Milton	1
Live Oak	3	Mossy Head	1
Orlando	3	Ocoee	1
Palm Beach Gardens	3	Oldsmar	1
Taft	3	Palatka	1
West Miami	3	Pinellas Park	1
Zephyrhills	3	Quincy	1
Avon Park	2	Ruskin	1
Brooksville	2	Safety Harbor	1
Cantonment	2	Sanford	1
Fort Meade	2	Seffner	1
Haines City	2	Starke	1
Oxford	2	Wildwood	1
Saint Petersburg	2	Winter Park	1
South Miami	2		

3 Facilitation of Review Process of Recommended Countermeasures with FDOT Panel

3.1 Overview

Two major subtasks were included as part of this activity. The first was to prepare needed information and materials on recommended countermeasures for preventing incorrect turns at highway-rail grade crossings and candidate sites for future field studies for project panel to review. Key panel members for this project included the FDOT project manager and representatives from FDOT Districts 1, 4, and 7. The second was for CUTR to coordinate, schedule, and facilitate the review process to present and discuss the recommended countermeasures and candidate sites with project panel members to obtain feedback, comments, and suggestions.

3.2 Information and Material Preparation for Panel Review and Discussions

CUTR collected and prepared the following information and materials before review of recommended countermeasures and candidate sites via meetings or teleconferences with project panel members:

- Incident information and contributing factors for incorrect turns onto railroad tracks near downstream intersections.
- Proven effectiveness of wrong-way driving treatments, including pavement markings with guidance information.
- Examples of pavement markings with guidance information to prevent wrong-way driving.
- Recommended low-cost and potentially effective countermeasures to prevent incorrect turns of vehicles onto railroad tracks including Countermeasure I: Elimination of arrow pavement markings and signs, Countermeasure II: Implementation of pavement markings with guidance information, and Countermeasure III: Extension of edge-line pavement markings at highway-rail grade crossings.
- Illustration of pavement markings with guidance information and edge-line markings.
- Recognition in compliance of countermeasures with MUTCD and State standards.
- Introduction of analysis method for evaluating recommended countermeasures to prevent incorrect turns onto railroad tracks for future pilot studies.
- Presentation of candidate sites for consideration for future pilot studies.

For illustration purposes, recommended countermeasures I, II, III, and a combination of the three, as described in Chapter 1 (Figure 1-3, Figure 1-5, and Figure 1-6), were proposed for panel review.

3.3 Facilitation of Review Process of Recommended Countermeasures

CUTR communicated and coordinated with the FDOT project manager and representatives from FDOT Districts 1, 4, and 7 to facilitate the review process and discuss recommended countermeasures, candidate sites, and evaluation methods via three meetings. Highlights of the CUTR presentation and panel discussions are provided below, and meeting minutes are provided in Appendix I.

3.3.1 Highlights of CUTR Presentation for FDOT Districts 1, 4, and 7

- CUTR introduced the background of the project, major contributing causes of incorrect turns, and recommended cost-effective countermeasures for future pilot testing in several FDOT Districts.
- Some signage and pavement markings before highway-rail crossings may cause driver confusion and contribute to incorrect turns onto rail tracks (e.g., arrow pavement markings before rail crossings).
- FDOT District 7 has received much praise from the general public on (1) removal of left-turn arrow pavement markings on exclusive left-turn lane(s) before an interstate off-ramp intersection and (2) replacement of the interstate shield (e.g., shield of I-275), direction (e.g., South), and straight arrow pavement markings to prevent wrong-way driving or incorrect turns onto interstate off-ramps.
- To eliminate potential confusion, NCUTCD suggests preventing turning arrow pavement markings within 50 or 100 ft prior to a grade crossing.
- Recommended countermeasures for a future pilot study include:
  - Removing arrow pavement markings from upstream of rail crossings and replacing them with straight arrow pavement markings with guidance information.
  - Extending edge lines across rail crossing areas.
  - Using a combination of above countermeasures.
- Instead of using shield pavement markings, abbreviated identification of interstates (e.g., I-95), US highways (e.g., US 301), State roads (SR 60), or County roads (CR 39) could be used to save cost.
- A proposed methodology was presented to evaluate the effectiveness of recommended countermeasures in a future pilot project. The method would be to compare the proportion of isolated slowing vehicles with speeds at or below the 15^{th} percentile before and after implementation of the recommended countermeasures.

3.3.2 Highlights of Specific Discussions and Conclusions from FDOT District 1 Meeting

- CUTR presented five candidate sites in District 1 at which potential risks of an incorrect turn exist.
- Mr. Wheeler mentioned that several sites in Lakeland have shared through and right-turn lanes but not exclusive turn lanes and asked if they should be considered for candidate sites. Dr. Lin responded that a shared through and right-turn lane may also be considered for a candidate site for a future pilot study.
- To identify candidate sites, Mr. Wheeler indicated that historical incorrect turn data at highway-rail grade crossings in Lakeland or other cities in District 1 would be useful.
- FDOT District 1 confirmed that the proposed countermeasures are adequate for a future pilot testing project and the proposed evaluation methodology is adequate and could be used for a future pilot test to evaluate the proposed countermeasures.
- Mr. Mathes mentioned that FDOT District 1 Transportation Systems Management and Operations (TSM&O) would provide needed support for this project.
- Regarding the funding for conducting the pilot test, FDOT project manager Catherine Bradley suggested that FDOT Districts could cover the cost for pavement markings or signage for a future pilot test via existing/future maintenance contracts or roadway

resurfacing contracts. The FDOT Central office may also seek funding to cover the pavement markings or signs if Districts cannot cover them via existing or future contracts. Dr. Lin noted that another potential solution is to obtain approval from the FDOT Research Center to include the expenditure for the pilot test in the project budget.

3.3.3 Highlights of Specific Discussions and Conclusions from FDOT District 4 Meeting

- CUTR presented six candidate sites in District 4 at which potential risks of an incorrect turn exist.
- Mr. Overton indicated that there is no exclusive right-turn lane for the site at West Sample Rd near I-95, Pompano Beach. Dr. Lin noted that this site was on the list because of previous crashes and incidents. CUTR may explore other countermeasures for this site (e.g., street lighting for this location due to several nighttime incidents).
- Mr. Overton asked how CUTR measured vehicle speeds at the candidate sites. Dr. Lin replied that CUTR used Wavetronix to collect speed data before the railroad crossings.
- Mr. Overton mentioned that District 4 would take action to have the "Right Lane Must Turn Right" sign on eastbound Commercial Blvd removed immediately. Because of its positioning so close to the railroad tracks, motorists could get confused and turn onto the railroad tracks.
- Mr. Overton suggested researching benefit and cost information for implementing the proposed countermeasures for preventing incorrect turns onto railroad tracks. Dr. Lin will explore and research the information.
- Dr. Lin will send examples of incident reports obtained from a previous project to FDOT District 4 representatives.
- Dr. Lin mentioned that Dynamic Envelope pavement markings were used in several locations in FDOT District 4 and would like to get more information and evaluation results, if available.
- Ms. Xie mentioned that the FDOT Office of Development may have the information related to the implementation or evaluation results of Dynamic Envelope pavement markings countermeasures. She will provide Dr. Lin with contact information for the office.
- FDOT District 4 representatives support the proposed countermeasures for a future pilot testing project and believe that the proposed evaluation methodology is adequate and could be used for a future pilot test to evaluate the proposed countermeasures.
- Dr. Lin asked if FDOT District 4 would be able to support the implementation of proposed low-cost countermeasures (pavement markings) at 2–3 sites in District 4 in a future pilot test project via District existing/future maintenance contracts or roadway resurfacing contracts. Mr. Overton noted that FDOT District 4 should have resources to implement these low-cost countermeasures.

3.3.4 Highlights of Specific Discussions and Conclusions from FDOT District 7 Meeting

- CUTR presented eight candidate sites in District 7 at which potential risks of an incorrect turn exist.
- Mr. Dunn mentioned that shield pavement markings are implementable on US, SR, County, and City roads to display the road number and target direction; they are not implementable on named roadways (e.g., Kennedy Blvd)

- Mr. Dunn stated that the cost for a shield pavement marking with color (interstate shield pavement marking) could be more expensive than striped pavement markings of railroad crossing areas or Dynamic Envelope pavement markings. Thus, striped pavement markings of railroad crossing areas or Dynamic Envelope pavement markings were suggested to be considered as a proposed countermeasure.
- Mr. Boyle mentioned that the site selection process should consider historical incorrect turn records and asked for supporting incident or crash data for potential candidate sites in Tampa. Dr. Lin and Dr. Wang indicated that the source of incident data come primarily from railroad companies and asked for guidance from FDOT District 7 team to obtain the incident data. Mr. Love suggested that CUTR contact Scott Allbritton of FDOT Rail Contracts and Signal Programs for incident records at railroad crossings in the Tampa Bay area. CUTR will contact Mr. Allbritton to obtain incident records in Tampa Bay.
- The District 7 team believed that the proposed evaluation methodology is adequate and could be used for future pilot testing.

Based on the results of panel review and following communications with the three districts, CUTR finalized countermeasures to prevent incorrect turns onto railroad tracks and the sites for the future pilot study and developed an evaluation plan for the pilot deployment of selected countermeasures.

4 Development of Deployment and Evaluation Plan for Pilot Implementation of Selected Countermeasures

4.1 Overview

A deployment and evaluation plan for assessing the performance of proposed countermeasures in preventing incorrect turns at grade crossings was developed based on feedback received from the FDOT project manager, rail administrators, and managers and engineers from FDOT Districts 1, 4, and 7. The deployment and evaluation plan includes the following:

- Technical specifications of proposed countermeasures
- Implementation criteria
- Recommended locations (sites) for deployment and evaluation
- Recommended countermeasures at selected sites
- Expected deployment data and duration
- Data collection plan and data analysis methodology
- Potential benefits of the future deployment

4.1.1 Technical Specifications

Improvement strategies from the combined four countermeasures are proposed to reduce driver confusion in selecting proper turning points when approaching at-grade crossings (Table 1-1). Technical specifications of improvement strategies, which is a combination of various countermeasures, were retrieved from the MUTCD and are summarized in Table 4-2. Estimated unit costs for deployment activities are provided in Table 4-2.

4.1.2 Estimated Unit Cost for Countermeasure Implementations

FDOT publishes statewide average costs for its bid items. The future pilot implementation of proposed countermeasures would be a small project and bid item costs are likely to be lower than those in the pilot implementation. An FDOT District “pushbutton” contract—a quick-response, small-job contract—could provide a better basis for future pilot implementation of the proposed countermeasures. The higher value for each countermeasure implementation from the above two sources was selected for estimated unit cost for each countermeasure implementation activity, as shown in Table 4-2. The quantities of deployment activities vary across sites (e.g., number of right-turn arrows to remove), and the total deployment cost also varies from site to site. The total cost for each selected site was estimated based on the individual deployment plan.

Table 4-1 Technical Specifications of Proposed Countermeasures

Improvement Strategy	MUCTD Specifications	Suggested Application
Remove Right-turn Arrows + Straight Arrow + Cardinal Direction + Elongated Route Shields	• *Section 3B.20, MUTCD* • White color • 6 ft or more in height • Not exceed 3 lines • Interstate route shield	If signalized intersection connects to interstate
Straight Arrow + Cardinal Direction + Destination Name	• *Section 3B.20, MUTCD* • White color • 6 ft or more in height • Not exceed 3 lines • Road name in abbreviations	If signalized intersection connects to surface road
Edge Line Extension over At-grade Crossings	• *3B.04, MUTCD* • Solid white line • Width of 6 in.	At any highway-rail grade crossings
Qwick Kurb	• *MUTCD (2009) 2C.64* • Alternating black and retroreflective yellow stripes • Stripes angle at 45 degrees	At highway-rail grade crossing with hatched-out median and potential risks of incorrect U-turns

Table 4-2 Estimated Unit Cost

Deployment Activity	Unit Cost
Remove right arrow	$58.14 each
Remove “Only” message	$75.24 each
Add straight arrow	$83.25 each
Add interstate route shield	$2,775.00 each
Add thermoplastic, standard, white word	$177.60 each
Add white solid line	$0.95 per foot
Add Qwick Kurb	$65 per foot
Maintenance of traffic cost	Additional 10%
Mobilization cost	Additional 10%

4.1.3 Implementation Criteria

Ten sites were recommended for deployment and evaluation in FDOT Districts 1, 4 and 7. The site selection followed the following criteria:

- At-grade crossing close to signalized intersection at which drivers have potential risk to incorrectly turn onto rail track
- At-grade crossing with incident records related to incorrect turn (high priority) or other reasons
- Recommendations from FDOT Districts
- Diversity of connecting roads (interstates and surface roads)

The characteristics of the ten selected sites and recommended countermeasures are described in the next section.

4.2 Characteristics of Recommended Sites and Countermeasures

4.2.1 District 1

Site 1: Combee Rd @ US 92, Lakeland, FL

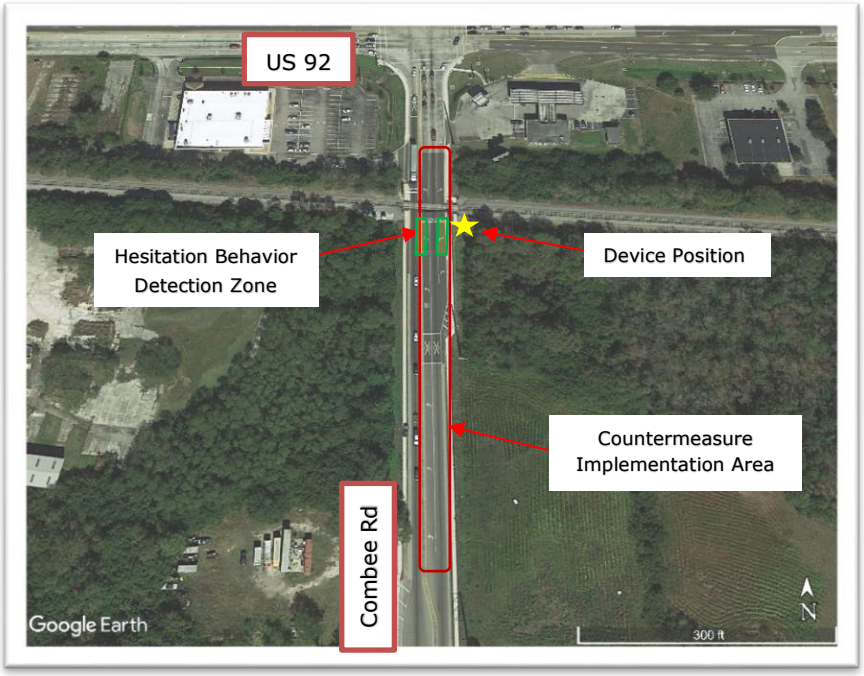


Figure 4-1 Combee Rd @ US 92.

Figure 4-2 Combee Rd @ US 92, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right- and left-turn lanes

Incidents Reported:

- 4 incidents – 12/5/2014, 3/20/2010, 4/1/2003, and 7/22/1987 (see Appendix II - A)
- 1 injury event, 1 fatality event
- Recommended for consideration by FDOT District 1
- Recommended for grade separation or other safety measures in districtwide draft Highway Rail Grade Separation report
- Number of incidents reported daytime (6:00 AM to 7:00 PM): 3
- Number of incidents reported nighttime (7:00 PM to 6:00 AM): 1

Suggested Countermeasures:

- Replace 2 continuous right-turn arrows on right-turn lane before at-grade crossing with 2 straight arrows + "East" + "US92"
- Replace 5 continuous left-turn arrows on left-turn lane before at-grade crossing with 5 straight arrows + "West" + "US92"
- Extend edge-lines over at-grade crossing

Table 4-3 Estimated Cost of Countermeasures, Combee Rd @ US 92

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Remove right/left arrow	58.14	7	406.98
Add straight arrow	83.25	7	582.75
Add message	177.60	14	2,486.40
Add line	0.95	40 x 2	76.00
Sub Total			*3,552.13*
Maintenance	10%		355.21
Mobilization	10%		355.21

Site 2: US 41 @ US 301, Bradenton, FL

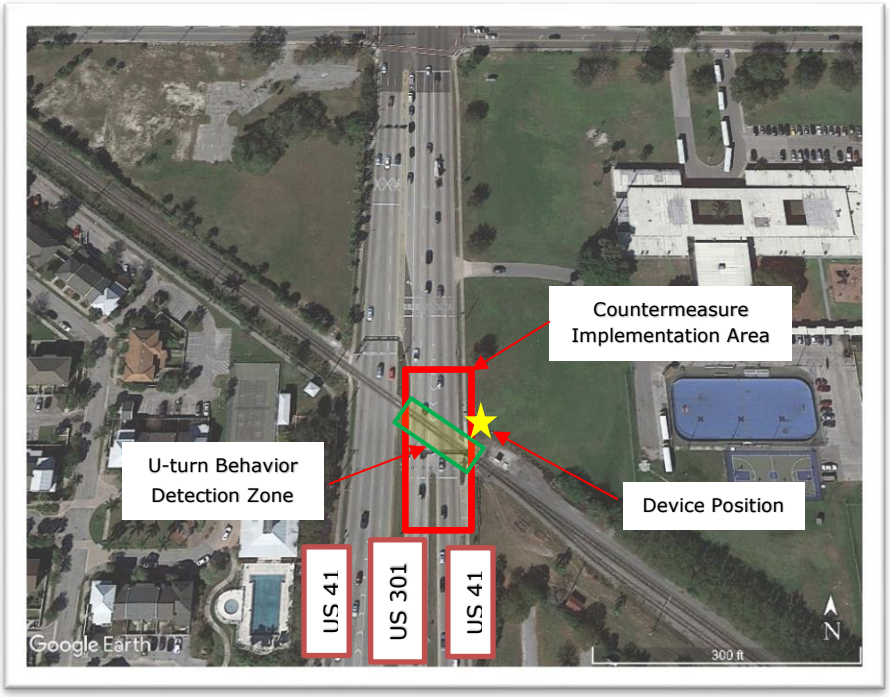


Figure 4-3 US 41 @ US 301.

Figure 4-4 US 41 @ US 301, Street View.

Potential Risks:

- Drivers making U-turns on at-grade crossing

Incidents Reported:

- Vehicle from US 41 crossing 3 travel lanes to make U-turn at the traffic signal
- Vehicle from US 41 crossing 3 travel lanes to make U-turn on the railroad tracks
- Incidents witnessed by FDOT District 1 officials
- Recommended for consideration by FDOT District 1
- Recommended for grade separation or other safety measures in districtwide draft Highway Rail Grade Separation report

Suggested Countermeasures:

- Add straight arrows + "Only" on every travel lane of northbound US 41 before at-grade crossing
- Add straight arrows + "Only" on every travel lane of northbound US 301 before stop line of at-grade crossing
- Add Qwick Kurb at hatched-out median area
- Extend edge-lines over at-grade crossing

Table 4-4 Estimated Cost of Countermeasures, US 41 @ US 301

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Add straight arrow	83.25	4	333.00
Add message	177.60	4	710.40
Add line	0.95	15 × 4 ft	57.00
Add Qwick Kurb along hatched-out median	65	100 × 2 ft	13,000.00
Sub Total			*14,100.40*
Maintenance	10%		1,410.04
Mobilization	10%		1,410.04

4.2.2 District 4

Site 3: Hollywood Blvd @ I-95, Hollywood, FL

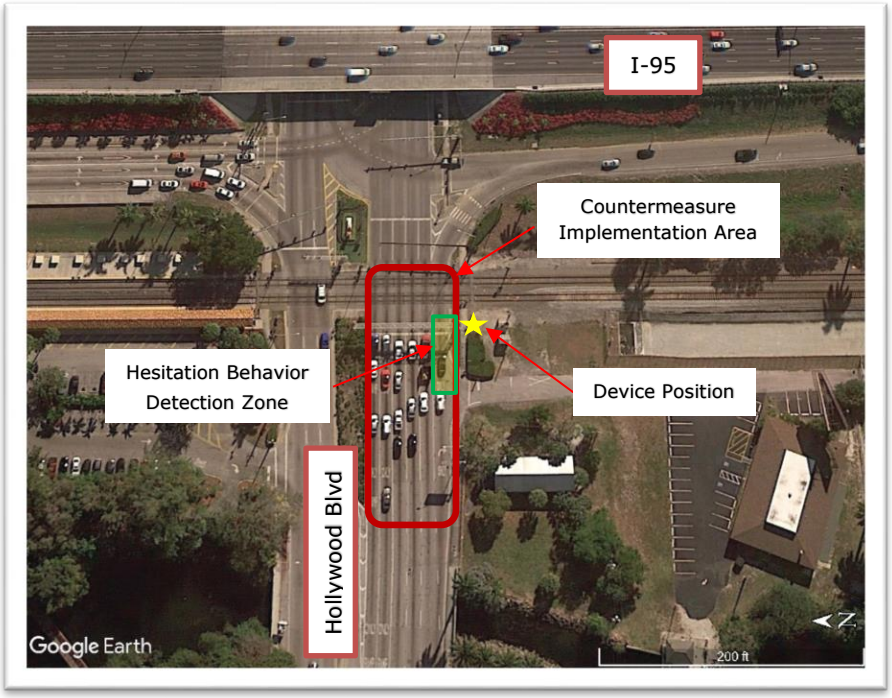


Figure 4-5 Hollywood Blvd @ I-95.

Figure 4-6 Hollywood Blvd @ I-95, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 3 train-vehicle crashes, 5 incidents
  - 2 incidents in 1998 and 1989 (see Appendix II - B)
  - 3 train-vehicle crashes in 2010–2011 (see Appendix II - G)
  - 3 incidents May 2012–January 2013 (see Appendix II - G)
- Number of incidents reported daytime (6:00 AM to 7:00 PM):3
- Number of incidents reported nighttime (7:00 PM to 6:00 AM):5
- Recommended for consideration by FDOT District 4 and FDOT manager in previous FDOT research project
- Recommended for consideration by FDOT District 4

Suggested Countermeasures:

- Replace continuous right-turn arrows on right-turn lane before at-grade crossing with straight arrow + "South" + I-95 shield
- Extend edge-lines over at-grade crossing

Table 4-5 Estimated Cost of Countermeasures, Hollywood Blvd @ I-95

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Remove right/left arrow	58.14	2	116.28
Remove "Only" message	75.24	2	150.48
Add interstate route shield	2,775.00	2	5,550.00
Add straight arrow	83.25	2	166.50
Add message	177.60	2	355.20
Add line	0.95	90 ft x 2	171.00
Sub Total			*6,509.46*
Maintenance	10%		650.95
Mobilization	10%		650.95

Site 4: Forest Hill Blvd @ I-95, Lake Clarke Shores, FL

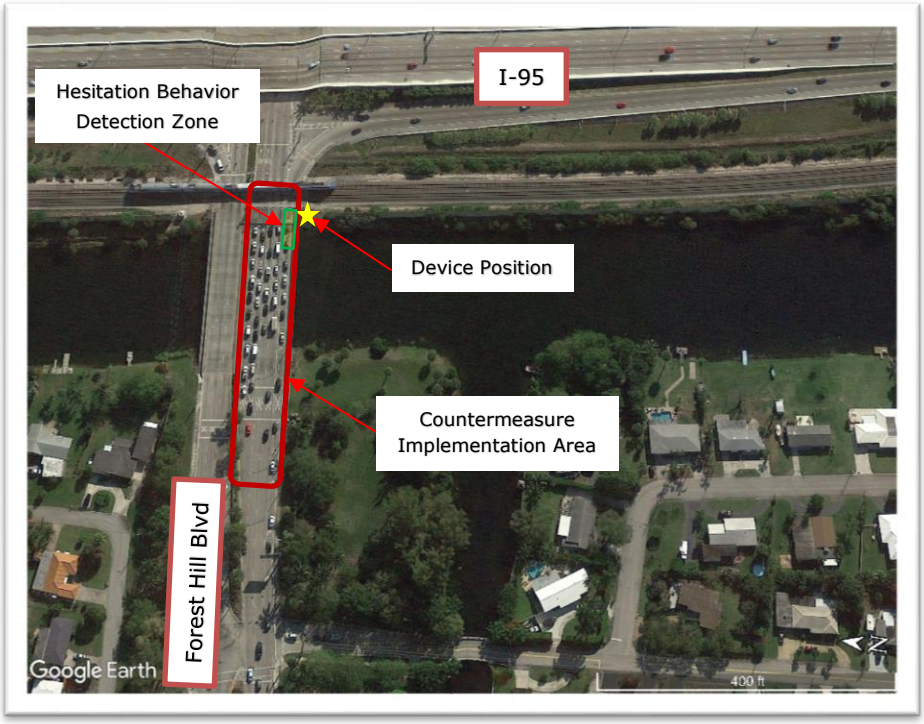


Figure 4-7 Forest Hill Blvd @ I-95.

Figure 4-8 Forest Hill Blvd @ I-95, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 3 train-vehicle crashes, 10 crossing incidents
  - 7 incidents – 2014, 2008, 2006, 2001, 1991, 1991, 1988 (see Appendix II - C)
  - 1 fatality
  - 3 train-vehicle crashes 2010–2011 (see Appendix II - G)
  - 3 incidents May 2012–January 2013 (see Appendix II - G)
- Number of incidents reported Day Time (6:00 AM to 7:00 PM): 7
- Number of incidents reported Night Time (7:00 PM to 6:00 AM): 6
- Recommended for consideration by FDOT District 4 and project manager in previous FDOT research project
- Recommended for consideration by FDOT District 4

Suggested Countermeasures:

- Replace 7 continuous right-turn arrows on right-turn lane before at-grade crossing with 2 straight arrow + "South" + I-95 shield and 2 straight arrows + "South" + "I-95"
- Extend edge-lines over at-grade crossing

Table 4-6 Estimated Cost of Countermeasures, Forest Hill Blvd @ I-95

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Remove right/left arrow	58.14	7	406.98
Remove "Only" message	75.24	4	300.96
Add interstate route shield	2,775.00	2	5,550.00
Add straight arrow	83.25	4	333.00
Add message	177.60	6	1065.60
Add line	0.95	90 ft x 2	171.00
Sub Total			*7,827.54*
Maintenance	10%		782.75
Mobilization	10%		782.75

Site 5: W Hallandale Beach Blvd @ I-95, Pembroke Park, FL

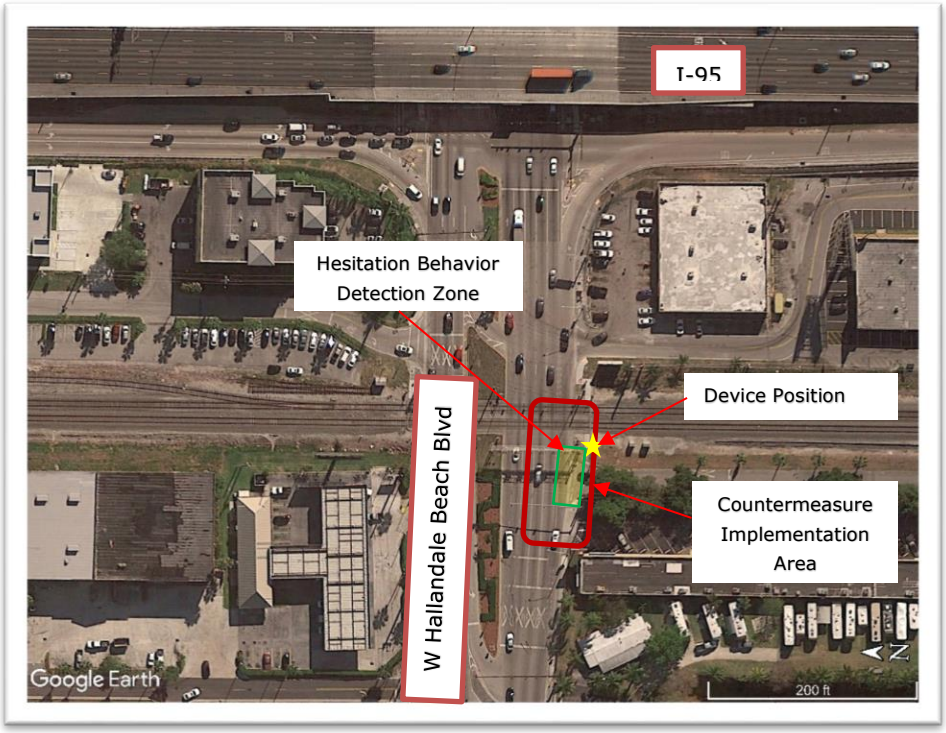


Figure 4-9 W Hallandale Beach Blvd @ I-95.

Figure 4-10 W Hallandale Beach Blvd @ I-95, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 3 train-vehicle crashes, 1 crossing incidents
  - 3 train-vehicle crashes 2010–2011 (see Appendix II - G)
  - 1 incidents May 2012–January 2013 (see Appendix II - G)
- Number of incidents reported Day Time (6 AM to 7 PM):3
- Number of incidents reported Night Time (7 PM to 6 AM):1
- Recommended for consideration by FDOT District 4 and project manager in a previous FDOT research project
- Recommended for consideration by FDOT District 4

Suggested Countermeasures:

- Add with 1 straight arrow + "South" + I-95 shield" on right-turn lane before at-grade crossing
- Extend edge-lines over at-grade crossing

Table 4-7 Estimated Cost of Countermeasures, W Hallandale Beach Blvd @ I-95

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Add interstate route shield	2,775.00	1	2,775.00
Add straight arrow	83.25	1	83.25
Add message	177.60	1	177.60
Add line	0.95	50ft * 2	95.00
Sub Total			*3130.85*
Maintenance	10%		313.09
Mobilization	10%		313.09

Site 6: W Commercial Blvd @ I-95, Oakland Park, FL

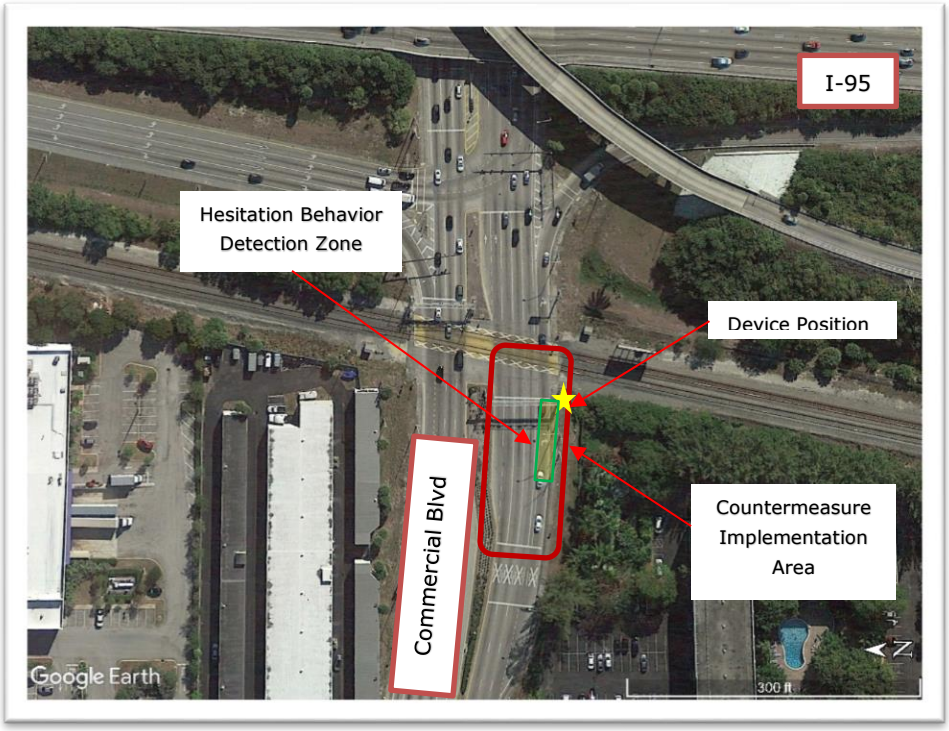


Figure 4-11 W Commercial Blvd @ I-95.

Figure 4-12 W Commercial Blvd @ I-95, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 4 train-vehicle crashes, 1 crossing incidents
  - 4 train-vehicle crashes 2010–2011 (see Appendix II - G)
  - 1 incidents May 2012–January 2013 (see Appendix II - G)
- Number of incidents reported Day Time (6 AM to 7 PM):4
- Number of incidents reported Night Time (7 PM to 6 AM):1
- Recommended for consideration by FDOT District 4 and project manager in a previous FDOT research project
- Recommended for consideration by FDOT District 4

Suggested Countermeasures:

- Add with 1 straight arrow + "South" + I-95 shield"+ 1 straight arrow on right-turn lane before at-grade crossing
- Extend edge-lines over at-grade crossing

Table 4-8 Estimated Cost of Countermeasures, W Commercial Blvd @ I-95

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Add interstate route shield	2,775.00	1	2,775.00
Add straight arrow	83.25	2	166.50
Add message	177.60	1	177.60
Add line	0.95	70ft * 2	133.00
Sub Total			*3252.10*
Maintenance	10%		325.21
Mobilization	10%		325.21

Site 7: W Pembroke Rd @ I-95, Hollywood, FL

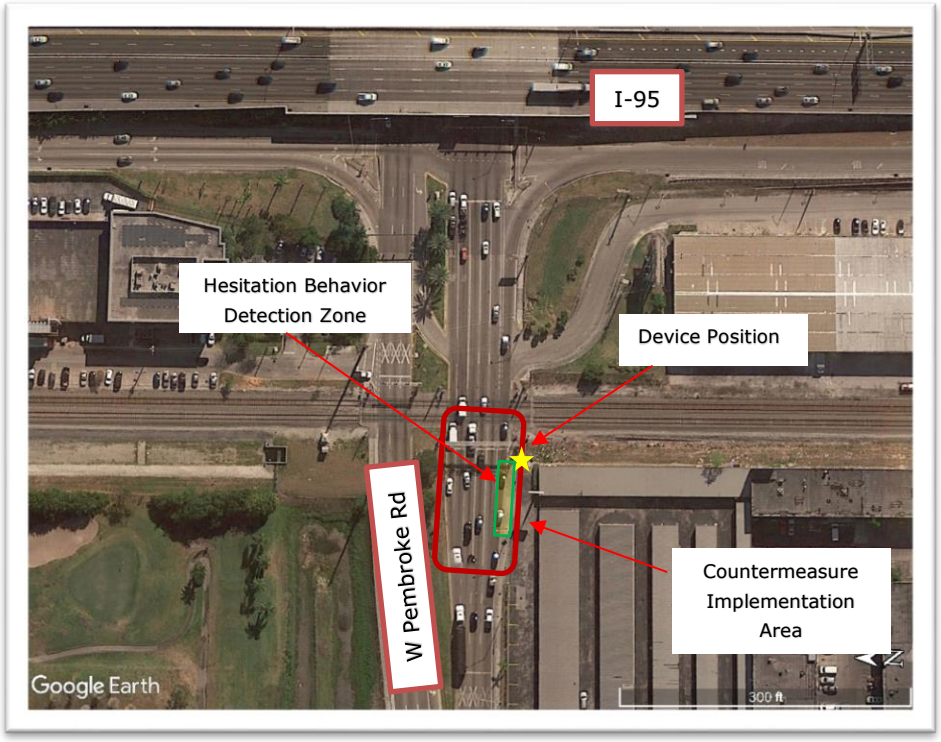


Figure 4-13 W Pembroke Rd @ I-95.

Figure 4-14 W Pembroke Rd @ I-95, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 6 train-vehicle crashes, 1 crossing incidents
  - 3 train-vehicle crashes 2010–2011 (see Appendix II - G)
  - 3 incidents May 2012–January 2013 (see Appendix II - G)
- Number of incidents reported Day Time (6 AM to 7 PM):3
- Number of incidents reported Night Time (7 PM to 6 AM):3
- Recommended for consideration by FDOT District 4 and project manager in a previous FDOT research project
- Recommended for consideration by FDOT District 4

Suggested Countermeasures:

- Add with 1 straight arrow + "South" + interstate 95 shield" on right-turn lane before at-grade crossing
- Extend edge-lines over at-grade crossing

Table 4-9 Estimated Cost of Countermeasures, Forest Hill Blvd @ I-95

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Add interstate route shield	2,775.00	1	2,775.00
Add straight arrow	83.25	1	83.25
Add message	177.60	1	177.60
Add line	0.95	50ft * 2	95.00
Sub Total			*3130.85*
Maintenance	10%		313.09
Mobilization	10%		313.09

4.2.3 District 7

Site 8: Busch Blvd @ N Boulevard St, Tampa, FL

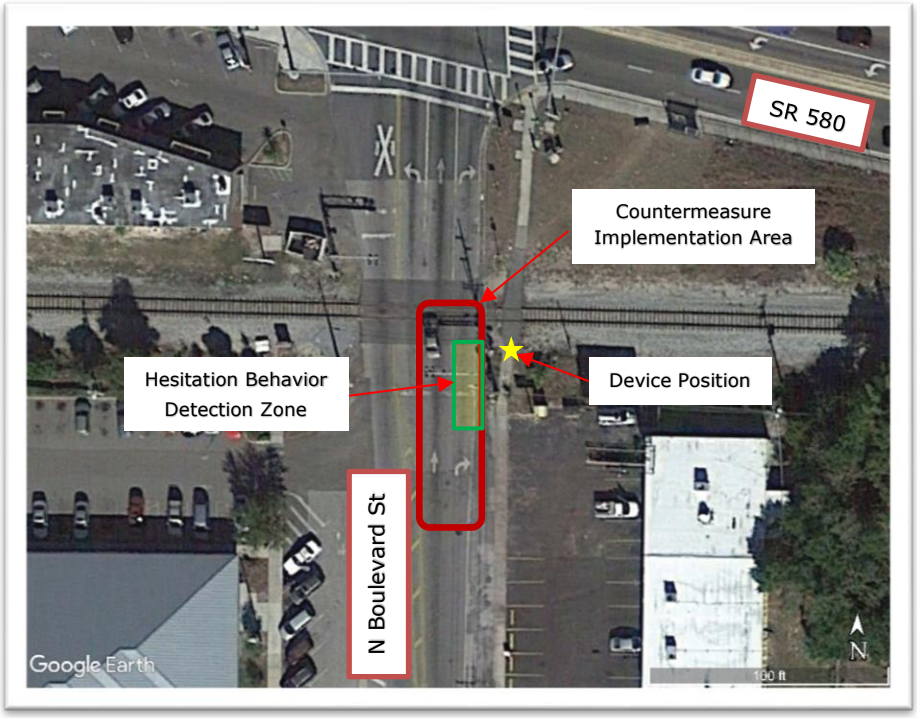


Figure 4-15 Busch Blvd @ N Boulevard St.

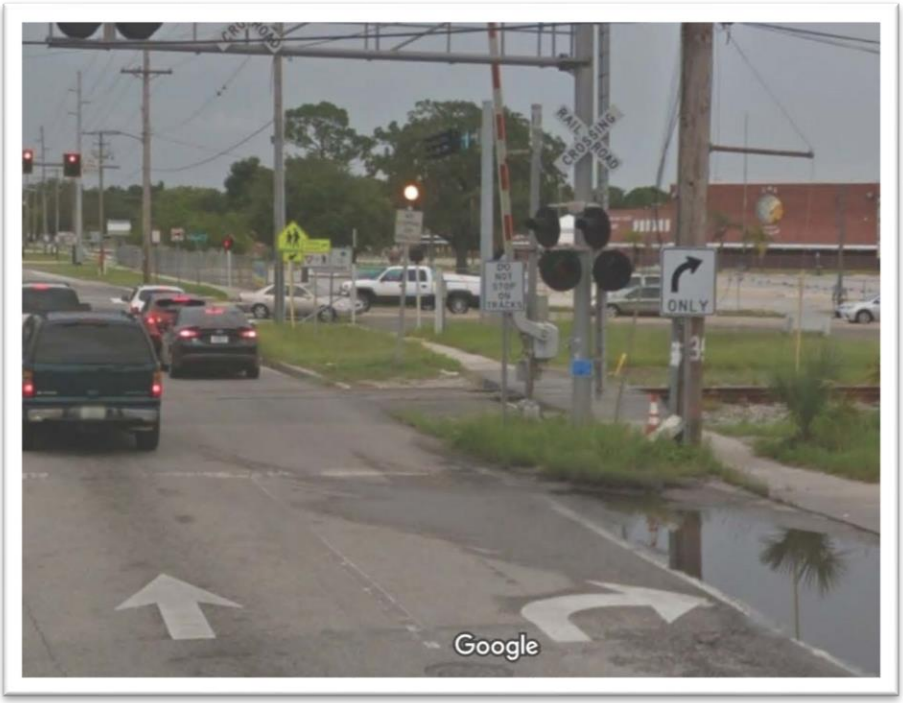


Figure 4-16 Busch Blvd @ N Boulevard St, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from right-turn lane

Incidents Reported:

- 3 incidents
  - 2 incidents – 10/21/12 and 06/23/2012 (see Appendix II - D)
  - 1 incident – 01/12/1987 (see Appendix II - D)
  - 1 injury event
- Number of incidents reported daytime (6:00 AM to 7:00 PM): 2
- Number of incidents reported nighttime (7:00 PM to 6:00 AM): 1
- Recommended for consideration by FDOT District 7

Suggested Countermeasures:

- Replace continuous right-turn arrows on right-turn lane before at-grade crossing with straight arrow + "East" + "SR 580"
- Extend edge-lines over at-grade crossing

Table 4-10 Estimated Cost of Countermeasures, Busch Blvd @ N Boulevard St

Countermeasures	Unit Cost ($)	Quantity	Total Cost ($)
Remove right/left arrow	58.14	1	58.14
Add straight arrow	83.25	1	83.25
Add message	177.60	2	355.20
Add line	0.95	45 ft x 2	85.50
Sub Total			*582.09*
Maintenance	10%		58.21
Mobilization	10%		58.21

Site 9: E Adamo Dr @ N 39th St, Tampa, FL

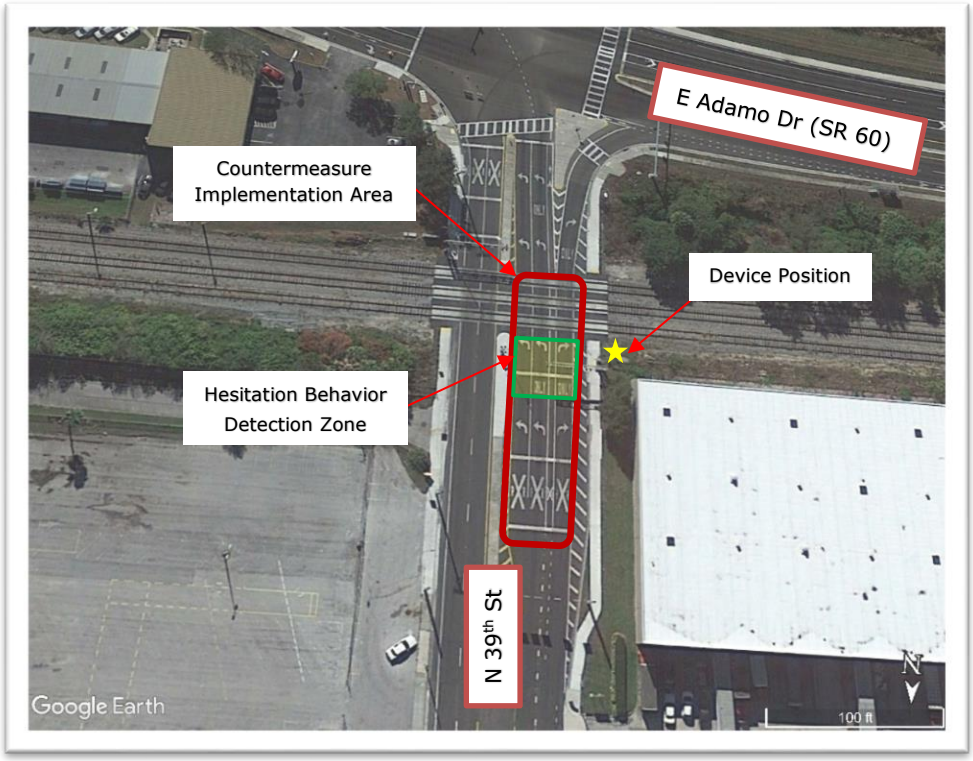


Figure 4-17 E Adamo Dr @ N 39th St.

Figure 4-18 E Adamo Dr @ N 39th St, Street View.

Potential Risks:

- Drivers susceptible to turn onto rail tracks from left- and right-turn lanes

Incidents Reported:

- 8 incidents – 11/16/2010, 9/19/2002, 4/2/2001, 5/20/2001, 7/12/1999, 4/16/1994, 8/8/1991, 8/25/1987 (see Appendix II - E)
- 5 injury events, 1 fatality event
- Number of incidents reported daytime (6:00 AM to 7:00 PM): 5
- Number of incidents reported nighttime (7:00 PM to 6:00 AM): 3

Suggested Countermeasures:

- Replace continuous right-turn arrows on the right-turn lane before the at-grade crossing with straight arrow + "West" + "SR 60"
- Extend edge-lines over the at-grade crossing

Table 4-11 Estimated Cost of Countermeasures, E Adamo Dr @ N 39th St

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Remove right/left arrow	58.14	2	116.28
Add straight arrow	83.25	2	166.50
Add message	177.60	4	710.40
Add line	0.95	40 ft x 2	76.00
Sub Total			*1,069.18*
Maintenance	10%		106.92
Mobilization	10%		106.92

Site 10: Tampa Road@ State St W, Oldsmar, FL

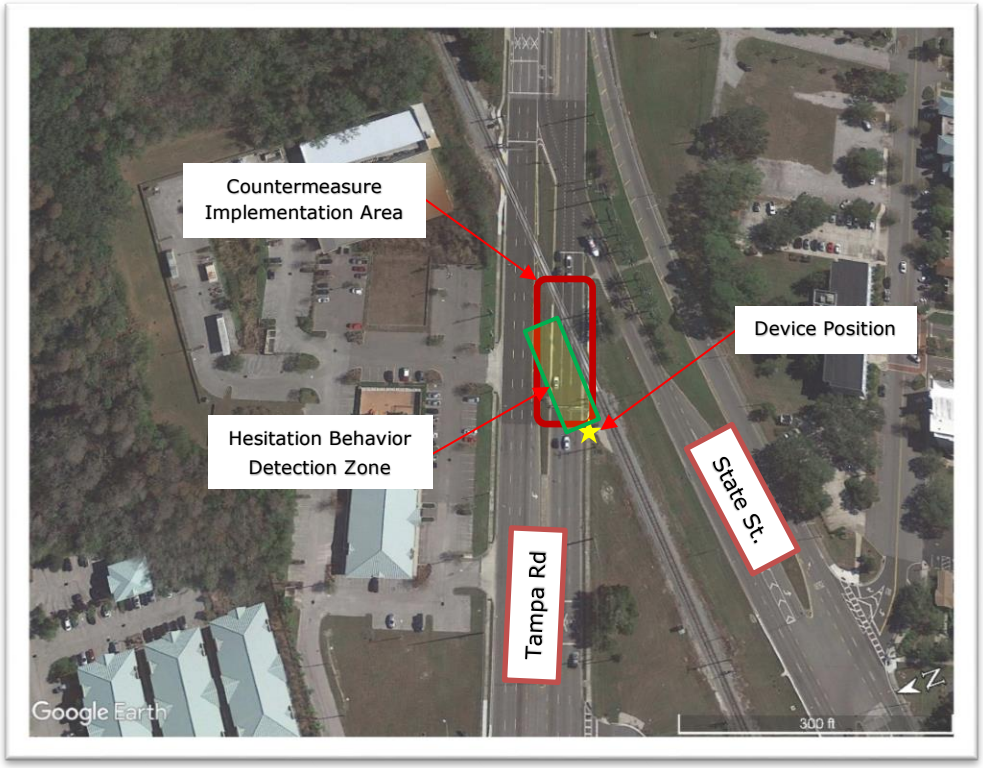


Figure 4-19 Tampa Rd @ State St W.

Figure 4-20 Tampa Rd @ State St W, Street View.

Potential Risks:

- Drivers susceptible to turn onto or stop on rail tracks

Incidents Reported:

- 1 incident - 11/14/2010 (see Appendix II - F)
- 5 train-vehicle crashes 2010–2011 (see Appendix II - G)
- 1 incident May 2012–January 2013 (see Appendix II - G)
- 1 injury event
- Number of incidents reported daytime (6:00 AM to 7:00 PM): 3
- Number of incidents reported nighttime (7:00 PM to 6:00 AM): 4

Suggested Countermeasures:

- Add straight arrow on every travel lane before at-grade crossing
- Extend edge-lines over the at-grade crossing

Table 4-12 Estimated Cost of Countermeasures, Tampa Rd @ State St W

Countermeasure	Unit Cost ($)	Quantity	Total Cost ($)
Add straight arrow	83.25	3	249.75
Add line	0.95	25 ft x 2	47.50
Sub Total			*297.25*
Maintenance	10%		29.73
Mobilization	10%		29.73

4.3 Data Collection Plan and Data Analysis Methodology

A before-after study will be conducted at selected sites to evaluate the performance of the proposed countermeasures to prevent incorrect turns at highway-rail grade crossings. The research team will collect data in two stages at each selected site: "before," with existing pavement markings, and "after," after implementing the proposed.

4.3.1 Data Collection Plan

A Wavetronix SmartSensor (Figure 4-21) and a camera (such as GoPro 5) on a Pneumatic Locking Telescoping Mast will be mounted at each candidate site. The installation positions and detection zones for the ten candidate sites are shown in Figure 4-1 Combee Rd @ US 92, Figure 4-3 US 41 @ US 301, Figure 4-5 Hollywood Blvd @ I-95, Figure 4-7 Forest Hill Blvd @ I-95, Figure 4-9 W Hallandale Beach Blvd @ I-95, Figure 4-11 W Commercial Blvd @ I-95, Figure 4-13 W Pembroke Rd @ I-95, Figure 4-15 Busch Blvd @ N Boulevard St, Figure 4-17 E Adamo Dr @ N 39th St, and Figure 4-19 Tampa Rd @ State St W. The Wavetronix SmartSensor uses the latest radar technology to collect and deliver traffic statistics, including traffic volume and classification, average speed, individual vehicle speed, lane occupancy, and presence on multiple lanes. Data for individual speeds of cars approaching the railroad crossings will be processed to identify hesitation behaviors using the methodology introduced below. Traffic monitoring videos from the camera will be used to verify the hesitating vehicles.

Figure 4-21 Wavetronix SmartSensor.

The Wavetronix SmartSensor and cameras will be powered by a gasoline-powered inverter generator. An RS-485 cable will be used to connect the Wavetronix SmartSensor with a laptop. Researchers can configure and monitor the SmartSensor on the laptop through the SmartSensor Manager software. The data collection procedure will be as follows:

1. The research team will coordinate with the Project Manager and Districts 1, 4, and 7 to request permissions for temporarily installing devices on roadside and monitoring traffic and to determine the deployment and data collection schedule.

2. Once approvals are obtained from the Project Manager and the Districts, data collection for the "before" stage will be conducted for one day at each candidate site: 4 during daytime hours (10:00 AM–2:00 PM) and 4 during nighttime hours (7:00 PM–11:00 PM). Two research assistants will set up the devices before collection, monitor the process during data collection, and detach the devices after data collection for each day. A total of seven days will be used for the "before" data collection (does not include preparation, travel, coordination, and other additional time).
3. After completing the "before" data collection, the FDOT Districts or contractors will implement the proposed countermeasures at the candidate sites, which is expected to be completed within 1–2 months after the "before" stage.
4. Once the deployment is completed, the research team will conduct another one-day observation at each site, 4 during daytime hours (10:00 AM–2:00 PM) and 4 during nighttime hours (7:00 PM–11:00 PM), using the same methodology.
5. Speed data from the SmartSensor and videos will be reviewed in the lab, and hesitation events will be identified and verified. These data will be exported into a project database for qualitative and quantitative analyses.

Steps 2 through 5 will be conducted separately in different districts according to the progress of deployment and schedule.

4.3.2 Data Analysis Methodology

A driver who experiences potential hesitation is one who has a much lower speed and a significant headway from the previous vehicle; an example is shown in Figure 4-22. The first vehicle is traveling at 30.2 mph when passing the sensor; the second vehicle passes the sensor 1 minute and 32 seconds after the first, at a speed of 9.1 mph. The second vehicle is either experiencing hesitation or is simply traveling slowly. The red line shows the 15th percentile speed of the sample, the value used to mine a low threshold. All vehicles experiencing hesitation are generally under this value. It was recognized that this method is not 100% accurate, but vehicles experiencing hesitation are potentially in this group. Care was taken that vehicles following a slower vehicle were not counted in the calculations.

The collected speed data will be reviewed in the lab to identify vehicles with hesitation using the method described in the example. The hesitation rate will be calculated at each site for the two stages using the following equation:

$$\textit{Hesitation rate} = \#\ \textit{of hesitation vehicles} \div \#\ \textit{of turning vehicles}$$

A statistical comparison will be conducted on hesitation rates between the "before" and "after" stages. If the hesitation rates are significantly reduced after implementing the countermeasures, it could state the proposed countermeasures can reduce the risk of incorrect turns at highway-rail grade crossings.

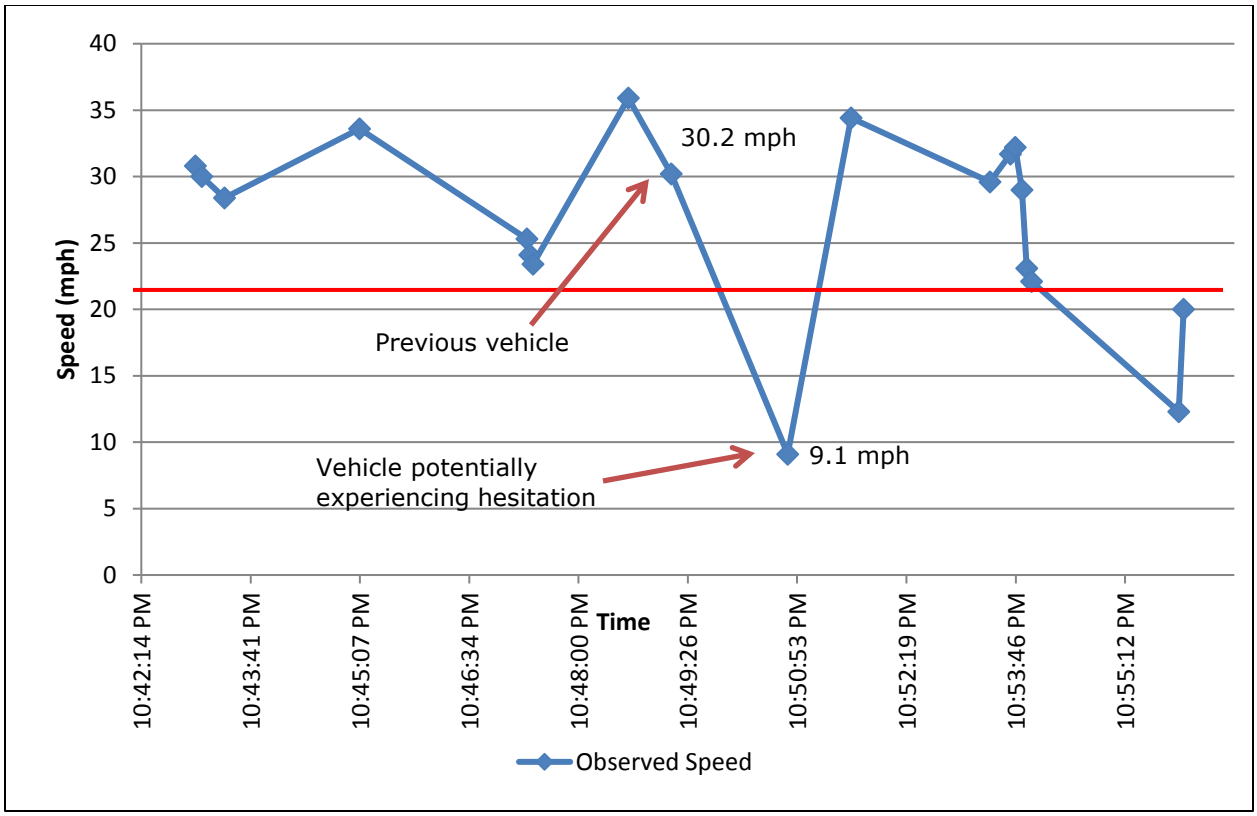


Figure 4-22 Example of hesitation vehicle.

5 Conclusions

Incorrect turns at highway-rail grade railroad crossings are serious issues in traffic safety management. According to previous studies, confusing traffic control and guidance cause these issues. This study proposed potentially cost-effective countermeasures aimed at addressing these safety issues and prevent incorrect turns at railroad crossings. The countermeasures include:

I. Eliminating potentially misleading arrow pavement markings and signs
II. Painting pavement markings (straight arrows) with guidance information before crossings
III. Extending edge line markings at highway-rail grade crossings
IV. Installing Qwick Kurb if there is a potential risk of incorrect U-turn at railroad crossings

CUTR coordinated with FDOT Districts 1, 4, and 7 to confirm the feasibility of the proposed countermeasures and candidate sites for evaluation. Ten highway-rail grade crossings were identified for implementation of the proposed countermeasures and performance evaluation. The CUTR research team developed a detailed deployment and evaluation plan for pilot implementation of selected countermeasures including candidate sites, proposed countermeasures, estimated costs, data collection plan, and data analysis methodology were developed.

Replacing continuous right-turn or left-turn arrows with straight arrows before at-grade crossings, in conjunction with guidance information and the addition of edge lines, are low-cost countermeasures to reduce drivers' confusion in selecting proper turning points as they approach at-grade crossings. The use of Qwick Kurb could reduce or eliminate potential risk of incorrect U-turn at railroad crossings or the danger of crossing many travel lanes to make a U-turn. Understanding the effectiveness of the proposed countermeasures through a before-after study will be beneficial to support the use of widespread implementation of these low-cost countermeasures in the future in order to significantly prevent incorrect turns at highway-rail grade crossings.

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APPENDIX I MEETING MINUTES

BDV25 TWO 977-11
Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

Meeting with FDOT District 1
March 17, 2017

Meeting Minutes

Attendees:

FDOT District 7:	Mr. David Wheeler, Mr. Mark Mathes
FDOT Central Office:	Ms. Catherine Bradley
CUTR:	Dr. Pei-Sung Lin, Dr. Zhenyu Wang

CUTR Presentation:

- The purpose of the meeting was to coordinate and communicate with FDOT District 1 to review recommended countermeasures for preventing incorrect turns onto railroad tracks and obtain input.
- Dr. Lin introduced the background of the project, major contributing causes of incorrect turns, and recommended cost-effective countermeasures for future pilot testing in several FDOT districts.
- The group reviewed a summary table of incidents of vehicles on railroad tracks due to various causes, including incorrect turns in Florida in 2012 (source: CSX). Lakeland had 12 incidents in 2012.
- Some signage and pavement markings before highway-rail crossings may cause driver confusion and contribute to incorrect turns onto rail tracks (e.g., arrow pavement markings before rail crossings).
- FDOT District 7 has received much praise from the general public on the (1) removal of left-turn arrow pavement markings on exclusive left-turn lane(s) before an interstate off-ramp intersection and (2) replacement of the interstate shield (e.g., shield of I-275), direction (e.g., South), and straight arrow pavement markings to prevent wrong-way driving or incorrect turns onto interstate off-ramps.
- To eliminate potential confusion, the National Committee on Uniform Traffic Control Devices (NCUTCD) suggests preventing turning arrow pavement markings within 50 or 100 feet prior to a grade crossing.
- Recommended countermeasures for a future pilot study include:
  - Removing arrow pavement markings from the upstream of rail crossings and replacing them with straight arrow pavement markings with guidance information (e.g., I-75 SB).
  - Extending edge lines across rail crossing areas.
  - Using a combination of both countermeasures.

    - Instead of using shield pavement markings, abbreviated Interstates (e.g., I-75), US highways (e.g. US 301), State roads (SR 60), or County roads (CR 39) could be used to save costs.
- CUTR showed five candidate sites in District 1 at which potential risks of an incorrect turn exist.
- Dr. Lin explained a proposed methodology that could be used to evaluate the effectiveness of recommended countermeasures in a future pilot project. The method would be to compare the proportion of isolated slowing vehicles with speeds at or below the 15th percentile before and after the implementation of recommended countermeasures.
- Dr. Lin asked District 1 to recommend two sites within the District for countermeasure evaluation in a future pilot project.

FDOT District 1 Comments and Group Discussion:

- Mr. Wheeler noted that several sites in Lakeland have shared through and right-turn lanes, but not exclusive turn lanes and asked about considering them for candidate sites. Dr. Lin said that they should be considered for a future pilot study because they offer an additional scenario for testing.
- To help identify candidate sites, Mr. Wheeler asked if CUTR had historical incorrect turn data at highway-rail grade crossings in Lakeland or other cities in District 1. Dr. Lin responded that CUTR had some incident data (mainly from railroad companies) for locations in FDOT District 4, but not for Districts 1 or 7, and asked for guidance from the FDOT District 1 team to obtain additional incident data. Mr. Wheeler will check with the FDOT District 1 Rail Administrator on obtaining incident data for incorrect turns onto railroad tracks for the Lakeland area or other cities if needed. (ACTION ITEM) CUTR will also explore ways and sources to obtain the incident data.
- Mr. Wheeler and Mr. Mathes confirmed that the proposed countermeasures are adequate for a future pilot testing project and that the proposed evaluation methodology is adequate and could be used for a future pilot test to evaluate the proposed countermeasures.
- Mr. Mathes noted that FDOT District 1 Transportation Systems Management and Operations (TSM&O) will provide needed support for this project.
- How the pilot test will be funded was discussed. Ms. Bradley suggested that the cost for pavement markings or signage for a future pilot test could be planned ahead and covered from District existing/future maintenance contracts or roadway resurfacing contracts. The FDOT Central office may also seek funding to cover the pavement markings or signs if Districts cannot cover them via existing or future contracts. Dr. Lin noted that another potential solution is to obtain approval from the FDOT Research Center to include the expenditure for the pilot test in the project budget.
- The District 1 team will review, discuss, and recommend two sites for a future pilot test.
- *(Action Item)* CUTR will arrange a follow-up meeting to discuss the following:
    - Finalization of countermeasures to prevent incorrect turns onto railroad tracks
    - Technical specifications of selected countermeasures
    - Implementation criteria
    - Expected locations in FDOT District 1 for testing and evaluation

BDV25 TWO 977-11

Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

Meeting with FDOT District 4
March 21, 2017

Meeting Minutes

Attendees:

FDOT District 4:	Mr. Jonathan Overton, Ms. Yujing Xie, Mr. Jonathan Ford
FDOT Central Office:	Ms. Catherine Bradley
CUTR:	Dr. Pei-Sung Lin, Dr. Zhenyu Wang

CUTR Presentation:

- The purpose of the meeting was to coordinate and communicate with FDOT District 4 to review recommended countermeasures for preventing incorrect turns onto railroad tracks, describe evaluation methodology, present potential candidate sites for a pilot study, and obtain input.
- Dr. Lin introduced the background of the project, data analysis on incorrect turns onto railroad tracks, major contributing causes of incorrect turns, and recommended cost-effective countermeasures for future pilot testing in several FDOT Districts.
- Signage and pavement markings before highway-rail crossings may cause driver confusion and contribute to incorrect turns onto railroad tracks (e.g., arrow pavement markings before rail crossings).
- FDOT has received positive feedback from the general public on the (1) removal of left-turn arrow pavement markings on exclusive left-turn lane(s) before an interstate off-ramp intersection and (2) replacement of the interstate shield (e.g., shield of I-275), direction (e.g., South), and straight arrow pavement markings to prevent wrong-way driving or incorrect turns onto interstate off-ramps.
- To eliminate potential confusion, NCUTCD suggests preventing turning arrow pavement markings within 50 or 100 feet prior to a grade crossing.
- Recommended countermeasures for a future pilot study include:
  - Removing arrow pavement markings from the upstream of rail crossings and replacing them with straight arrow pavement markings with guidance information (e.g., I-95 SB).
  - Extending edge lines across rail crossing areas.
  - Using a combination of both countermeasures.
- Instead of using shield pavement markings, abbreviated Interstates (e.g., I-95), US highways (e.g., US 1), and State roads (SR 842) could be used to save costs.
- CUTR showed six candidate sites in District 4 at which potential risks of an incorrect turn exist.
- Dr. Lin explained a proposed methodology that could be used to evaluate the effectiveness of recommended countermeasures in a future pilot project. The method

compares the proportion of isolated slowing vehicles with speeds at or below the 15th percentile before and after the implementation of recommended countermeasures.
- Dr. Lin asked District 4 to recommend at least two sites within the District for countermeasure evaluation in a future pilot project.

FDOT District 4 Comments and Group Discussion:

- Mr. Ford asked about the timing for train and vehicle crashes due to incorrect turns. Dr. Lin replied that more crashes occurred during the daytime.
- Mr. Overton indicated that there is no exclusive right-turn lane for the site at West Sample Rd near I-95, Pompano Beach. Dr. Lin noted that this site was on the list because of previous crashes and incidents. CUTR may explore other countermeasures for this site (e.g., street lighting for this location due to several nighttime incidents).
- Mr. Overton asked how the CUTR team measured the vehicle speeds at candidate sites. Dr. Lin replied that CUTR used Wavetronix to collect speed data.
- Mr. Overton mentioned that District 4 would take action to have the "Right Lane Must Turn Right" sign on eastbound Commercial Blvd removed immediately. Because of its positioning so close to the railroad tracks, motorists could get confused and turn onto the railroad tracks.
- Mr. Overton suggested researching benefit and cost information for implementing the proposed countermeasures for preventing incorrect turns onto railroad tracks. (*Action Item*) Dr. Lin will explore and research the information.
- (*Action Item*) Dr. Lin will send examples of incident reports obtained from a previous project to FDOT District 4 representatives.
- Dr. Lin mentioned that Dynamic Envelope pavement markings were used in several locations in FDOT District 4 and would like to get more information and evaluation results if available. Ms. Xie mentioned that Office of Development may have the information related to the implementation or evaluation results of Dynamic Envelope pavement markings countermeasures. (Action Item) Ms. Xie will provide Dr. Lin with the contact information of the office.
- FDOT District 4 representatives support the proposed countermeasures for a future pilot testing project and believe that the proposed evaluation methodology is adequate and could be used for a future pilot test.
- Dr. Lin asked if FDOT District 4 would support the implementation of proposed low-cost countermeasures (pavement markings) at two or three sites in District 4 in a future pilot test project via District existing/future maintenance contracts or roadway resurfacing contracts. Mr. Overton stated that FDOT District 4 should have resources to implement these low-cost countermeasures.
- (*Action Item*) The FDOT District 4 team will review, discuss, and recommend at least two sites for a future pilot test.
- (*Action Item*) CUTR will arrange a follow-up meeting to discuss the following:
    - Finalization of countermeasures to prevent incorrect turns onto railroad tracks
    - Technical specifications of the selected countermeasures
    - Criteria for selecting sites for implementing proposed countermeasures
    - Expected locations in FDOT District 4 for testing and evaluation

BDV25 TWO 977-11

A Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

Meeting with FDOT District 7
March 14, 2017

Meeting Minutes

Attendees:

FDOT District 7: Mr. George Boyle, Mr. Steve Love, Mr. Kevin Dunn
CUTR: Dr. Pei-Sung Lin, Dr. Zhenyu Wang

CUTR Presentation:

- The purpose of the meeting was to coordinate and communicate with FDOT District 7 to review recommended countermeasures for preventing incorrect turns onto railroad tracks and obtain input.
- Dr. Lin introduced the background of the project, major contributing causes of incorrect turns, and recommended cost-effective countermeasures for future pilot testing in several FDOT districts.
- The group reviewed a summary table of incidents of vehicles on railroad tracks due to various causes, including incorrect turns in Florida in 2012 (source: CSX). Tampa had 56 incidents in 2012.
- Some signage and pavement markings before highway-rail crossings may cause driver confusion and contribute to incorrect turns onto rail tracks (e.g., arrow pavement markings before rail crossings).
- FDOT District 7 has received much praise from the general public on the (1) removal of left-turn arrow pavement markings on exclusive left-turn lane(s) before an interstate off-ramp intersection and (2) replacement of the interstate shield (e.g., shield of I-275), direction (e.g., South), and straight arrow pavement markings to prevent wrong-way driving or incorrect turns onto interstate off-ramps.
- To eliminate potential confusion, NCUTCD suggests preventing turning arrow pavement markings within 50 or 100 feet prior to a grade crossing.
- Recommended countermeasures for a future pilot study include:
  - Removing arrow pavement markings from the upstream of rail crossings and replacing them with straight arrow pavement markings with guidance information (e.g., I-75 SB)
  - Extending edge lines across rail crossing areas
  - Using a combination of these countermeasures.
- Instead of using shield pavement markings, abbreviated Interstates (e.g., I-75), US highways (e.g. US 301), State roads (SR 60), or County roads (CR 39) could be used to save expenditure.
- CUTR proposed eight candidate sites in District 7 at which potential risks of an incorrect turn exist.
- Dr. Lin explained a proposed methodology that could be used to evaluate the effectiveness of recommended countermeasures in a future pilot project. The method

would be to compare the proportion of isolated slowing vehicles with speeds at or below the 15th percentile before and after the implementation of recommended countermeasures.
- Dr. Lin asked District 7 to recommend two sites within the District for countermeasure evaluation in a future pilot project.

FDOT District 7 Comments and Group Discussion:

- Mr. Dunn mentioned that shield pavement markings are implementable on US, State, County, and City roads to display the road number and target direction. They are not implementable on named roadways (e.g., Kennedy Blvd).
- Mr. Dunn stated that the cost for a shield pavement marking with color (interstate shield pavement marking) could be more expensive than striped pavement markings of railroad crossing areas or Dynamic Envelope pavement markings. Thus, striped pavement markings of railroad crossing areas or Dynamic Envelope pavement markings were suggested to be considered as a proposed countermeasure.
- (*Action Item*) CUTR will check and compare the expenditures for installing a shield pavement marking, striped pavement markings of an entire railroad crossing area, or Dynamic Envelope pavement markings.
- Mr. Boyle mentioned that the site selection process should consider historical incorrect turn records and asked for supporting incident or crash data for potential candidate sites in Tampa. Dr. Lin and Dr. Wang indicated that the source of incident data come primarily from railroad companies and asked for guidance from FDOT District 7 to obtain the incident data. Mr. Love suggested that the CUTR team contact Scott Allbritton with FDOT Rail Contracts and Signal Programs for incident records at railroad crossings in the Tampa Bay area. (Action Item) CUTR will contact Mr. Allbritton to obtain incident records in Tampa Bay.
- The FDOT District 7 team thinks the proposed evaluation methodology is adequate and could be used for future pilot testing and will review, discuss, and recommend two sites for future pilot testing.
- CUTR will arrange a follow-up meeting to discuss the following:
  - Finalization of countermeasures to prevent incorrect turns onto railroad tracks
  - Technical specifications of the selected countermeasures
  - Implementation criterions
  - Expected locations in FDOT District 7 for testing and evaluation

APPENDIX II APPENDIX INCIDENT REPORTS

A – Combee Rd @ US 92, Lakeland

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Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 624151P - SR-659 / COMBEE RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-659 / COMBEE RD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by on 3/3/2015 2:00:10 PM
Safety Index Rank: 111
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	12	5	2014	0	0
Select	3	20	2010	1	0
Select	4	1	2003	0	1
Select	7	22	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	000138454
Incident Date/Time	12/5/2014 4:30 PM
GSA county name	POLK
GSA city name	LAKELAND
Highway name	COMBEE RD
Highway user estimated speed	0
Highway user vehicle type	Pick-up truck
Highway user direction	South
Position of highway user	Stopped on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	SINGLE MAIN
FRA track class	4
Number of locomotive units	3
Number of cars	109
Train speed(mph)	047
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Yes
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	T17830 STRUCK A VEHICLE AT THE CROSSING, NO INJURIES WERE REPORTED. PROTECTION ALSO AT CROSSING: ADV ANCE WARNING AND PAVEMENT MARKINGS (STOP LINES & RR XING SYMBOLS).

Rail Highway Crossing Inventory

Crossing Number: 624151P - SR-659 / COMBEE RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-659 / COMBEE RD
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Last Updated by on 3/3/2015 2:00:10 PM
Safety Index Rank: 111
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	12	5	2014	0	0
Select	3	20	2010	1	0
Select	4	1	2003	0	1
Select	7	22	1987	0	0

Incident Data

Amtrak involvement	K
First RR code	ATK
RR assigned number	115218
Incident Date/Time	3/20/2010 11:33 AM
GSA county name	POLK
GSA city name	
Highway name	; COMBEE RD
Highway user estimated speed	35
Highway user vehicle type	Auto
Highway user direction	West
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Passenger train
Type of track	Main
Track identification	SINGLE MAIN TRACK
FRA track class	4
Number of locomotive units	2
Number of cars	9
Train speed(mph)	46
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Yes
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	1
Narrative	TRAIN # 91 OPERATING WITH LOCOMOTIVES E/73-E/154 AND 9 CARS STRUCK AN AUTOMOBILE AT MP A847.88; COMB EE RD CROSSING.

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Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 624151P - SR-659 / COMBEE RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-659 / COMBEE RD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by on 3/3/2015 2:00:10 PM
Safety Index Rank: 111
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	12	5	2014	0	0
Select	3	20	2010	1	0
Select	4	1	2003	0	1
Select	7	22	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	040312004
Incident Date/Time	4/1/2003 5:25 PM
GSA county name	POLK
GSA city name	LAKELAND
Highway name	COMBEE ROAD
Highway user estimated speed	0
Highway user vehicle type	Pick-up truck
Highway user direction	North
Position of highway user	Stopped on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAIN
FRA track class	5
Number of locomotive units	2
Number of cars	27
Train speed(mph)	050
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Yes
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	1
Total injured as reported on F6180.57	0
Narrative	VEHICLE WAS STOPPED ON TRACKS DUE TO TRAFFIC BEING BACKED UP. TRAIN STRUCK VEHICLE CAUSING FATAL INJ URIES TO THE DRIVER..

Logout | Contact Support

Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 624151P - SR-659 / COMBEE RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-659 / COMBEE RD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by on 3/3/2015 2:00:10 PM
Safety Index Rank: 111
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	12	5	2014	0	0
Select	3	20	2010	1	0
Select	4	1	2003	0	1
Select	7	22	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	078712335
Incident Date/Time	7/22/1987 11:52 PM
GSA county name	POLK
GSA city name	LAKELAND
Highway name	COMBEE RD
Highway user estimated speed	30
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	LAKELAND SUB
FRA track class	4
Number of locomotive units	3
Number of cars	21
Train speed(mph)	050
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

B – Hollywood Blvd @ I-95, Hollywood, FL

Rail Highway Crossing Inventory

Search | Crossing | Imports | Statistics | Reports

Crossing Number: 628281A - SR-820 / HOLLYWOOD BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-820 / HOLLYWOOD BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hollis Dowell on 6/24/2015 11:05:47 AM
Safety Index Rank: 32
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	8	18	1998	0	0
Select	7	25	1989	0	0

Incident Data

Amtrak involvement	
First RR code	TCCX
RR assigned number	081898
Incident Date/Time	8/18/1998 8:33 AM
GSA county name	BROWARD
GSA city name	HOLLYWOOD
Highway name	HOLLYWOOD BLVD.
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Stopped on crossing
RR Equipment involved	Train (units pushing)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Commuter train
Type of track	Main
Track identification	SINGLE MAIN
FRA track class	4
Number of locomotive units	1
Number of cars	3
Train speed(mph)	020
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

Rail Highway Crossing Inventory

Search | Crossing | Imports | Statistics | Reports

Crossing Number: 628281A - SR-820 / HOLLYWOOD BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-820 / HOLLYWOOD BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hollis Dowell on 6/24/2015 11:05:47 AM
Safety Index Rank: 32
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	8	18	1998	0	0
Select	7	25	1989	0	0

Incident Data

Amtrak involvement	
First RR code	UTSZ
RR assigned number	0725891
Incident Date/Time	7/25/1989 4:48 PM
GSA county name	BROWARD
GSA city name	HOLLYWOOD
Highway name	HOLLYWOOD BLVD
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	West
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pushing)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Passenger train
Type of track	Main
Track identification	SINGLE MAIN TRACK
FRA track class	4
Number of locomotive units	1
Number of cars	4
Train speed(mph)	015
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

C – Forest Hill Blvd @ I-95, Lake Clarke Shores, FL

Rail Highway Crossing Inventory

Search | Crossing | Imports | Statistics | Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	SFRV
RR assigned number	011614
Incident Date/Time	1/16/2014 8:15 AM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	0
Highway user vehicle type	Van
Highway user direction	East
Position of highway user	Stopped on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Commuter train
Type of track	Main
Track identification	MAIN LINE 1
FRA track class	4
Number of locomotive units	1
Number of cars	3
Train speed(mph)	055
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	DRIVER OF HIGHWAY VEHICLE STOPPED WITH THE FRONT OF THE VEHICLE FOULING ML1 AND WAS CLIPPED BY THE L OCOMOTIVE. REPORTS INDICATED THE DRIVER EXITED THE VEHICLE PRIOR TO IMPACT. NO INJURIES REPORTED.

Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
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Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	SFRV
RR assigned number	051908
Incident Date/Time	5/19/2008 8:18 AM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	35
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Commuter train
Type of track	Main
Track identification	MAIN LINE 1
FRA track class	4
Number of locomotive units	1
Number of cars	2
Train speed(mph)	055
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Yes
Motorist passed standing highway vehicle	Unknown
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	HIGHWAY USER FAILED TO STOP AT THE CROSSING, DROVE THROUGH THE CROSSING GATE ARM AND STRUCK THE SIDE OF THE COMMUTER TRAIN. NO INJURIES WERE REPORTED. CROSSING WARNINGS REPORTED AS OPERATING PROPERLY. THIS TRAIN WAS A DMU WITH TWO SELF-PROPELLED PASSENGER CARS AND A PASSENGER COACH IN THE CENTER.

Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	TCCX
RR assigned number	112906
Incident Date/Time	11/29/2006 8:02 AM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	0
Highway user vehicle type	Other (specify)
Highway user direction	West
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Commuter train
Type of track	Main
Track identification	MAIN LINE 1
FRA track class	4
Number of locomotive units	1
Number of cars	2
Train speed(mph)	030
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Side of vehicle approach
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	SOUTHBOUND COMMUTER TRAIN STRUCK A WESTBOUND VEHICLE WHICH HAD STALLED ON MAIN LINE 1. DRIVER OF THE VEHICLE FLED PRIOR TO IMPACT. NO INJURIES REPORTED. ALL CROSSING WARNING DEVICES WERE REPORTED AS O PERATING PROPERLY.

Logout | Contact Support

Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	TCCX
RR assigned number	072101
Incident Date/Time	7/21/2001 11:14 PM
GSA county name	PALM BEACH
GSA city name	LAKE CLARKE SHORES
Highway name	FOREST HILL BLVD
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	West
Position of highway user	Stopped on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Passenger train
Type of track	Main
Track identification	SINGLE MAIN
FRA track class	4
Number of locomotive units	1
Number of cars	3
Train speed(mph)	072
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	NORTHBOUND COMMUTER TRAIN P652 STRUCK AN UNOCCUPIED VEHICLE AT FOREST HILL BLVD. CROSSING ON SINGLE MAIN TRACK. THE DRIVER OF THE VEHICLE FLED THE SCENE OF THE ACCIDENT PRIOR TO IMPACT, NO INFORMATIO N OF DRIVER AVAILABLE. TRAIN SUSTAINED MINOR DAMAGES. THE VEHICLE SUSTAINED MAJOR DAMAGE. NO INJU RIES.

Rail Highway Crossing Inventory

Search | Crossing | Imports | Statistics | Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	019112016
Incident Date/Time	1/11/1991 1:50 AM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Rail equipment
Type of train	Freight train
Type of track	Main
Track identification	MAINLINE
FRA track class	4
Number of locomotive units	4
Number of cars	116
Train speed(mph)	020
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	Unknown
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

Logout | Contact Support

Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	019112025
Incident Date/Time	1/12/1991 3:30 AM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAIN TRACK
FRA track class	4
Number of locomotive units	4
Number of cars	122
Train speed(mph)	035
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

Rail Highway Crossing Inventory

Crossing Number: 628139W - SR-882 / FOREST HILL BLVD
Railroad Operating Company: SOUTH FLORIDA REGIONAL TRANSPORTATION AUTHORITY
Local Street Name: SR-882 / FOREST HILL BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Hector Hartmann on 8/26/2015 10:07:40 AM
Safety Index Rank: 19
Railroad Responsible FRA Field

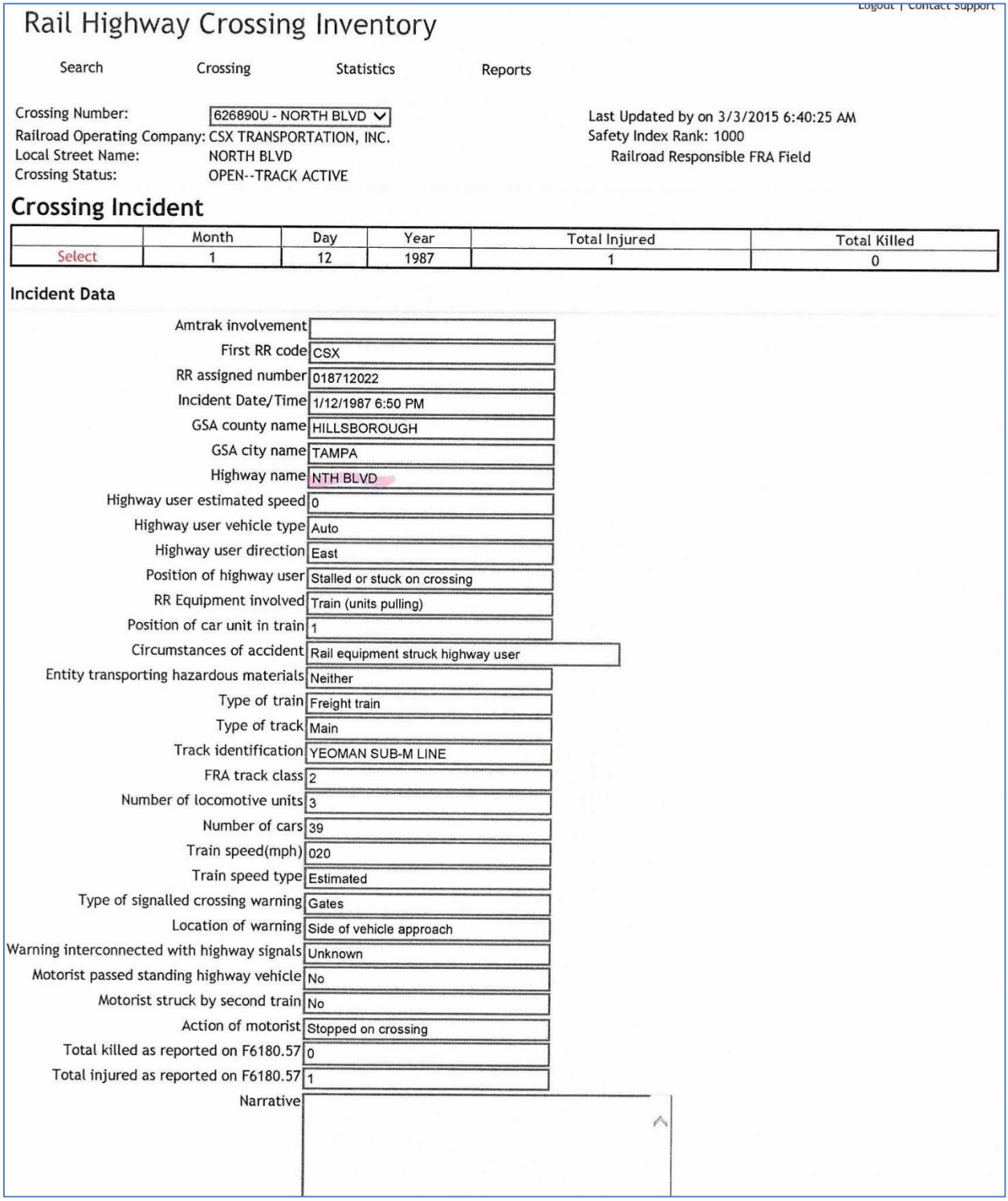
Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	16	2014	0	0
Select	5	19	2008	0	0
Select	11	29	2006	0	0
Select	7	21	2001	0	0
Select	1	11	1991	0	0
Select	1	12	1991	0	0
Select	2	12	1988	0	1

Incident Data

Amtrak involvement	K
First RR code	ATK
RR assigned number	80212WAS03
Incident Date/Time	2/12/1988 6:45 PM
GSA county name	PALM BEACH
GSA city name	WEST PALM BEACH
Highway name	FOREST HILL BLVD
Highway user estimated speed	
Highway user vehicle type	Pedestrian
Highway user direction	
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Passenger train
Type of track	Main
Track identification	MAIN
FRA track class	4
Number of locomotive units	1
Number of cars	13
Train speed(mph)	060
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	
Motorist struck by second train	
Action of motorist	
Total killed as reported on F6180.57	1
Total injured as reported on F6180.57	0
Narrative	

D – Busch Blvd @ N Boulevard St, Tampa, FL



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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 626890U - NORTH BLVD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: NORTH BLVD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by on 3/3/2015 6:40:25 AM
Safety Index Rank: 1000
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	1	12	1987	1	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	018712022
Incident Date/Time	1/12/1987 6:50 PM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	NTH BLVD
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	East
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	YEOMAN SUB-M LINE
FRA track class	2
Number of locomotive units	3
Number of cars	39
Train speed(mph)	020
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Side of vehicle approach
Warning interconnected with highway signals	Unknown
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	1
Narrative	

Table II-1 Incident Data for Busch Blvd @ N Boulevard St, Tampa, FL

Incident Data at Busch Blvd and N Boulevard St	
10/21/2012	2348 hours, Tampa Police reported vehicle on tracks at MP SY 850.3 in Clearwater Subdivision at N Boulevard St in Tampa, FL. PSCC attempted to contact JF Train Dispatcher on Avtec with no answer. Jacksonville Chief Train Dispatcher was notified.
06/23/2012	1450 hours, Operator 66 with Tampa Police Department reported vehicle on tracks due to auto accident at MP SY 850.32 on Clearwater Subdivision at N Boulevard St in Tampa, Florida. JF Train Dispatcher notified via Avtec.

E – E Adamo Dr @ N 39th St, Tampa, FL

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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	82265
Incident Date/Time	11/16/2010 3:30 AM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	FRANK ADAMO DR
Highway user estimated speed	20
Highway user vehicle type	Auto
Highway user direction	South
Position of highway user	Moving over crossing
RR Equipment involved	Train (standing)
Position of car unit in train	3
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Yard
Track identification	TS
FRA track class	1
Number of locomotive units	2
Number of cars	13
Train speed(mph)	
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	Yes
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	A LATE MODEL PT CRUISER DELIBERATELY DISREGARDED THE CROSSING DEVICES AND STRUCK 082415. DRIVER AGE IS UNKNOWN. PROTECTION ALSO AT THE CROSSING INCLUDES ADVANCE WARNING AND PAVEMENT MARKINGS (STOPLIN ES AND RRXING SYMBOLS). UNKNOWN WHICH RAILCAR IN TRAIN WAS STRUCK. ESTIMATED CAR 3 IN TRAIN ORDER.

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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	090212025
Incident Date/Time	9/19/2002 7:35 AM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	FRANK ADAMMO DRIVE
Highway user estimated speed	10
Highway user vehicle type	Auto
Highway user direction	South
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAINLINE
FRA track class	3
Number of locomotive units	2
Number of cars	55
Train speed(mph)	020
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	1
Narrative	VEHICLE DROVE THROUGH WORKING CROSSING GATES AND INTO THE SIDE OF ONCOMIN TRAIN. VEHICLE STRUCK THE TRAIN CAUSING VEHICLE DRIVER TO BE INJURED..

Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	040112002
Incident Date/Time	4/2/2001 7:30 PM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	FRANK ADAMO DRIVE
Highway user estimated speed	50
Highway user vehicle type	Auto
Highway user direction	North
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAIN
FRA track class	2
Number of locomotive units	2
Number of cars	75
Train speed(mph)	025
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	1
Narrative	VEHICLE DROVE AROUND WORKING CROSSING GATES AND STRUCK THE SIDE OF LEAD ENGINE CSXT4695. VEHICLE D RIVER INJURED.

Logout | Contact Support

Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	050112014
Incident Date/Time	5/20/2001 8:02 AM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	FRANK ADAMO DRIVE
Highway user estimated speed	30
Highway user vehicle type	Auto
Highway user direction	South
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAIN
FRA track class	2
Number of locomotive units	2
Number of cars	67
Train speed(mph)	018
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	1
Total injured as reported on F6180.57	0
Narrative	VEHICLE DROVER AROUND GATES AND INTO PATH OF ONCOMING TRAIN. TRAIN STRUCK VEHICLE AND DRIVER WAS FAT ALLY INJURED.

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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	079912013
Incident Date/Time	7/12/1999 5:29 PM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	FRANK ADAMO DRIVE
Highway user estimated speed	15
Highway user vehicle type	Auto
Highway user direction	South
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	MAIN
FRA track class	2
Number of locomotive units	2
Number of cars	45
Train speed(mph)	020
Train speed type	Recorded
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	2
Narrative	VEHICLE WENT THROUGH GATES AND STRUCK SIDE OF TRAIN. 2 OCCUPANTS IN VEHICLE INJURED. DAMAGE TO ENGIN E CSXT 2251.

Logout | Contact Support

Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	049412005
Incident Date/Time	4/16/1994 8:20 AM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	HWY 60 ADAMO DRIVE
Highway user estimated speed	5
Highway user vehicle type	Truck
Highway user direction	East
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	PALMETTO SUB
FRA track class	2
Number of locomotive units	2
Number of cars	62
Train speed(mph)	008
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	1
Narrative	

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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	089112018
Incident Date/Time	8/8/1991 5:59 AM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	HWY 60 & ADAMO DR
Highway user estimated speed	10
Highway user vehicle type	Truck
Highway user direction	East
Position of highway user	Moving over crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck by highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	PALMETTO SUB
FRA track class	2
Number of locomotive units	3
Number of cars	89
Train speed(mph)	014
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	Yes
Motorist struck by second train	No
Action of motorist	Went around the gate
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

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Rail Highway Crossing Inventory

Search Crossing Statistics Reports

Crossing Number: 624820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	16	2010	0	0
Select	9	19	2002	1	0
Select	4	2	2001	1	0
Select	5	20	2001	0	1
Select	7	12	1999	2	0
Select	4	16	1994	1	0
Select	8	8	1991	0	0
Select	8	25	1987	0	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	088712399
Incident Date/Time	8/25/1987 6:45 PM
GSA county name	HILLSBOROUGH
GSA city name	TAMPA
Highway name	ADAMO DR
Highway user estimated speed	0
Highway user vehicle type	Auto
Highway user direction	West
Position of highway user	Stalled or stuck on crossing
RR Equipment involved	Train (units pulling)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Freight train
Type of track	Main
Track identification	PALMETTO SUB
FRA track class	1
Number of locomotive units	3
Number of cars	117
Train speed(mph)	010
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	Yes
Action of motorist	Stopped on crossing
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	0
Narrative	

F – Tampa Rd @ State St W, Oldsmar, FL

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Rail Highway Crossing Inventory

Search Crossing Imports Statistics Reports

Crossing Number: 626845A - SR-584 / TAMPA RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-584 / TAMPA RD
Crossing Status: OPEN--TRACK ACTIVE

Last Updated by on 3/3/2015 12:50:08 PM
Safety Index Rank: 1167
Railroad Responsible FRA Field

Crossing Incident

	Month	Day	Year	Total Injured	Total Killed
Select	11	14	2010	4	0

Incident Data

Amtrak involvement	
First RR code	CSX
RR assigned number	82181
Incident Date/Time	11/14/2010 6:45 PM
GSA county name	PINELLAS
GSA city name	OLDSMAR
Highway name	584 SR
Highway user estimated speed	0
Highway user vehicle type	Other motor vehicle
Highway user direction	West
Position of highway user	Stopped on crossing
RR Equipment involved	Light loco(s)(moving)
Position of car unit in train	1
Circumstances of accident	Rail equipment struck highway user
Entity transporting hazardous materials	Neither
Type of train	Light loco(s).
Type of track	Main
Track identification	SINGLE MAIN
FRA track class	2
Number of locomotive units	1
Number of cars	0
Train speed(mph)	25
Train speed type	Estimated
Type of signalled crossing warning	Gates
Location of warning	Both sides
Warning interconnected with highway signals	No
Motorist passed standing highway vehicle	No
Motorist struck by second train	No
Action of motorist	Other (specify)
Total killed as reported on F6180.57	0
Total injured as reported on F6180.57	4
Narrative	070214 STRUCK A SUV STOPPED ON THE TRACKS. HIGHWAY OCCUPANTS WERE INJURED. PROTECTION ALSO AT THE X ING INCLUDE ADVANCE WARNING AND PAVEMENT MARKINGS (STOPLINES AND RRXING SYMBOLS). DRIVER AGE; GENDE R ARE UNKNOWN.

G – Incident Summary from Previous Study

Due to the unusual nature of incidents of incorrect turning of vehicles onto railroad tracks, these incidents are likely underreported, not documented clearly, and/or not documented. The reporting of this type of incident also relies on oral communication or written notes from railroad companies to District rail engineers and administrators.

Table II-2 are candidate sites that were highly recommended for pilot implementation of countermeasures in a previous FDOT-sponsored project by former FDOT Project Manager Edgar Bryant and former FDOT District 4 Office of Modal Development railroad engineer Hector Hartmann. The recommendations were mainly based on the incident reporting of incorrect turns of vehicles onto railroad tracks by railroad companies. Table II-2 is the incident summary.

Table II-2 Improved Traffic Control Measures to Prevent Incorrect Turns at Highway Rail Grade Crossings*

SITE NO.	LOCATION	TOWN/CITY	NUMBER OF TRAIN-VEHICLE CRASHES (2010 – 2011)	NUMBER OF REPORTED INCIDENTS (May 2012 – Jan 2013
1	West Hallandale Beach Blvd @ SW 30th Ave	PEMBROKE PARK	3 (2 days/1night)	1 (1 day)
2	W Commercial Blvd @ I-95	OAKLAND PARK	4 (4 nights)	1 (1 day)
3	Forest Hill Blvd @ I-95	LAKE CLARKE SHORE	3 (1 day/2 nights)	3 (2 days/1 night)
4	Tampa Road @ State St. W	OLDSMAR	5 (2 days/3 nights)	1 (1 nights)
5	W Pembroke Road @ I-95	HOLLYWOOD	3 (2 days/1 night)	3 (3 nights)
6	Hollywood Blvd @ I-95	HOLLYWOOD	3 (1 day/2 nights)	3 (3 nights)
7	W Sample Road @ NW 8th Ave	POMPANO BEACH	3 (2days/1 night)	4 (1day/3 nights)
8	Washington Ave @ North Gertrude Ave	ORLANDO	3 (1 day/2 nights)	3 (3 nights)
9	Magnolia Ave @ North Orange Ave	ORLANDO	0	N/A 1 night in 2006
10	Intl Speedway Blvd @ South Charles St	DAYTONA BEACH	0	N/A 1 night in 2006
11	Miner Road @ US 1	HYPOLUXO	0	1 2 from 2006 to 2007

* "Improved Traffic Control Measures to Prevent Incorrect Turns at Highway Rail Grade Crossings," Final Report, FDOT BDK85 TWO 977-45, November 2013