Final Report

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

PREPARED FOR
Florida Department of Transportation

December 2017
A Pilot Study for Preventing Incorrect Turns at Highway-Rail Grade Crossings

BDV25-977-11
Final Report

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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

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>WHEN YOU KNOW</th>
<th>MULTIPLY BY</th>
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<th>SYMBOL</th>
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<tr>
<td><strong>LENGTH</strong></td>
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<td></td>
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</tr>
<tr>
<td>in</td>
<td>inches</td>
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<td>millimeters</td>
<td>mm</td>
</tr>
<tr>
<td>ft</td>
<td>feet</td>
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</tr>
<tr>
<td>yd</td>
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<td>meters</td>
<td>m</td>
</tr>
<tr>
<td>mi</td>
<td>miles</td>
<td>1.61</td>
<td>kilometers</td>
<td>km</td>
</tr>
<tr>
<td><strong>AREA</strong></td>
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<td></td>
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</tr>
<tr>
<td>in²</td>
<td>square inches</td>
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<td>m²</td>
</tr>
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<td>yd²</td>
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<td>square meters</td>
<td>m²</td>
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<td>ac</td>
<td>acres</td>
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<td>hectares</td>
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<tr>
<td>mi²</td>
<td>square miles</td>
<td>2.59</td>
<td>square kilometers</td>
<td>km²</td>
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<tr>
<td><strong>VOLUME</strong></td>
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</tr>
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<td>fl oz</td>
<td>fluid ounces</td>
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</tr>
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<td>gal</td>
<td>gallons</td>
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<td>liters</td>
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</tr>
<tr>
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<td>cubic meters</td>
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**NOTE**: Volumes greater than 1000 L shall be shown in m³.

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<th>MULTIPLY BY</th>
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<th>SYMBOL</th>
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<tr>
<td><strong>MASS</strong></td>
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<td>oz</td>
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<td>28.35</td>
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<tr>
<td>T</td>
<td>short tons (2000 lb)</td>
<td>0.907</td>
<td>megagrams (or “metric ton”)</td>
<td>Mg (or “t”)</td>
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<table>
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<th>MULTIPLY BY</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit</td>
<td>5 ((F - 32)/9) or ((F - 32)/1.8)</td>
<td>Celsius</td>
<td>°C</td>
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<td><strong>Illumination</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>fc</td>
<td>foot-candles</td>
<td>10.76</td>
<td>lux</td>
<td>lx</td>
</tr>
<tr>
<td>ft</td>
<td>foot-Lamberts</td>
<td>3.426</td>
<td>candela/m²</td>
<td>cd/m²</td>
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<thead>
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<th>WHEN YOU KNOW</th>
<th>MULTIPLY BY</th>
<th>TO FIND</th>
<th>SYMBOL</th>
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<tbody>
<tr>
<td><strong>FORCE and PRESSURE or STRESS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lb</td>
<td>poundforce</td>
<td>4.45</td>
<td>newtons</td>
<td>N</td>
</tr>
<tr>
<td>lb/in²</td>
<td>poundforce per square inch</td>
<td>6.89</td>
<td>kilopascals</td>
<td>kPa</td>
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</tbody>
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TECHNICAL REPORT DOCUMENTATION

<table>
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16. Abstract
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.

17. Key Words
Incorrect turn, At-grade crossing, Railroad tracks, Pavement markings, Safety, Countermeasures, Pilot implementation, Signalized intersection, Hesitation rate

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- FDOT District 1: David Wheeler, Arlene Barnes, Barbara Daugherty, Mark Mathes
- 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.

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

*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 countermeasures, 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

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

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 Research and Recommendation of Countermeasures

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].](image)

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

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

*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.
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.
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.](image)

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.
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]:

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

![Countermeasure III: Extension of edge lines](image)

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

<table>
<thead>
<tr>
<th>Reference</th>
<th>Treatments</th>
<th>Notes/Findings</th>
</tr>
</thead>
</table>
| 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

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

### 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.
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.

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.
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).

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<thead>
<tr>
<th>CROSSING</th>
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<td>838210</td>
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Table 2-1 Identified Crashes/Incidents Caused by Incorrect Turns at Highway-Rail Crossings in Florida (2010-2014) (Continued).

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

<table>
<thead>
<tr>
<th>City</th>
<th># Incidents</th>
<th>City</th>
<th># Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tampa</td>
<td>56</td>
<td>Barberville</td>
<td>1</td>
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<tr>
<td>Jacksonville</td>
<td>29</td>
<td>Bartow</td>
<td>1</td>
</tr>
<tr>
<td>Pensacola</td>
<td>20</td>
<td>Belleview</td>
<td>1</td>
</tr>
<tr>
<td>Plant City</td>
<td>19</td>
<td>Bostwick</td>
<td>1</td>
</tr>
<tr>
<td>Lakeland</td>
<td>12</td>
<td>Bowling Green</td>
<td>1</td>
</tr>
<tr>
<td>Hialeah</td>
<td>11</td>
<td>Boynton Beach</td>
<td>1</td>
</tr>
<tr>
<td>Pompano Beach</td>
<td>10</td>
<td>Bradley</td>
<td>1</td>
</tr>
<tr>
<td>Boca Raton</td>
<td>9</td>
<td>Bushnell</td>
<td>1</td>
</tr>
<tr>
<td>Hollywood</td>
<td>9</td>
<td>Chattahoochee</td>
<td>1</td>
</tr>
<tr>
<td>Clearwater</td>
<td>8</td>
<td>Chipley</td>
<td>1</td>
</tr>
<tr>
<td>Miami</td>
<td>8</td>
<td>Cypress</td>
<td>1</td>
</tr>
<tr>
<td>West Palm Beach</td>
<td>8</td>
<td>Dade City</td>
<td>1</td>
</tr>
<tr>
<td>Tallahassee</td>
<td>7</td>
<td>De Land</td>
<td>1</td>
</tr>
<tr>
<td>Mulberry</td>
<td>6</td>
<td>Deerfield Beach</td>
<td>1</td>
</tr>
<tr>
<td>Delray Beach</td>
<td>5</td>
<td>Dover</td>
<td>1</td>
</tr>
<tr>
<td>Homestead</td>
<td>5</td>
<td>Fort Lauderdale</td>
<td>1</td>
</tr>
<tr>
<td>Land O Lakes</td>
<td>5</td>
<td>Green Cove Springs</td>
<td>1</td>
</tr>
<tr>
<td>Largo</td>
<td>5</td>
<td>Holt</td>
<td>1</td>
</tr>
<tr>
<td>Palmetto</td>
<td>5</td>
<td>Holt (Holts)</td>
<td>1</td>
</tr>
<tr>
<td>Alachua</td>
<td>4</td>
<td>Homeland</td>
<td>1</td>
</tr>
<tr>
<td>Auburndale</td>
<td>4</td>
<td>Interlachen</td>
<td>1</td>
</tr>
<tr>
<td>De Funiak Springs</td>
<td>4</td>
<td>Lake Alfred</td>
<td>1</td>
</tr>
<tr>
<td>Indiantown</td>
<td>4</td>
<td>Lake Como</td>
<td>1</td>
</tr>
<tr>
<td>Oakland Park</td>
<td>4</td>
<td>Lake Wales</td>
<td>1</td>
</tr>
<tr>
<td>Ocala</td>
<td>4</td>
<td>Lawtey</td>
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</tr>
<tr>
<td>Opa-Locka</td>
<td>4</td>
<td>Longwood</td>
<td>1</td>
</tr>
<tr>
<td>Orange Park</td>
<td>4</td>
<td>Lutz</td>
<td>1</td>
</tr>
<tr>
<td>Hawthorne</td>
<td>3</td>
<td>Maccenenny</td>
<td>1</td>
</tr>
<tr>
<td>Lake Worth</td>
<td>3</td>
<td>Milton</td>
<td>1</td>
</tr>
<tr>
<td>Live Oak</td>
<td>3</td>
<td>Mossy Head</td>
<td>1</td>
</tr>
<tr>
<td>Orlando</td>
<td>3</td>
<td>Ocoee</td>
<td>1</td>
</tr>
<tr>
<td>Palm Beach Gardens</td>
<td>3</td>
<td>Oldsmar</td>
<td>1</td>
</tr>
<tr>
<td>Taft</td>
<td>3</td>
<td>Palatka</td>
<td>1</td>
</tr>
<tr>
<td>West Miami</td>
<td>3</td>
<td>Pinellas Park</td>
<td>1</td>
</tr>
<tr>
<td>Zephyrhills</td>
<td>3</td>
<td>Quincy</td>
<td>1</td>
</tr>
<tr>
<td>Avon Park</td>
<td>2</td>
<td>Ruskin</td>
<td>1</td>
</tr>
<tr>
<td>Brooksville</td>
<td>2</td>
<td>Safety Harbor</td>
<td>1</td>
</tr>
<tr>
<td>Cantonment</td>
<td>2</td>
<td>Sanford</td>
<td>1</td>
</tr>
<tr>
<td>Fort Meade</td>
<td>2</td>
<td>Seffner</td>
<td>1</td>
</tr>
<tr>
<td>Haines City</td>
<td>2</td>
<td>Starke</td>
<td>1</td>
</tr>
<tr>
<td>Oxford</td>
<td>2</td>
<td>Wildwood</td>
<td>1</td>
</tr>
<tr>
<td>Saint Petersburg</td>
<td>2</td>
<td>Winter Park</td>
<td>1</td>
</tr>
<tr>
<td>South Miami</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 15th 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

<table>
<thead>
<tr>
<th>Improvement Strategy</th>
<th>MUCTD Specifications</th>
<th>Suggested Application</th>
</tr>
</thead>
</table>
| 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

<table>
<thead>
<tr>
<th>Deployment Activity</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove right arrow</td>
<td>$58.14 each</td>
</tr>
<tr>
<td>Remove “Only” message</td>
<td>$75.24 each</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>$83.25 each</td>
</tr>
<tr>
<td>Add interstate route shield</td>
<td>$2,775.00 each</td>
</tr>
<tr>
<td>Add thermoplastic, standard, white word</td>
<td>$177.60 each</td>
</tr>
<tr>
<td>Add white solid line</td>
<td>$0.95 per foot</td>
</tr>
<tr>
<td>Add Qwick Kurb</td>
<td>$65 per foot</td>
</tr>
<tr>
<td>Maintenance of traffic cost</td>
<td>Additional 10%</td>
</tr>
<tr>
<td>Mobilization cost</td>
<td>Additional 10%</td>
</tr>
</tbody>
</table>
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.](image1)

![Figure 4-2 Combee Rd @ US 92, Street View.](image2)
Potential Risks:
- Drivers susceptible to turn onto rail tracks from right- and left-turn lanes

Incidents Reported:
- 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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove right/left arrow</td>
<td>58.14</td>
<td>7</td>
<td>406.98</td>
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<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>7</td>
<td>582.75</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>14</td>
<td>2,486.40</td>
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<tr>
<td>Add line</td>
<td>0.95</td>
<td>40 x 2</td>
<td>76.00</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td></td>
<td></td>
<td><strong>3,552.13</strong></td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>355.21</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>355.21</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>4</td>
<td>333.00</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>4</td>
<td>710.40</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>15 × 4 ft</td>
<td>57.00</td>
</tr>
<tr>
<td>Add Qwick Kurb along hatched-out median</td>
<td>65</td>
<td>100 × 2 ft</td>
<td>13,000.00</td>
</tr>
<tr>
<td>Sub Total</td>
<td></td>
<td></td>
<td>14,100.40</td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
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</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>1,410.04</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove right/left arrow</td>
<td>58.14</td>
<td>2</td>
<td>116.28</td>
</tr>
<tr>
<td>Remove “Only” message</td>
<td>75.24</td>
<td>2</td>
<td>150.48</td>
</tr>
<tr>
<td>Add interstate route shield</td>
<td>2,775.00</td>
<td>2</td>
<td>5,550.00</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>2</td>
<td>166.50</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>2</td>
<td>355.20</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>90 ft x 2</td>
<td>171.00</td>
</tr>
<tr>
<td>Sub Total</td>
<td></td>
<td></td>
<td>6,509.46</td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>650.95</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>650.95</td>
</tr>
</tbody>
</table>
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
  - 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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
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<tbody>
<tr>
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<td>58.14</td>
<td>7</td>
<td>406.98</td>
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<tr>
<td>Remove “Only” message</td>
<td>75.24</td>
<td>4</td>
<td>300.96</td>
</tr>
<tr>
<td>Add interstate route shield</td>
<td>2,775.00</td>
<td>2</td>
<td>5,550.00</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>4</td>
<td>333.00</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>6</td>
<td>1065.60</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>90 ft x 2</td>
<td>171.00</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
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<td></td>
<td>7,827.54</td>
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<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>782.75</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>782.75</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add interstate route shield</td>
<td>2,775.00</td>
<td>1</td>
<td>2,775.00</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>1</td>
<td>83.25</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>1</td>
<td>177.60</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>50ft * 2</td>
<td>95.00</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td></td>
<td></td>
<td><strong>3130.85</strong></td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>313.09</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>313.09</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add interstate route shield</td>
<td>2,775.00</td>
<td>1</td>
<td>2,775.00</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>2</td>
<td>166.50</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>1</td>
<td>177.60</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>70ft * 2</td>
<td>133.00</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add interstate route shield</td>
<td>2,775.00</td>
<td>1</td>
<td>2,775.00</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>1</td>
<td>83.25</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>1</td>
<td>177.60</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>50ft * 2</td>
<td>95.00</td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
<td></td>
<td></td>
<td><strong>3130.85</strong></td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>313.09</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>313.09</td>
</tr>
</tbody>
</table>
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

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

<table>
<thead>
<tr>
<th>Countermeasures</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove right/left arrow</td>
<td>58.14</td>
<td>1</td>
<td>58.14</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>1</td>
<td>83.25</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>2</td>
<td>355.20</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>45 ft x 2</td>
<td>85.50</td>
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<td><strong>Sub Total</strong></td>
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<td></td>
<td><strong>582.09</strong></td>
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<tr>
<td>Maintenance</td>
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<td>58.21</td>
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<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>58.21</td>
</tr>
</tbody>
</table>
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:

- 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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove right/left arrow</td>
<td>58.14</td>
<td>2</td>
<td>116.28</td>
</tr>
<tr>
<td>Add straight arrow</td>
<td>83.25</td>
<td>2</td>
<td>166.50</td>
</tr>
<tr>
<td>Add message</td>
<td>177.60</td>
<td>4</td>
<td>710.40</td>
</tr>
<tr>
<td>Add line</td>
<td>0.95</td>
<td>40 ft x 2</td>
<td>76.00</td>
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<td><strong>Sub Total</strong></td>
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<td><strong>1,069.18</strong></td>
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<tr>
<td>Maintenance</td>
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</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>106.92</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Unit Cost ($)</th>
<th>Quantity</th>
<th>Total Cost ($)</th>
</tr>
</thead>
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<tr>
<td>Add straight arrow</td>
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<td>249.75</td>
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<tr>
<td>Add line</td>
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<td>25 ft x 2</td>
<td>47.50</td>
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<td><strong>297.25</strong></td>
</tr>
<tr>
<td>Maintenance</td>
<td>10%</td>
<td></td>
<td>29.73</td>
</tr>
<tr>
<td>Mobilization</td>
<td>10%</td>
<td></td>
<td>29.73</td>
</tr>
</tbody>
</table>
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.](image)

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:

\[ \text{Hesitation rate} = \frac{\text{# of hesitation vehicles}}{\text{# of turning vehicles}} \]

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.
References


[5] Florida Department of Transportation (FDOT), "Route Shield Pavement Markings.," Florida Department of Transportation (FDOT), 2012.


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
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

Rail Highway Crossing Inventory

<table>
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Crossing Incident

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Incident Data

- Amtrak involvement: None
- First RR code: CSX
- RR assigned number: 000130454
- Incident Date/Time: 12/2/2014 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: 108
- 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: T17820 STRUCK A VEHICLE AT THE CROSSING, NO INJURIES WERE REPORTED, PROTECTION ALSO AT CROSSING: ADVANCE WARNING AND PAVEMENT MARKINGS (STOP LINES & RR XING SYMBOLS).
Rail Highway Crossing Inventory

Crossing Number: B24151F - SR-659 / COMBEE RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-659 / COMBEE RD
Crossing Status: OPEN - TRACK ACTIVE

Crossing Incident

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Incident Data

- Amtrak Involvement: K
- First RR code: ATK
- RR assigned number: 16218
- 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 F6-180.57: 0
- Total injured as reported on F6-180.57: 1

Narrative: TRAIN # 91 OPERATING WITH LOCOMOTIVES E/73-E/154 AND 9 CARS STRUCK AN AUTOMOBILE AT MP AB87.88; COMBEE RD CROSSING.
Rail Highway Crossing Inventory

Crossing Number: 6241161P - 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

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Incident Data

Amtrak involvement: No
First RR code: CSX
RR assigned number: 040312004
Incident Date/Time: 4/11/2003 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 signaling 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 INJURIES TO THE DRIVER.
### Rail Highway Crossing Inventory

- **Crossing Number:** 82431SP - 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

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### Incident Data

- **Amtrak Involvement:**
- **First RR code:** CSX
- **RR assigned number:** 0787/12335
- **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):** 000
- **Train speed type:** Estimated
- **Type of signalized crossing warning:** Gates
- **Location of warning:** Both sides
- **Warning interconnected with highway signal:** 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:**

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### Rail Highway Crossing Inventory

**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

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### Incident Data

- **Amtrak Involvement:** No
- **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:** T
- **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 locomotives 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

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

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Incident Data

Amtrak involvement: No
First RR code: UTBZ
RR assigned number: 0725891
Incident Date/Time: 7/25/1989 4:46 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 signaled 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
C – Forest Hill Blvd @ I-95, Lake Clarke Shores, FL

Rail Highway Crossing Inventory

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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

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Incident Data

- Amtrak involvement: 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): 0
- Type of signalled crossing warning: Recorded
- Location of warning: Gates
- Warnings 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 MIL AND WAS CLIPPED BY THE LOCOMOTIVE. REPORTS INDICATED THE DRIVER EXITED THE VEHICLE PRIOR TO IMPACT, NO INJURIES REPORTED.
Rail Highway Crossing Inventory

Crossing Incident

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Incident Data

- Amtrak involvement: No
- First RR code: SFVR
- RR assigned number: 051908
- Incident Date/Time: 5/19/2008 6:18 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: None
- 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
- 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

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Incident Data

Amtrak Involvement:  
First RR code: TCOX  
RR assigned number: 112906  
Incident Date/Time: 11/28/2006 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): 0300  
Train speed type: Estimated  
Type of signalled crossing warning: Gate  
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 F6180.97: 0  
Total injured as reported on F6180.97: 0

Narrative: SOUTHBOUND COMMUTER TRAIN STRUCK A WESTBOUND VEHICLE WHICH HAD STALLED ON MAIN LINE 1. DRIVERS OF THE VEHICLE FLED PRIOR TO IMPACT. NO INJURIES REPORTED. ALL CROSSING WARNING DEVICES WERE REPORTED AS OPERATING PROPERLY.
### Rail Highway Crossing Inventory

**Crossing Number:** B2B13959 - 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:**

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### Crossing Incident

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### 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 involved:**
- **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:** 1
- **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 P052 STRUCK AN UNDERRIDDEN VEHICLE AT FOREST HILL BLVD. CROSSING ON SINGLE MAIN TRACK. THE DRIVER OF THE VEHICLE FILED THE SCENE OF THE ACCIDENT PRIOR TO IMPACT, NO INFORMATION OF DRIVER AVAILABLE. TRAIN SUSTAINED MINOR DAMAGES. THE VEHICLE SUSTAINED MAJOR DAMAGE. NO INJURIES.
# Rail Highway Crossing Inventory

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

**Crossing Incident**

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**Incident Data**

- **Amtrak involvement:** No  
- **First RR code:** CSX  
- **RR assigned number:** 019112016  
- **Incident Date/Time:** 11/11/1991 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 material:** 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:** 020  
- **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:** 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

**Safety Index Rank:** 19
**Railroad Responsible FRA Field:**

**Crossing Incident**

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**Incident Data**

- **Amtrak involvement:** No
- **First RR code:** CEX
- **RR assigned number:** 0199112025
- **Incident Date/Time:** 11/2/1988 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
- **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 signaled 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:**

- [Narrative content]
# Rail Highway Crossing Inventory

**Crossing Number:** 828159W - 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

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## Crossing Incident

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## Incident Data

- **Amtrak involvement:** Yes
- **First RR code:** ATK
- **RR assigned number:** 828159W-8003
- **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:**
- **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 signaled 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

---

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### Rail Highway Crossing Inventory

<table>
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### Incident Data

- **Amtrak involvement:**
  - 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

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

<table>
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<td>10/21/2012</td>
<td>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.</td>
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<tr>
<td>06/23/2012</td>
<td>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.</td>
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### Rail Highway Crossing Inventory

<table>
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<th>024520X - N. 39th Street</th>
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<td>OPEN--TRACK ACTIVE</td>
<td>Railroad Responsible FRA Field</td>
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#### Crossing Incident

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#### Incident Data

- **Amtrak Involvement**: None
- **First RR Code**: CSX
- **RR Assigned Number**: 024520X
- **Incident Date/Time**: 11/16/2010 3:30 AM
- **GSA County Name**: HILLSBOROUGH
- **GSA City Name**: TAMPA
- **Highway Name**: E 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**: None
- **Type of Train**: Freight
- **Type of Track**: Yard
- **Track Identification**: TB
- **FRA Track Class**: 1
- **Number of Locomotive Units**: 2
- **Number of Cars**: 13
- **Train Speed (mph)**: Estimated
- **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

#### 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 (TO PLOTTIES AND RISING SYMBOLS). UNKNOWN WHICH RAILCAR IN TRAIN WAS STRUCK. ESTIMATED CAR 3 IN TRAIN ORDER.
## Rail Highway Crossing Inventory

**Crossing Number:** 624802X - N. 39th Street  
**Railroad Operating Company:** CSX TRANSPORTATION, INC.  
**Local Street Name:** N. 39th Street  
**Crossing Status:** OPEN--TRACK ACTIVE  

### Crossing Incident

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</table>

### Incident Data

- **Amtrak Involvement:** No  
- **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 ONCOMING TRAIN. VEHICLE STRUCK THE TRAIN CAUSING VEHICLE DRIVER TO BE INJURED.
## Rail Highway Crossing Inventory

**Search**

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**Statistics**

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM

Safety Index Rank: 99

Railroad Responsible FRA Field

### Crossing Incident

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</table>

### Incident Data

| Amtrak Involvement | | |
|--------------------|--------------------------|
| First RR code      | CSX                      |
| RR assigned number | 040112002                |
| Incident Date/Time | 4/20/2001 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: 1
- Number of cars: 2
- Train speed (mph): 325
- Estimated train speed type: 2
- Type of signalled crossing warning: Gates
- Location of warning: Both sides
- Warning interconnected with highway signals: No
- Driver passed standing highway vehicle: No
- Driver struck by second train: No
- Action of driver: 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 CSX 4695. Vehicle D River injured.
## Rail Highway Crossing Inventory

**Crossing Number:** 024526X - N. 59th Street  
**Railroad Operating Company:** CSX TRANSPORTATION, INC.  
**Local Street Name:** N. 39th Street  
**Crossing Status:** OPEN--TRACK ACTIVE  

### Crossing Incident

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### Incident Data

- **Amtrak Involvement:** CSX  
- **RR Assign Number:** 05012014  
- **Incident Date/Time:** 07/20/2001 8:02 AM  
- **GSA county name:** HILLSBOROUGH  
- **GSA city name:** TAMPA  
- **Highway Name:** FRANK-ADAMO DRIVE  
- **Highway user estimated speed:** 30 mph  
- **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:** 3  
- **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:** 87  
- **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 DROVE AROUND GATES AND INTO PATH OF ONCOMING TRAIN. TRAIN STRUCK VEHICLE AND DRIVER WAS FATAL INJURED.
## Rail Highway Crossing Inventory

**Search**

Crossing Number: 624520X - N. 39th Street

Railroad Operating Company: CSX TRANSPORTATION, INC.

Local Street Name: N. 39th Street

Crossing Status: OPEN - TRACK ACTIVE

**Reports**

Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM

Safety Index Rank: 99

Railroad Responsible FRA Field

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### Crossing Incident

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### Incident Data

- **Amtrak Involvement**: Rail equipment struck by highway user
- **First RR code**: CSX
- **RR assigned number**: 07369:2013
- **Incident Date/Time**: 11/12/1999 5:29 PM
- **GSA county name**: HILLSBOROUGH
- **GSA city name**: TAMPA
- **Highway name**: FAIR-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**: 0

---

**Narrative**: VEHICLE WENT THROUGH GATES AND STRUCK SIDE OF TRAIN. 2 OCCUPANTS IN VEHICLE INJURED. DAMAGE TO ENGIN CSXT 2251.
Rail Highway Crossing Inventory

Crossing Number: 024620X - 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 11:17:33 AM
Safety Index Rank: 99
Railroad Responsible FRA Field

Crossing Incident

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Incident Data

- Antrak Implication
- First RR code: CSX
- RR assigned number: 049429005
- Incident Date/Time: 4/16/1994 6:20 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: 52
- Train speed (mph): Estimated
- 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:
Rail Highway Crossing Inventory

Crossing Number: 524820X - N. 39th Street
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: N. 39th Street
Crossing Status: OPEN--TRACK ACTIVE

Crossing Incident

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Incident Data

- Amtrak involvement: False
- First RR code: CSX
- RR assigned number: 08912018
- Incident Date/Time: 6/8/1991 5:59 AM
- GSA county name: HILLSBOROUGH
- GSA city name: TAMPA
- Highway name: HWY 80 & ADAMS 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: 59
- 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: 

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

**Crossing Number:** 024820X - N. 38th Street

**Railroad Operating Company:** CSX TRANSPORTATION, INC.

**Local Street Name:** N. 39th Street

**Crossing Status:** OPEN - TRAFFIC ACTIVE

**Last Updated by Catherine Bradley on 4/7/2017 11:17:35 AM**

**Safety Index Rank:** 99

**Railroad Responsible FRA Field**

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<td>1994</td>
<td>1</td>
</tr>
<tr>
<td>Select</td>
<td>8</td>
<td>8</td>
<td>1991</td>
<td>0</td>
</tr>
<tr>
<td>Select</td>
<td>8</td>
<td>25</td>
<td>1987</td>
<td>0</td>
</tr>
</tbody>
</table>

### Incident Data

- **Amtrak involvement:** CSX
- **First RR code:** 0086712599
- **Incident Date/Time:** 6/25/1987 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:** 3
- **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**

---

**82**
F – Tampa Rd @ State St W, Oldsmar, FL

Rail Highway Crossing Inventory

Crossing Number: 62084SA - SR-584 / TAMPA RD
Railroad Operating Company: CSX TRANSPORTATION, INC.
Local Street Name: SR-584 / TAMPA RD
Crossing Status: OPEN - TRACK ACTIVE

Crossing Incident

<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
<th>Year</th>
<th>Total Injured</th>
<th>Total Killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>14</td>
<td>2010</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Incident Data

- Amtrak involvement: No
- First RR code: CSX
- RR assigned number: 82161
- Incident Date/Time: 11/14/2010 6:45 PM
- GSA county name: PINELLA
- GSA city name: OLDSMAR
- Highway name: SR-584
- 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 material: None
- Type of train: Neither
- 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 signaled 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: 07/21/14 STRUCK A 500-LBV STOPPED ON THE TRACKS.
HIGHWAY OCCUPANTS WERE INJURED. PROTECTION
ALSO AT THE XING INCLUDE ADVANCE WARNING AND
PAVEMENT MARKINGS (STOP LINES AND RISING
SYMBOLS). DRIVER AGE; GENDER 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 ofModal 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*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>West Hallandale Beach Blvd @ SW 30th Ave</td>
<td>PEMBROKE PARK</td>
<td>3 (2 days/1 night)</td>
<td>1 (1 day)</td>
</tr>
<tr>
<td>2</td>
<td>W Commercial Blvd @ I-95</td>
<td>OAKLAND PARK</td>
<td>4 (1 nights)</td>
<td>1 (1 day)</td>
</tr>
<tr>
<td>3</td>
<td>Forest Hill Blvd @ I-95</td>
<td>LAKE CLARKE SHORE</td>
<td>3 (1 day/2 nights)</td>
<td>3 (2 days/1 night)</td>
</tr>
<tr>
<td>4</td>
<td>Tampa Road @ State St. W</td>
<td>OLDSMAR</td>
<td>5 (2 days/3 nights)</td>
<td>1 (1 nights)</td>
</tr>
<tr>
<td>5</td>
<td>W Pembroke Road @ I-95</td>
<td>HOLLYWOOD</td>
<td>3 (2 days/1 night)</td>
<td>3 (3 nights)</td>
</tr>
<tr>
<td>6</td>
<td>Hollywood Blvd @ I-95</td>
<td>HOLLYWOOD</td>
<td>3 (1 day/2 nights)</td>
<td>3 (3 nights)</td>
</tr>
<tr>
<td>7</td>
<td>W Sample Road @ NW 8th Ave</td>
<td>POMPANO BEACH</td>
<td>3 (2 days/1 night)</td>
<td>4 (1 day/3 nights)</td>
</tr>
<tr>
<td>8</td>
<td>Washington Ave @ North Gertrude Ave</td>
<td>ORLANDO</td>
<td>3 (1 day/2 nights)</td>
<td>3 (3 nights)</td>
</tr>
<tr>
<td>9</td>
<td>Magnolia Ave @ North Orange Ave</td>
<td>ORLANDO</td>
<td>0</td>
<td>N/A 1 night in 2006</td>
</tr>
<tr>
<td>10</td>
<td>Int'l Speedway Blvd @ South Charles St</td>
<td>DAYTONA BEACH</td>
<td>0</td>
<td>N/A 1 night in 2006</td>
</tr>
<tr>
<td>11</td>
<td>Miner Road @ US 1</td>
<td>HYPOLUXO</td>
<td>0</td>
<td>1 from 2006 to 2007</td>
</tr>
</tbody>
</table>

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