STRATEGIES FOR REDUCING RAILROAD TRESPASSING

Pilot Program

January 2020

FDOT

FMO
FREIGHT & MULTIMODAL OPERATIONS

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Executive Summary

Trespassing[1] on railroad property is the leading cause of all rail-related deaths in the United States. Compared to other states, Florida ranks the third highest in railroad Casualties (fatalities and injuries) from 2015 to 2018. In response to this issue, the Florida Department of Transportation's Freight and Multi-modal Operations Manager (FDOT FMO) has taken the initiative to work towards practical corrective actions to curtail trespassing Incidents. The Central Florida Rail Corridor (CFRC)/SunRail Commuter Rail System was chosen to evaluate methods to mitigate trespassing. On the CFRC, a Pilot Area was selected and studied for trespassing Hot Spots[2]. For each Hot Spot that was based on evaluation, a mitigation method was proposed and designed. The methods for determining each Hot Spot and its effectiveness are as follows:

- Data Mining – Data collection and analysis is key to identifying potential trends and areas with high frequency of trespassing. On the CFRC, the data collection and analysis consisted of compiling trespasser fatalities, strikes, suicides, near misses, observations using an aggregated data approach. Other risk variables were identified based on the Federal Railroad Administration's trespasser risk model that includes evidence of trespassing, homeless areas, train speed, alignment, and line of sight. The risk variables were tallied up and evaluated using the Risk Assessment System[3] to determine each Hot Spot within the Pilot Area. The effectiveness of this method is proportional to quantity and quality of the data.

- Origin-Destination Analytics – The analysis is used to identify the source and destination of trespassers. One example of trespassing could be due to a school on one side of the tracks and a park on the other. The use of origin-destination analytics proved vital in determining the root causes of trespassing in various Hot Spots and was instrumental in determining optimum engineering controls, design concepts and targeted outreach.

- Alternate Route Analysis – In conjunction with origin-destination analytics, alternate route analytics evaluates the potential routes a trespasser will use. This method plays a vital role in determining the most appropriate engineering controls for trespass mitigation. If a reasonable alternate route between an origin-destination exists, then exclusion from the right-of-way will be more successful. If, however, a reasonable alternate route between origin-destination does not exist, channelization or more robust exclusionary devices are appropriate.

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1 According to the FRA's Guide for Preparing Accident/Incident Reports, a trespasser is defined as someone "who is on the part of railroad property used in railroad operation and whose presence is prohibited, forbidden, or unlawful" (FRA, 2011). Trespassers in this sense do not include highway users involved in a collision with on-track equipment at a highway–rail or a pedestrian pathway crossing denoted with a U.S. Department of Transportation Inventory Number. Trespassing Incidents resulting in a Casualty are required to be reported to the FRA using FRA Form 6180.55a. Verified suicides are required to be reported to the FRA on the FRA 6180.55a reporting form. "Suicide data is data regarding the death of an individual due to that individual's commission of suicide as determined by a coroner, public police officer or other public authority; or injury to an individual due to that individual's attempted commission of suicide as determined by a public police officer or other public authority." Suicides may occur at highway–rail crossings, as well as away from crossings.

2 A specifc location that is popular for trespassing (i.e. high trespassing use).

3 Military Standard 882 E Risk Assessment System

- Unmanned Aerial Vehicles (Drones) – Drones can be attached with LiDAR, video and camera systems to gather actionable intelligence on trespassing. Drones were tested in this Pilot Program to gather information on Hot Spots inside the Pilot Area. While drone photogrammetry has been successful in other railroad applications, the use of drone video for trespassing data analytics was limited. Regulatory flight constraints, elevation, weather, and geography affected the quality of information gathered; as a result, the drone video footage was an untenable solution for identifying Hot Spots on the CFRC.

- Stakeholder Partnerships – Partnerships with local law enforcement and governments are crucial in providing validation of analytics and additional suggestions for corrective actions. Since the CFRC does not have a police force, raising trespasser concerns with local law enforcement increased their awareness of the magnitude of railroad trespassing and they acknowledged the need to take action regarding outreach and then enforcement. Their insight was instrumental in determining the most effective mitigation techniques for each Hot Spot.

- Engineering Controls and Conceptual Designs – For each Hot Spot, preventative measures were designed to address the root causes of trespassing. In total, four design concepts were developed:

    - Right-of-way Channelization – Channelization directs pedestrian traffic from current trespassing paths to designed safer crossing points. This concept realizes the necessity of persons that need to travel to and from specific locations on either side of the tracks. This engineering control consists of the construction of a sidewalk parallel to the right-of-way with a barrier or fence between the sidewalk and tracks that lead the trespasser to a fully automatic pedestrian crossing (pedestrian gate, possible swing gate, flashing lights, and bells).

    - Physical Deterrent – Physical deterrents are fences, walls or barriers that restrict access. They are best used in remote areas, and where loitering and criminal activity may be occurring. The most common form of deterrent is fencing, but walls or vegetation can used. The concept plans include standard FDOT Type B 6’ chain link fence and a more robust hardened fencing which consists of anti-climbing and anti-cutting fence material and possible overhead lighting.

    - Intelligent Right-of-Way Safety System Monitoring (camera monitoring system) and Law Enforcement Alert – This system uses video and closed-circuit television (CCTV) monitoring and data gathering using artificial intelligence to detect trespassers accurately and transmit an alert to the appropriate parties. It has accurate human detection and keeps a record of the number of Incidents. The system has a network-based distributive alert system that can be overlaid onto an

existing supervisory system or law enforcement network system such as Mutualink.[4]

- Rail Lighting Warning System – This warning system is a lighting system installed on the outside web of the rail on the field side alerting trespassers that a train is approaching. It is not an automatic trespasser detection system but rather a warning system installed in areas where origin-destination trespassing is occurring. An audible system can also accompany it. The system is non-vital, is independent of the track signal system, and does not identify or prevent trespass entry to the corridor.

- Outreach through Operation Lifesaver, Law Enforcement, and Media Relations – Outreach to the community through existing programs and the media can be an effective method to improve education about the dangers and legality of trespassing. In conjunction with data analytics, outreach can be focused on the groups with the highest probability of trespassing. On the CFRC, it was found that males between the ages of 30 to 69 are more likely to be struck by a train than any other group. This was helpful to local law enforcement who expressed an interest in conducting outreach with this group

The combination of all these methods greatly increases their effectiveness and lessens the likelihood of recurrence. Beginning with engineering controls and technologies suggested in this report, particularly the Intelligent Right-of-Way Safety System (camera monitoring system), trespassers will not only be detected but will also be counted, which bolsters accurate safety data and allows railroads to better track persons entering the corridor. From this data, mitigation designs can be better targeted and outreach and enforcement programs will be more effective. It is recommended that the conceptual designs presented in this report be deployed across the rail network throughout Florida and by doing so, take the next step in solving the Florida railroads' statistically deadliest and tragic safety issue.

[4] Mutualink is a system that shares live video feed from SunRail cameras with law enforcement.

01

Introduction and Background

Purpose and Need

Trespassing on railroad property accounts for 94% of all rail-related deaths in the United States[5]. While the number of fatalities has been reduced by 60% over the last few decades, in 2018, there were still 1,015 trespassing Casualties (fatalities and injuries)[6] nationwide, nearly three per day.

Florida is experiencing rapid population growth and an expansion of passenger rail in Central and South Florida. These factors have also led to a worsening in rail trespasser Casualties (see Figures 1 and 2). According to FRA's safety statistics between 2015 and 2018, Florida ranked the third highest state for the number of railway trespassing Casualties in the nation. In 2018, Florida was also tied for the third-highest state in railway suicides[7].

State	Cases
California	722
Texas	326
Florida	221
New York	189
Pennsylvania	175
Illinois	147
Georgia	130
North Carolina	122
Ohio	122
New Jersey	108

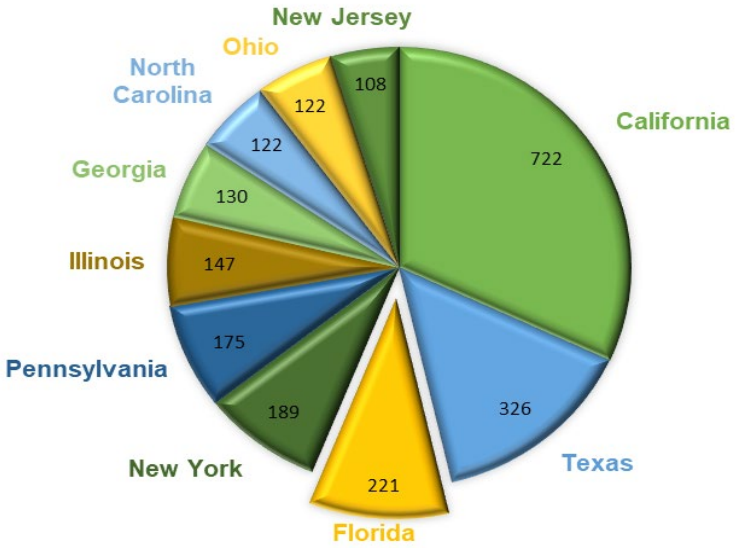


Figure 1: Top 10 States for Trespassing Total Casualties (2015 to 2018)

Trespasser Casualties in Florida have trended upward since 2011, as depicted in Figure 2. The addition of SunRail service in 2014 correlates to the increase in fatalities and injuries in the following years. A further rise in Casualties also occurred in 2017 and 2018. Contributing factors include:

- The addition of SunRail's Phase 2 South extension in July 2018, which included an increase in train service and an extension of the commuter rail service of approximately 17 miles.

[5] FRA (2018) FRA Report to Congress: National Strategy to Prevent Trespassing on Railroad Property and FRA Crossing Safety & Trespass Prevention https://www.fra.dot.gov/Page/P0841

[6] Per FRA, Casualties are fatalities and injuries.

[7] https://explore.dot.gov/t/FRA/views/TrespassandSuicideDashboard/TrespassOverview?:iid=1&:isGuestRedirectFromVizportal=y&:embed=y

- The Brightline service began revenue operation in South Florida in 2017, bringing express train service between Miami and West Palm Beach.

The number of trespasser Casualties has remained elevated since 2014 and necessitates a focused and multi-pronged mitigation approach to address trespassing along railroads in Florida (see Figure 2).

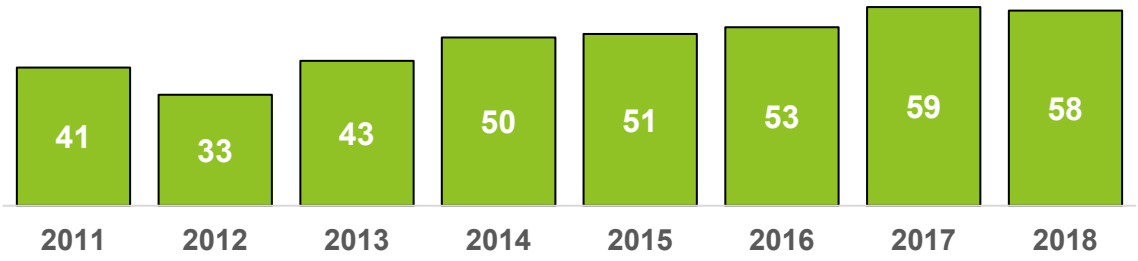


Figure 2: Number of Trespasser Casualties in Florida (2011 to 2018)

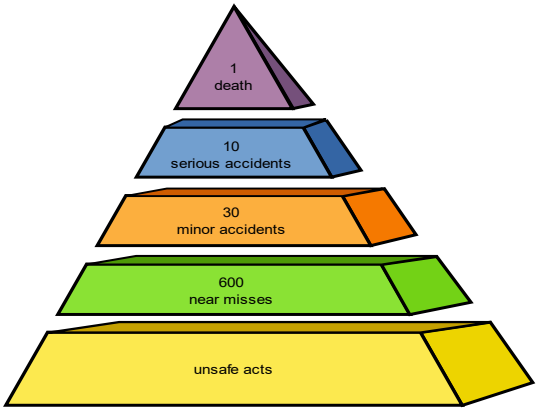


Figure 3: Heinrich's Accident Pyramid

Most trespassing Casualties and Incidents[8] are preventable. Heinrich's Accident Pyramid[9] depicts the ratio between the number of accidents causing various levels of injuries, near misses, and unsafe acts or as stated in trespassing terms, unreported trespasser observations (see Figures 3 and 4). Historical Incident data analyzed from CFRC follows a very similar pattern to Heinrich's Accident Pyramid. As shown in Figure 4, the majority of Incidents reported on the CFRC are unreported observations and observations without an immediate threat of a trespasser-train collision. The third most common category is near misses where a collision was imminent but was avoided by a narrow margin because the train engineer made an emergency brake application. The smallest share of total Incidents are the strikes,

Figure 4: CFRC Incident Pyramid

[8] Incidents are defined as fatalities, suicides, strikes, near misses and observations.

[9] Herbert W. Heinrich and Frank E. Bird - Accident Ratio Triangle

fatalities, and suicides where a trespasser was hit by a train resulting in injury or death.

In contrast to Heinrich's Accident Pyramid which holds that for every 10 serious accidents, there is one fatality, CFRC has experienced twice as many fatalities as serious accidents or strikes. This paradigm is understood in the railroad industry where train-on-human collisions are typically fatal and are single-point of failures.

Local law enforcement may routinely patrol areas around the railroad tracks, but limited access and resources constrain their anti-trespassing efforts. Addressing trespassing issues not only reduces the loss of life but also has the potential to decrease crime and unintended consequences such as derailments and property damage. Criminal behavior along the railroad corridor includes tagging, vandalism, or even damaging the track infrastructure and signal system. Any disruption to the track and its components could lead to the derailment of a train, which could result in further deaths and severe damage to the train and nearby property.

Project Overview

The FDOT Freight & Multimodal Operations (FMO) Office has looked to use engineering solutions that contribute to its culture-of-safety, as well as education and enforcement strategies (the Three E's: Engineering, Education, and Enforcement). The Three E's safety components have helped FDOT reduce highway-rail crossing fatalities; however, Incidents resulting from rail trespassing are a constant challenge.

In response to the growing number of trespassing fatalities, the FDOT FMO Office proposed an innovative and novel approach. Accordingly, this report evaluates the following strategies:

1. Conduct detailed analysis to identify the reasons for trespassing with data from various sources and interviews with CFRC/SunRail personnel, tenant railroads, other commuter railroads, and law enforcement. Evaluate trespassing Incidents and other variables to determine origin and destination routes.
2. Use a drone to video record emerging trespass areas and identify Hot Spots within the Pilot Area. Conduct field reviews to verify Hot Spots. Obtain ground survey of the Hot Spots to prepare conceptual design plans for trespassing mitigation.
3. Based on the analysis and root causes, focus on the following engineering controls:
    a. Channelize trespassers to designated crossings.
    b. Closed Circuit Television (CCTV) and artificial intelligence, sensors, and alert systems to notify the CFRC Dispatchers and law enforcement.
    c. Rail Lighting Warning System along the field side web of the rail to alert trespassers that a train is approaching.
    d. Hardened fencing similar to walls.
4. Prepare conceptual plans to determine feasibility of these engineering controls.

5. Create a task force of law enforcement and community stakeholders within the Pilot Area to obtain input regarding the origin-destination characteristics of the Hot Spots, the proposed conceptual plans, and discussion of targeted outreach.

CFRC/SunRail Pilot Program

SunRail/CFRC was used as the Pilot Program to determine the effectiveness of these strategies in reducing the incidence of trespassing. The methodology used for the SunRail Pilot Program is summarized in Figure 5:

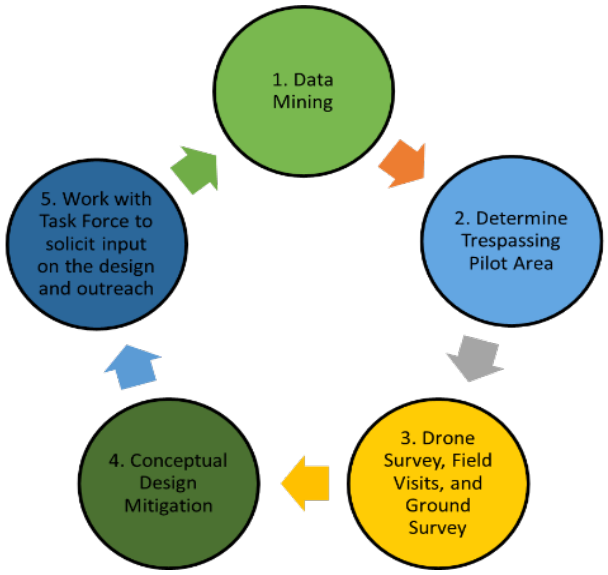


Figure 5: Pilot Program Cyclical Methodology Summary

CFRC/SunRail Characteristics

In the 2019 Fiscal Year, more than 2.4 million passengers made trips over the CFRC: 1.5 million were SunRail passengers, and the other 980,000 were Amtrak passengers. Currently, 40 SunRail trains per day operate over a 49-mile section of the 61-mile CFRC. Additionally, six Amtrak passenger trains, ten local CSX freight trains, and four through CSX freight trains operate daily on the CFRC, totaling 60 trains on an average weekday.

Figure 6: SunRail and Amtrak on the CFRC

CFRC Trespassing Statistics

Trespassing Incidents[10] have been increasing on the CFRC since SunRail began operation on May 1, 2014. As presented in Figure 7, the number of CFRC trespasser Incidents increased by 43% from 2016 to 2017 and has remained elevated since 2017. More importantly, fatalities have spiked significantly on the corridor. For the years 2015 and 2016, a total of four deaths and 132

[10] Trespassing Incidents are defined as fatalities, strikes, observations, near misses and suicides.

other Incidents occurred. In the next two-year period for 2017 and 2018, CFRC saw fatalities quadruple to 16 fatalities, and other Incidents increase to 227 (about 2.3 Incidents per week).

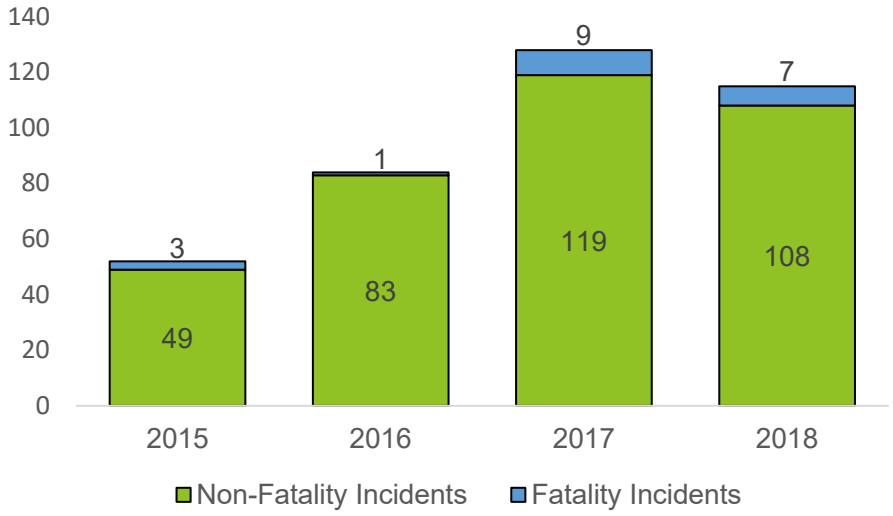


Figure 7: Number of CFRC Trespassing Incidents

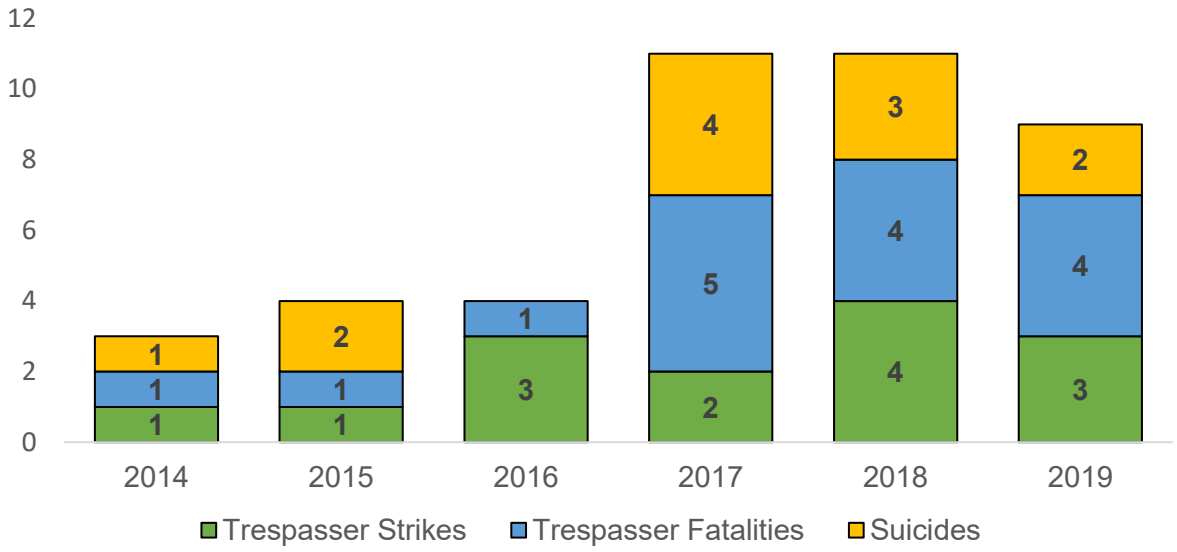


Figure 8: CFRC Trespassing Casualties May 2014 through August 2019

Trespasser strikes have averaged three strikes per year for the period from May 2014 through August 2019. Trespasser fatalities experienced an increase in 2017 after three years of only one fatality per year, increasing to just over 4 per year. The same time period also saw an increase in in the number of suicides[11] on the CFRC.

[11] Per FRA, suicides are confirmed from police reports, coroner reports or other public authority.

Root Causes of Trespassing

Trespassing on railroad property can occur at any location along the right-of-way when someone enters the corridor without authorization. Trespassing has several root causes depending on the motivation of the individual, and can be grouped into one of the following:

- Lack of understanding or appreciation of dangerous conditions
- Convenience,
- Crisis (suicide),
- Recreation,
- Loitering,
- Criminal activity.

All railroads should evaluate each location identified with repeated trespassing violations to determine root causes/motivation and implement the most effective mitigation strategy appropriate to the situation.

For example, mitigation for a situation where someone unintentionally enters the corridor in a public setting may be as simple as providing a vegetative barrier or low fence. Conversely, mitigation for a condition where someone intentionally enters the corridor with a strong motivational 'pull' (shortest route to a destination, vandalism, loitering, etc.), in an area with little or no observation, will require a more robust solution to mitigate the trespass (vandal-proof fencing, CCTV, etc.). As a result, the root causes of the trespassing events in the CFRC Pilot Area are evaluated in this report to provide the most useful conceptual design, law enforcement strategies, and public outreach initiatives.

02

CFRC Data Analysis

Trespassing Data Analytics

Analysis of current trends is critical to the overall reduction of railroad trespassing Incidents. Evaluation of trends can provide insight into the times when greater trespassing events occur. Incidents are mapped to look for clusters and identify nearby landmarks. Surrounding areas may contain characteristics such as schools, stadiums, shopping centers, hospitals, outdoor routes, etc. as likely sources or motivators for the trespassing behavior.

Moving the trespassing to a new location does not reduce the safety risk; as a result, the motives or causes of trespassing, as stated in Section 01, are critical to understand for ensuring permanent solutions.

CFRC Trespassing Data Sources

The data used in this report is from a CFRC maintained database of Incidents along the corridor. This information is collected from various data sources:

- SunRail Train and Maintenance-of-Way Crews,
- SunRail Station Ambassador observation reports,
- concerned individuals,
- law enforcement,
- coroner's reports,
- SunRail contractor reports,
- incident reports such as near misses,
- field reviews,
- interviews with businesses and communities,
- CCTV footage.

The FRA tracks trespassing Casualties. In 2018, about one-third of all railroad trespassing fatalities were due to suicide[12]. Suicide has different root causes and solutions than trespassing injuries and deaths and must be approached differently. Between July 2014 and June 2019, 3,520 Incidents, were reported. For each incident, the date and time, milepost location, and incident type are recorded. If a trespasser is not seen, however, it is not reported; as a result, the data results in a higher number of Incidents near passenger stations where people congregate and report trespassers. Without the deployment of comprehensive detection technology like CCTV, the best available data is derived from these human observation and Casualty reports.

CFRC Analytics

The CFRC incident logs were used as the data set to analyze trespassing events looking for key trends, causes, and identifying a potential Pilot Area.

[12] https://www.fra.dot.gov/Page/P1111

Many of the reported Incidents were trespassing related and outside the scope of this analysis. The relevant 421 trespass Incidents were identified for further evaluation. From this data set, the team conducted a geographic and trend analyses.

CFRC Incident Trend Analysis

The Incident data was also analyzed by time of day, day of week, and month, looking for key trends and insight into the Incidents on the corridor.

When analyzed by hour of day (see Figure 9), a definite increase in Incidents occurs in peak AM and PM rush hours. This trend is expected with the method of data collection. Rush hours have an increased number of operating trains and ambassadors at the stations which identify trespassers, and more conflicts between people and trains occur. It is noticeable that a lower number of Incidents are experienced over the night hours between 9:00 PM and 6:00 AM. This number is likely lower since fewer trains are operating during this time which would otherwise increase the number of Incidents.

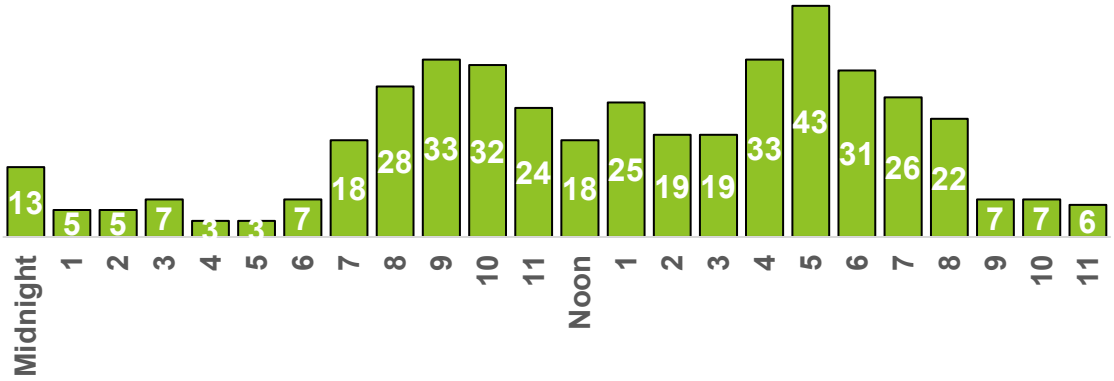


Figure 9: Incidents by Hour of Day

When analyzed by month, a higher number of Incidents occur in the winter months of December to March (see Figure 10: Incidents by Month). Many factors could cause this increase. In Florida, the winter months temperatures are more enjoyable than summer months, allowing more pedestrians to be outside throughout the day.

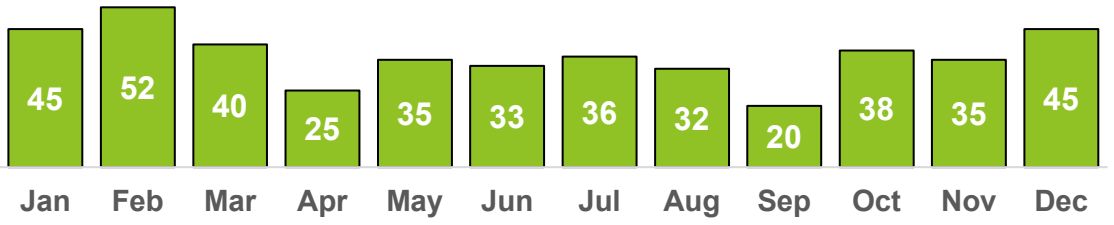


Figure 10: Incidents by Month

When analyzed by day of the week, there are more Incidents during the work week (Figure 11: Incidents by Day of Week). This increase is due to two main factors: a higher number of commuters and pedestrians during the week, and much like the observation bias found in the time of day analysis, SunRail does not operate on the weekends.

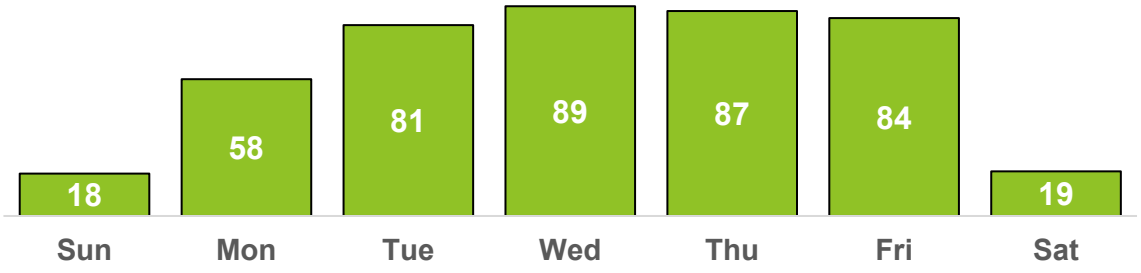


Figure 11: Incidents by Day of Week

Comparison of Causal Factors and Root Causes of Casualties

The CFRC/SunRail Casualty data was compared with the FRA nation-wide data and the Transportation Research Board's (TRB) Circular E-C242 report.

Gender, Age and Race Analysis

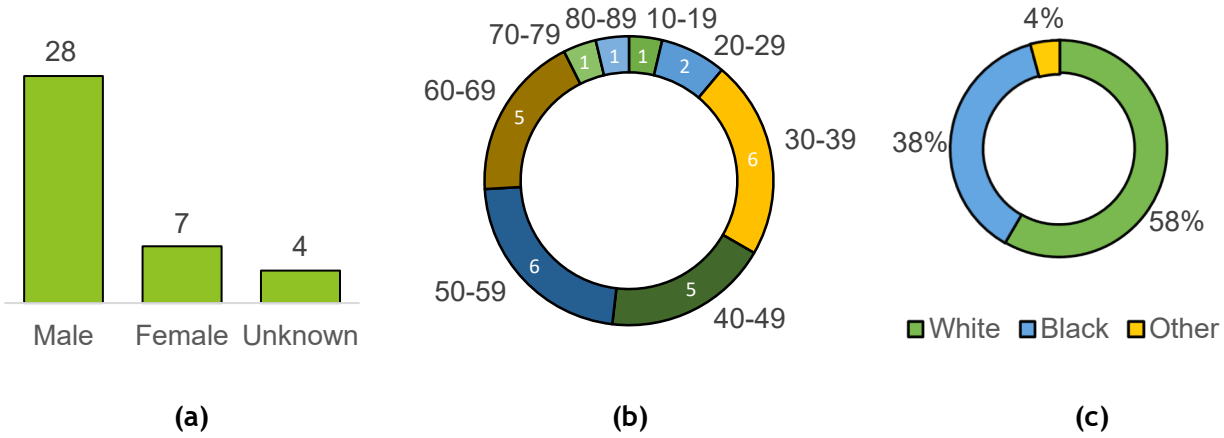


Figure 12: CFRC Trespasser Casualties by (a) Gender, (b) Age and (c) Race

On the CFRC, males are four times more likely to be struck by trains than females. Adults between the ages of 30 to 69 are more likely to be hit by a train. The white population is statistically more likely to be hit by a train than those of any other race. According to the U.S. Census Bureau, in the state of Florida white (non-Hispanic) makes up 53.5% of the total population, Hispanic 26.1%, Black or African American 16.9%, and Other 3.5%.

In the FRA's report entitled: Rail Trespasser Fatalities: Demographics and Behavior Profiles, June 2013, it stated that "*The most typical rail trespasser fatality involves White males who are possibly intoxicated,*

with a mean age of 38, and with low socioeconomic status". The TRB E-C242 study stated that*: "…two-thirds of railroad trespassing fatalities occur between the ages of 20 and 49. In the market analysis of income, family and life stages of the decedents, findings suggested that the two highest-risk "markets" 10that trespassing prevention efforts should focus on are (1) younger, lower-income, urban renters in second-tier cities with railroads; and (2) lower-income, rural homeowners who are likely to be empty nesters or couples without children. Finally, toxicology reports from coroners determined that drugs and/or alcohol were associated with approximately half of all trespasser fatalities*."

Time of Day Analysis

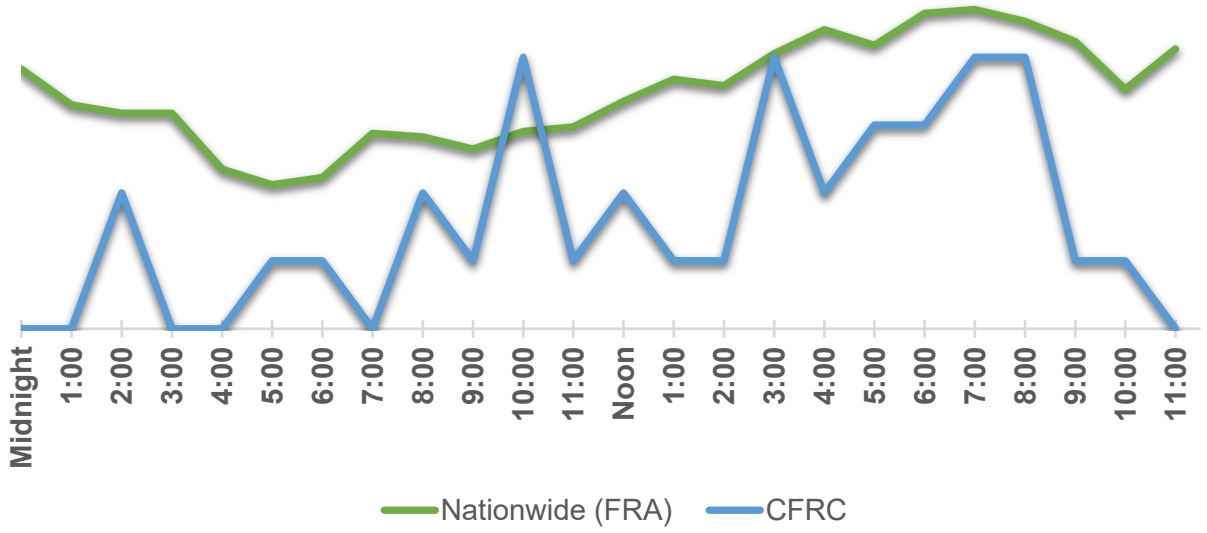


Figure 13: CFRC to Nationwide Comparison – Time of Day

Trespassing by time of day is similar to the FRA data with trespassing Casualties occurring more frequently between 6:00 p.m. and 8:00 p.m. A spike occurs, however, in the CFRC data at 10:00 a.m. and 3:00 p.m.

Day of Week Analysis

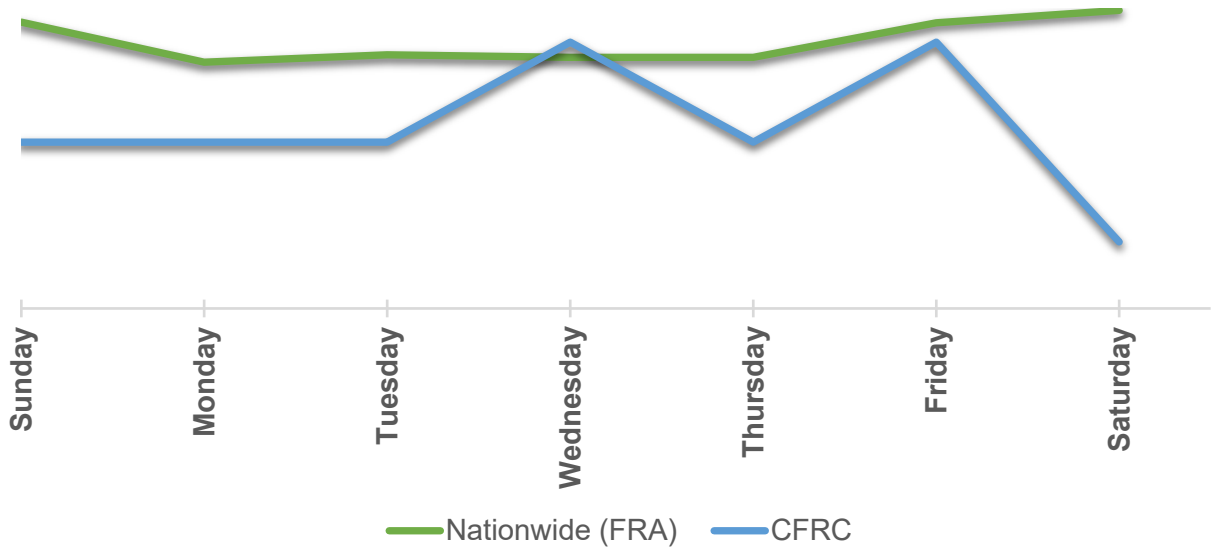


Figure 14: CFRC to Nationwide Comparison – Day of Week

Trespassing by day of the week is not consistent with FRA data because SunRail does not run on the weekends; however, the data during the weekdays are consistent with the FRA data except on Wednesdays where a small spike occurs.

Month of Year Analysis

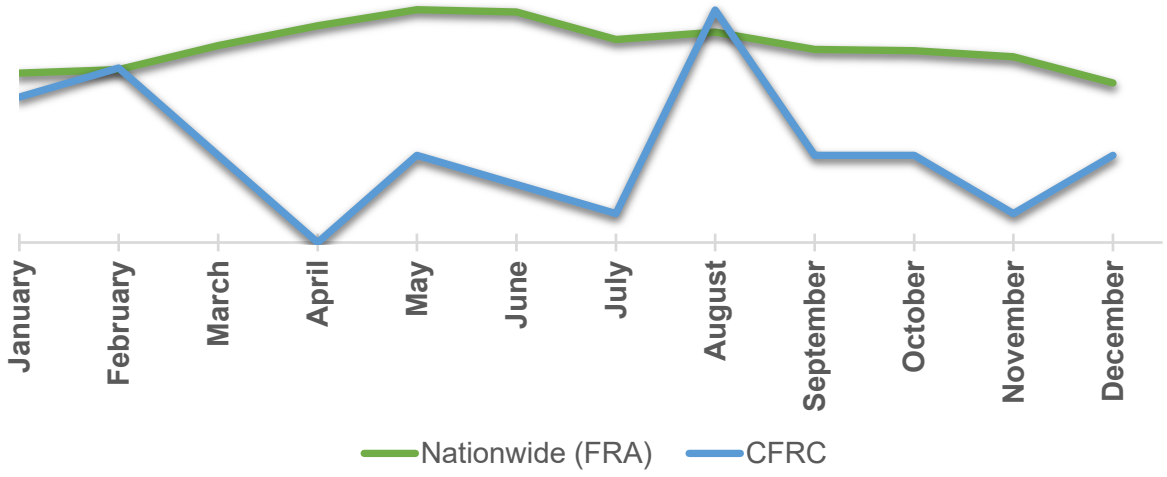


Figure 15: CFRC to Nationwide Comparison – By Month

The CFRC Casualties increase slightly in winter months and spike in August which are in contrast to the FRA data which depicts a decrease in casualties in winter months and no evidence of a spike in the summer months.

Other Factors Influencing Trespassing

Media reporting of a CFRC trespasser fatality may have contributed to an uptick in Incidents. In May of 2017, a teenager was walking his bike near the tracks and was struck and killed by a SunRail train in Seminole County. The event made media headlines with widespread coverage that was unparalleled compared to previous CFRC fatalities and Incidents. According to the FRA,[13] improper media coverage of a suicide event can lead to "copycat" Incidents. The TRB Circular states: "*Media reporting can negatively impact the occurrence of Incidents and can lead to copycat occurrences when misreported (Barker et al., 2016) (Havârneanu, 2015) (Mishara & Bardon, 2016) (DOT/FRA/ORD-17/02, 2017)*". Improper coverage includes: using the term "suicide" in the headline, including detailed information on the location and nature of the event, and showcasing a photo of a train in the article. While the event was not considered a suicide, the media sensationalization of it may have given rise to additional Incidents.

Pilot Area Selection

The Pilot Area was determined based on the following criteria:

- Data Mining – Locations of high frequency and consistency of trespassing.
- Ability to Use Drones – Testing the use of drones was a key element of this Pilot Program. Drones cannot be used on many locations on the CFRC due to various regulations and restrictions.
- Stakeholder Comments – Stakeholders identified key areas of trespassing concern.

Two locations were identified for further investigation for a total Pilot Area of approximately six miles:

- Church Ave to Ballard (MP 777.68 to MP 781.24)
- O'Brien Rd to Lake Ave (MP 781.58 to MP 783.84)

The Pilot Area is a mixed-use section of the CFRC with dense residential and commercial development at the far north end of the area in Longwood, Florida. Between Longwood and Altamonte Springs, FL, industrial parks and some residential communities adjoin the corridor. The Pilot Area includes denser residential and commercial districts near the Altamonte Springs Station and through downtown Maitland, FL with lighter residential and industrial parks in-between. A few small sections of the Pilot Area are undeveloped with natural vegetation and wetlands. The Pilot Area encompasses an array of different trespassing scenarios with its many parks and recreational areas, development types, schools, public buildings, secluded natural areas, and access to several lakes. In several areas, grade crossings are a great distance apart increasing the possibility of trespassing. The chosen Pilot Area with its geographical features, historical Incidents, installed fencing, and future fencing sections are shown below in Figure 16.

[13] FRA Report Reporting of Suicide and Trespassing Incidents by Online Media, dated March 2017

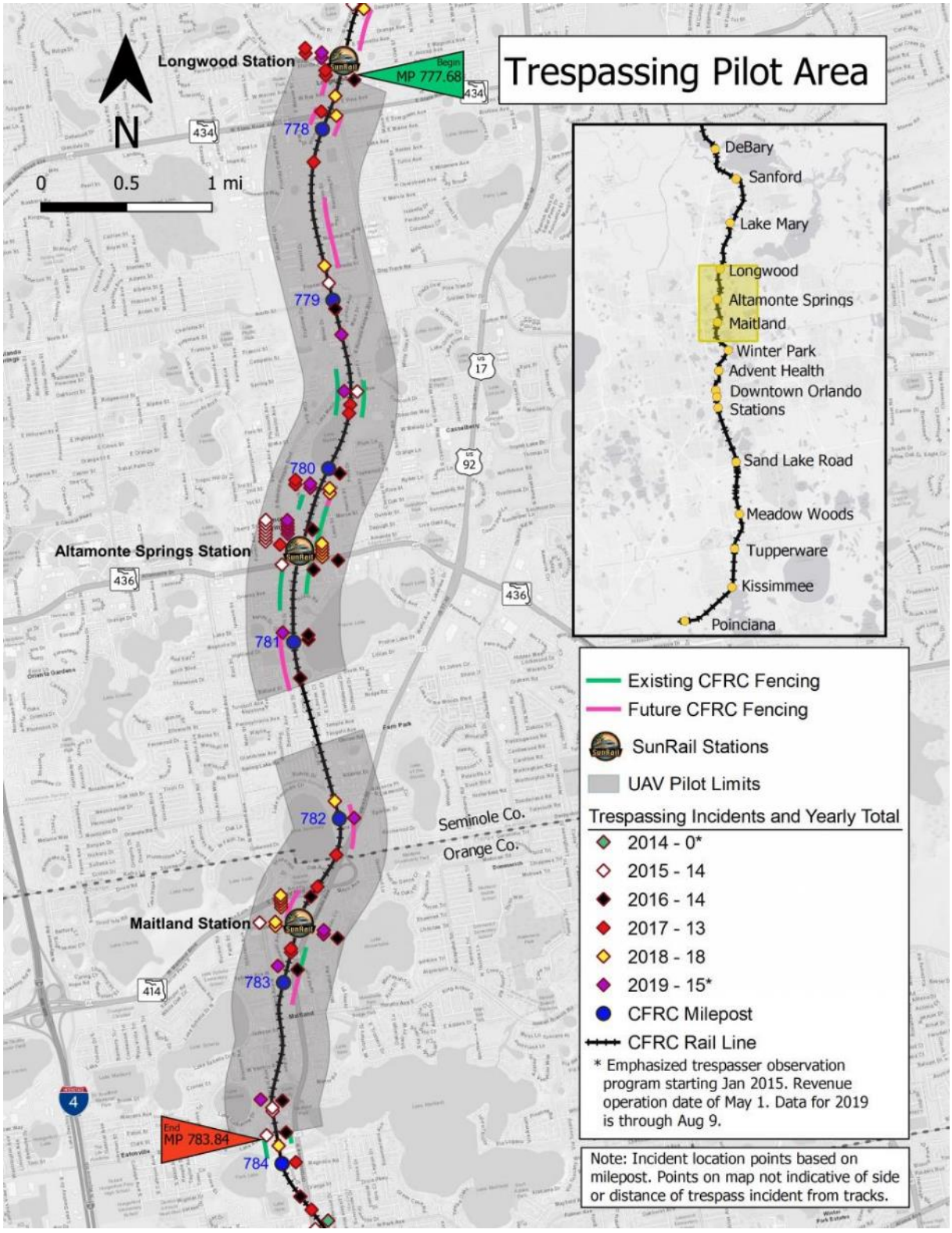


Figure 16: GIS map of Pilot Area showcasing historical Incident data and fencing

Pilot Area Analytics

From May 2014 to August 2019, the number of Incidents in the Pilot Area verses CFRC was 74 and 421, respectively. Within the six-mile Pilot Area, 74 Incidents represent approximately 18% of the total number of CFRC Incidents and 10% of total length of the CFRC, respectively. In 2018 and similar to the rest of the corridor, the total number of Incidents increased to 18 even though fencing was installed (see Figure 17).

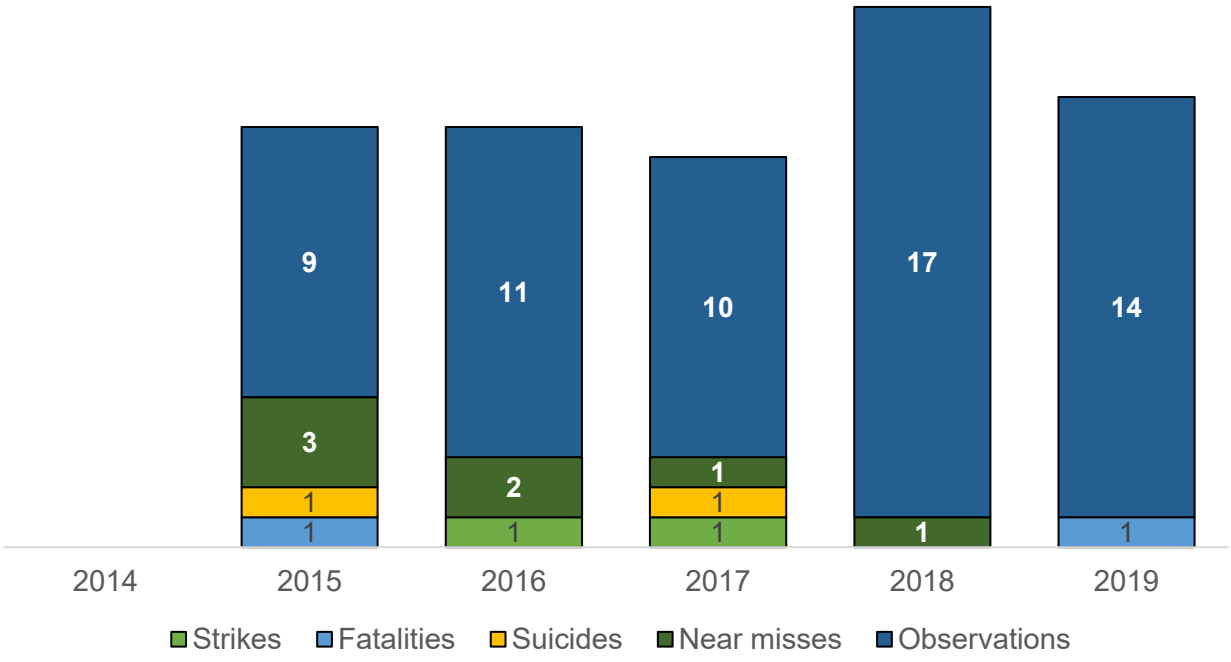


Figure 17: Pilot Area Incidents

Geographic Analysis of Pilot Area

Spatial evaluation of events provides insight that tables and graphs alone cannot always show. However, the data was recorded based on the nearest fractional railroad milepost. Using GIS software, mapping data was created for each milepost, and coordinates were assigned for each incident. Each incident was then mapped and compared to station locations, at-grade crossings, existing and future fencing installations, and nearby landmarks. The spatial mapping was shown by year to look for trends by location over time.

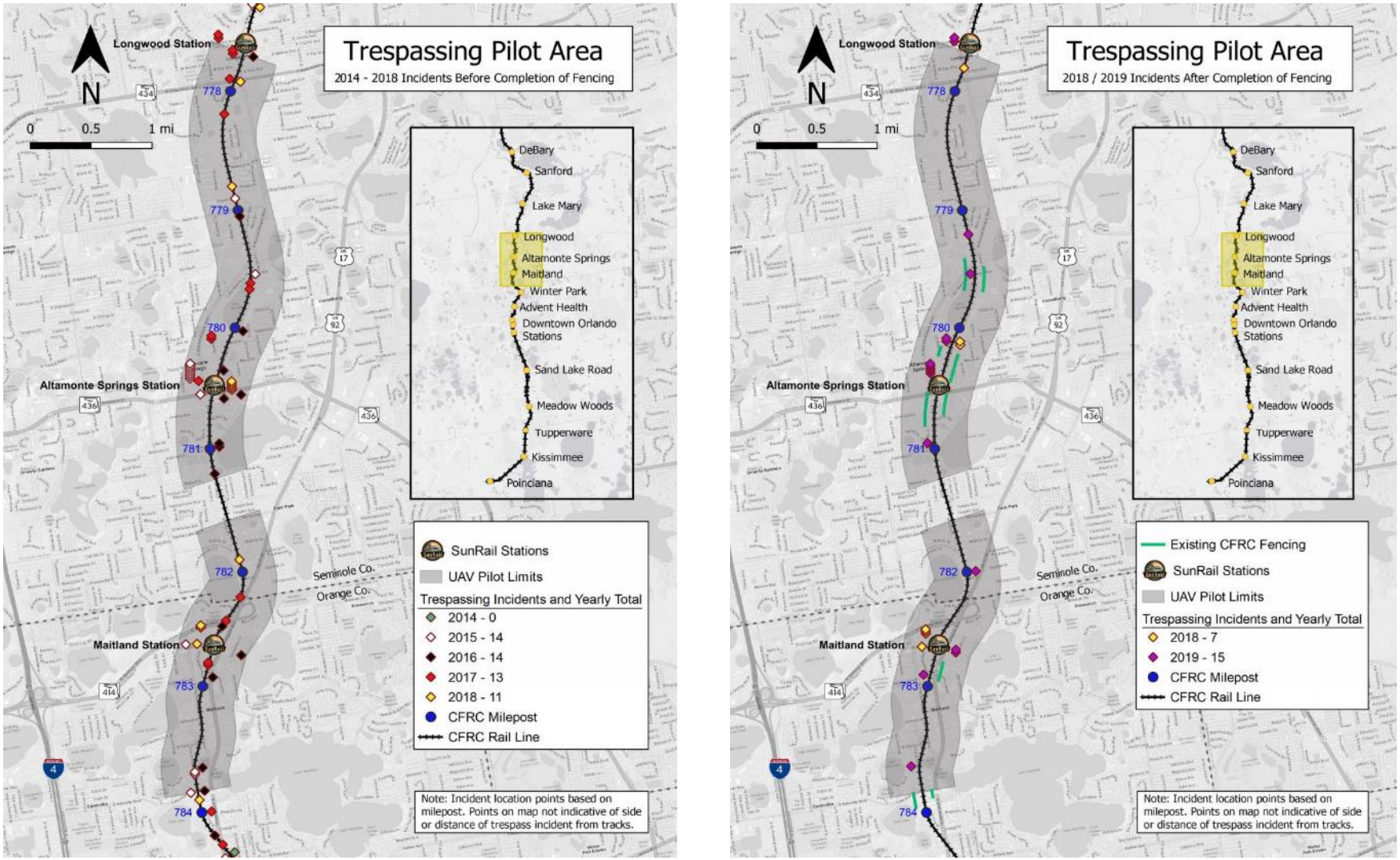
Fencing Evaluation in the Pilot Area

The existing fencing was installed in the Pilot Area in mid-2018. The 2015 FRA study, High-Security Fencing for Rail Right-of-WayApplications (DOT/FRA/ORD-15/38 FRA Report, 2015), examined current

uses of high-security fencing on several commuter railroad properties and recommended best practices for effective right-of-way fencing. The study states:

"…*to effectively prevent trespassing, fencing should address access from all sides (over, under, around, and through). The fencing should be strategically located, based on a robust hazard analysis. Stakeholder and community support key to its effectiveness. The installing railroad should have a policy regarding fencing and strongly support it."*

Within the Pilot Area, a record high of 18 Incidents occurred in 2018, with the next highest year occurring in 2019 with 15 Incidents. It appears that the fencing needed to be installed in longer lengths to cover the trespassing paths (see maps below). In 2020, fencing is planned to be extended in some of these areas.



(a) (b)

Figure 18: Map of Incidents (a) Before and (b) After Completion of Fencing in Mid 2018

Identification of Hot Spots in the Pilot Area

After the Pilot Area was identified, trespassing Hot Spots, frequently used trespassing paths and locations were identified using the following criteria:

1. Data Mining - Data gathered from CFRC was analyzed for trends and origins and destinations to identify locations, causes and paths of trespassing.
2. Stakeholders and Outreach - Letters were issued to homeless groups and Home Owners Associations, Law Enforcement, and other organizations. In total, over 30 letters and emails were issued to these groups regarding trespassing issues in their area and over 30 invitations were sent to them for the Trespassing Task Force which is described in Section 4 of this report.
3. Drone Deployment - A drone was deployed to collect 4K video data in the Pilot Area. High-definition videos were used to survey the Pilot Area and analyze the data using a geographic information system (GIS) technology. The survey was used to obtain aerial topographical information at the locations with the highest instances of trespassing events.
4. Field Verification - The team conducted field verification to validate Hot Spots within the Pilot Area and determine origin and destination routes. The surveyors completed a traditional survey for the conceptual design phase to identify mitigation strategies.
5. Hazard Analysis - Each Hot Spot was ranked using the hazard analysis and resolution process from the Military Standard 882E and FRA's Collision Hazard Analysis. The hazard analysis follows the following process: define the system, identify hazards and access hazards. The following disaggregate criteria were assessed for each Hot Spot:

I.	Prior Incidents	II.	Near Miss and Observation History
III.	Evidence of Trespassing	IV.	Attractions - Origin/Destination Centers
V.	Sight Obstruction	VI.	Track Curvature
VII.	Train Speed	VIII.	Type of Trespassing
IX.	Number of Daily Trains	X.	Number of Tracks
XI.	Suicides	XII.	Drone Capability

Each Hot Spot was then ranked based on assigning weight (point rating) for each type of criteria, and the points were added up for an overall ranking[14] to determine the risk. The ranking[15] was then assessed using the following risk assessment table:

[14] FRA and Volpe Center Assessment Criteria and Ranking Recommendations

[15] Military Standard 882E – Hazard Ranking System and FRA Collision Hazard Analysis

Frequency	Consequence							
	C1	C2	C3	C4	C5	C6	C7	C8
	Negligible	Minor	Minor with Medical Care	Serious Admitted to Hospital	Serious	Serious with Multiple Injuries	Critical	Disastrous
Certain	Medium	Medium	Medium	High	High	High	High	High
Likely	Low	Medium	Medium	Medium	Medium	High	High	High
Probable	Low	Low	Medium	Medium	Medium	Medium	High	High
Unlikely	Low	Low	Low	Low	Low	Medium	Medium	High
Rate	Negligible	Low	Low	Low	Low	Low	Medium	Medium
Improbable	Negligible	Negligible	Negligible	Negligible	Low	Low	Medium	Medium
Incredible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Low	Low

Figure 19: Military Standard 882 E Risk Assessment System and FRA Collision Hazard Analysis

After reviewing the data and drone survey, four “Hot Spots,” or areas of repeated trespassing Incidents, were identified. Each area was then traditionally surveyed for use in the development of the final design concepts. The following areas were classified as “Hot Spots”:

1. Prairie Lake Cove (MP 780.82 to 780.95)
2. Porsche (MP 781.90 to 781.99)
3. Oak (MP 782.22 to 782.30)
4. Lake Lily (MP 783.53 to 783.66)

The locations of the four determined “Hot Spots” can be seen on the map in Figure 20 below.

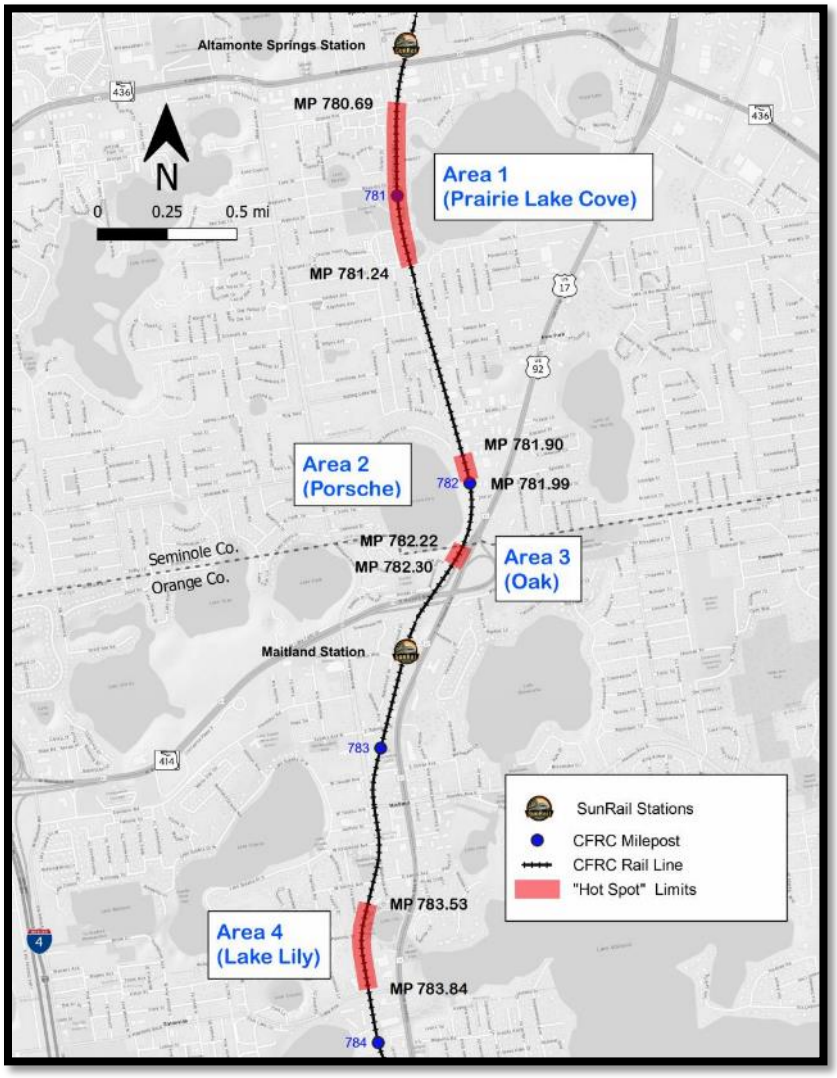


Figure 20: Hot Spot Locations

For each Hot Spot, historical Incidents and evidence of trespassers were reviewed. Evidence of trespassing includes: locations used by trespassers as part of pathways or trails to an origin/destination or gathering points for homeless and loitering. Different types of trespassing require specific mitigation techniques. They also share many traits that allow for consideration of universal methods. Universal methods may include education and enforcement. Specific solutions may consist of physical deterrents such as fencing, channelization (a sidewalk parallel to the track with fencing to a pedestrian crossing), or relocation of a homeless encampment. The specific approach to mitigation of trespass Incidents must be evaluated on a case-by-case basis. Ideally, the proposed solution will address both specific and universal characteristics. Consideration was made to try and eliminate the root causes of Incidents and not just move the problem to a new location. Detailed review of each Hot Spot can be found in Section 4.

03

Trespassing Prevention Methods

Review of Current Trespassing Prevention Methods

Current Trespassing Prevention Methods Used on CFRC

The CFRC conducted a trespassing hazard analysis on the 49-mile section of CFRC before and after construction for SunRail operation. A diagnostic was undertaken to determine pathways and encampments. Train Engineers were interviewed to obtain their perspective on the location of trespassing Hot Spots. CFRC incorporated train crew and platform ambassador observations into subsequent hazard analysis after revenue operation began. CFRC implemented various methods of mitigation such as landscape hardening (fencing, hazard rock and landscaping), public outreach, and law enforcement partnerships as follows:

Fencing

In 2018, CFRC installed a total of 28,549 linear feet of chain link fence with gates for maintenance access. CFRC installed the fencing in the areas that had evidence of trespassing.

Fencing was also strategically installed at high-traffic areas including:

- Intermediate fencing between tracks at platforms;
- Fencing at platform ends;
- Fencing at hotspots; and
- Fencing off areas close to the tracks.

Fencing was installed according to trespassing patterns and can be used to reinforce desired behavior by providing an attractive corridor alternative for biking, hiking, jogging, and walking. However, depending on the type of fence, trespassers can still find a way to climb or cut it.

Vegetation

The City of Winter Park planted shrubbery at the Winter Park Station between the platform and the adjacent park grounds. Vegetation can be planted to prevent small children as well as other trespassers from running or walking into the path of a moving train. Other options include landscaping rocks that can increase beauty and limit access to the corridor. Hazard rock was used extensively at SunRail platforms and in areas where trespassers are going under the fencing.

Right-of-way Maintenance

CFRC Maintenance-of-Way (MOW) personnel maintain the corridor as well as the track structure. Keeping the railroad right-of-way well maintained provides a deterrent to repeated trespassing events and increases the desirability of the corridor. MOW and FDOT are proactive in undertaking the following:

- Graffiti Removal – dissuades taggers from entering the right-of-way and tagging the columns and abutments of overpasses because of the prompt removal of their graffiti.
- Debris Removal – removes homeless encampments, trash, etc. after conferring with law enforcement.
- Vegetation Management – keeps trees, grass and other vegetation trimmed increasing visibility for law enforcement and deterring loitering and encampments.

Signage

The CFRC installed "No Trespassing" signage on all four quadrants of each grade crossing (126 grade crossings) and in areas that were considered high and moderate risk. CFRC also installed Crisis Signage in areas of high risk.

Signs provide a passive method to reduce accidental trespassing or collisions with trains. Signs only reduce the actions of those persons that abide by rules and are not aware that trespassing is prohibited.

Public Outreach

The Media Relations group conducts public outreach to schools, public events, general businesses, commercial driving businesses, transit agencies, community organizations (e.g., churches, shelters, civic groups), residential communities, and municipalities regarding safety around the tracks.

Locomotive and Cab Car Front-facing Cameras

A camera system is deployed on SunRail locomotives and cab cars. The camera video is reviewed after an Incident occurs and is also reviewed, at times, after a trespasser is identified. However, this system is not currently available to view in real time.

Fixed Camera with Pan, Tilt and Zoom

Cameras with pan, tilt and zoom have been installed at SunRail stations. Cameras improve data reporting and prevention and when used in conjunction with the station's public address system, the trespasser can be identified and alerted via the CFRC Dispatcher.

Current Trespassing Prevention Methods - Other Commuter Rail Systems

To validate the potential mitigation techniques and avoid past failures, letters were issued to other passenger railroad agencies to identify the best practices, lessons learned and innovative approaches to mitigate trespassing. Letters were issued to the following agencies:

- South Florida Regional Transit Authority (SFRTA);
- Virginia Railway Express (VRE);

- Rio Metro Regional Transit District (New Mexico Rail Runner);
- Utah Transit Authority (UTA); and,
- Illinois Suburban Railway in Chicago (METRA).

These systems have similar operating characteristics to SunRail. A summary of the findings from New Mexico Rail Runner and SFRTA are as follows:

New Mexico Rail Runner:

1. Trespasser Observations – The agency is working on a better system for train crews and Maintenance of Way personnel to report trespassers.

2. Successful Mitigations for Trespassers
    - Installation of multi-use trails (walking, bicycling, etc.) near the train tracks, including installation of fencing to block pedestrian access to the tracks.
    - Increased signage at highway-rail grade crossings.
    - Increased, targeted (pedestrian-sized) signage at multi-use crossings.
    - Collaboration with FRA, and local/city governments to inspect trespass areas and brainstorm ideas for approaching the issue.
    - Public Safety Announcements.
    - Outreach at elementary schools close to the train tracks (Operation Lifesaver).
    - Participation in annual Rail Safety Week events.
    - Summer library presentations for children with our mascot, Trax.
    - Approaching a high school's cross-country coach in person, to ask that he stop sending his team to practice their running next to the tracks.
    - Having safety materials available at most of our marketing outreach events.
    - Providing prosecution statutes/state laws to law enforcement officers during training events.
    - Quarterly joint operations meetings (with BNSF, Rail Runner, and Amtrak) to discuss areas of concern and possible solutions.
    - Walking trails have been effective.
    - Installed sturdy iron barriers/panels.
    - Natural barriers; use of cacti and other sharp plants.
    - At-grade solution: installed a pedestrian crossing from a housing area to a post office, restaurants, stores.
    - Asked law enforcement to park at stations and have a presence.

3. Unsuccessful Mitigations for Trespassers
    - Asking train crews and MOW personnel to report trespassers in our right-of-way by submitting a paper form at the end of their tour of duty.
    - Sending letters to area judges, to ask that they prosecute trespasser cases that arise in their courtrooms.

- Sending letters to area police departments, to request that they patrol and prosecute trespassers in their jurisdiction.
- Trying to video-record high-traffic/trespasser areas.
- Having train crew members become train safety outreach volunteers.

4. Public outreach
   - PSA's.
   - Persons at booths during health fairs (businesses and communities) to speak with people about train safety.
   - Distribution of materials, such as pamphlets, coloring books, and keychains with train safety messages on-board our trains.
   - Officer at the Tracks events (have volunteers and staff present at highway-rail grade crossings; police approach motorists stopped at the wrong side of the tracks with a verbal warning, and others handing out safety information and praising motorists who stop before the gates/tracks).
   - Annual invitations to all police, fire, and emergency management personnel to receive hands-on or classroom training about our equipment and territories.
   - Biennial Full-Scale Exercises with local emergency response agencies.
   - Invitations to Amtrak and BNSF to include their train equipment in our offer to provide training to emergency responders.
   - Participation in state-wide organizations dedicated to public safety (NM Emergency Management Association).
   - Speaking at conferences.
   - Participation of core group of emergency responders to plan future Full-Scale Exercises involving our trains.
   - Including train safety materials during any classroom training for educating non-railroad persons that will be working near the tracks.
   - Visiting schools that are near the tracks, and providing presentations.
   - Information on our website: https://www.riometro.org/345/Safety-Security;
   - Rail Safety Week campaign that includes interviews from a variety of our departments (operations, track, signal, dispatch, train crews), to relay the importance of safety to their profession, and how they work behind the scenes to keep the public safe: https://www.riometro.org/CivicAlerts.aspx?AID=153; Including safety messages and interviews with safety-sensitive employees in our quarterly magazine: https://issuu.com/mattgantner/docs/rr_exp_draft_5.

South Florida Regional Transportation Authority (SFRTA)

1. Engineering Controls and Mitigation Strategies

    - SFRTA has identified all high traffic areas of trespassing on the rail corridor.
    - A corridor fencing plan has been developed and is fencing (generally chain link) is being applied in applicable areas to channel trespassers towards crossings. SFRTA does not fence on both sides of the ROW. SFRTA has identified a security fence fabric (cut-resistant and non-scalable) to apply in areas where chain link is ineffective.
    - Additional FDOT "no trespass" signs have been installed along portions of the corridor where trespassing is most common.
    - SFRTA deploys directed Security patrols to areas of known trespassing.
    - SFRTA assisted Palm Beach County Sheriff's Dept. (Lake worth Beach Div.) in obtaining an FRA grant to provide LE patrols on the ROW within the City of Lake Worth Beach to enforce trespassing. This pilot project is expected to run for six months. Preliminary reports will be made available upon completion.
    - SFRTA has partnered with Palm Beach County 211 suicide prevention group. 211 suicide helpline signs have been posted at crossing throughout Palm Beach Co.

2. Public Outreach Initiatives
    - Operation Lifesaver (OL) presentations at schools near the SFRC Corridor.
    - OL and crossing safety presentations to County School District Transportation Department School bus drivers.
    - Train safety awareness week crossing blitzes.
    - Public safety awareness video messages on social media and in local movie theaters.
    - Distribution of passenger safety brochures and seat drops.

Proposed Engineering Design Mitigation Methods

Once the Hot Spot locations were identified, additional investigation was undertaken to evaluate potential solutions. Mitigation methods were validated and reviewed using field verification. Discussions were also held with the Trespassing Task Force to obtain their input. Each trespass counter-measure was analyzed based on feasibility. Finally, a conceptual design was prepared for each identified location in the Pilot Area.

System Safety Precedence

For each conceptual design a Safety Order of Precedence was used[16]. The standard System Safety Precedence in determining the hazard order between Low and High Risk is as follows:

1. Design for Minimum Hazard - From the beginning, design should eliminate hazards. If an identified hazard cannot be eliminated, reduce the associated risk to an acceptable level per Figure 19: Risk Assessment (Lowest Risk).
2. Incorporate Safety Devices/Features - If identified hazards cannot be eliminated or their associated risk adequately reduced through design selection, that risk must be reduced to an acceptable level, by incorporating protective safety design features or devices.
3. Provide Warning Devices - When design or safety devices cannot effectively eliminate identified hazards or adequately reduce associated risk, a device can be used to detect the condition and to produce a warning to alert trespassers of the hazard. Warning signals and their application should be designed to reduce the probability of an incorrect reaction to the signals from the train crews and maintenance.
4. Develop Procedures and Training - Where it is impractical to eliminate hazards through design selection or adequately reduce the associated risk with safety and warning devices, procedures and training should be used. No warning, caution, or other form of written advisory should be used as the only risk reduction method for high risk Incidents.

Design Concepts

For each Hot Spot, the following criteria was incorporated into the design of each mitigation strategy:

- Seeks to solve the root cause, not move the incident.
- Evaluates the root causes of trespassing to develop designs that resolve the issue.
- Provides low impact to nearby property owners.

[16] MIL-STD-882E "Standard Practice for System Safety" – Chapter 3 – 11 May 2012

- Has devices that are concealed, tamper and theft resistant.
- Provides communications or video integration with existing video monitoring systems (i.e. SunRail, FDOT, Mutualink) over secure network communications.

At each Hot Spot, the cost for each concept was estimated based upon on current available FDOT historical unit costs (when applicable) as well as assumed costs associated with maintenance of traffic, Roadway Worker In Charge protection, mobilization, and contingency. The conceptual designs for each Hot Spot have been prepared and are provided in Appendix A-2.

While a multitude of design solutions were studied, four general concepts were developed to accommodate the identified constraints and origin destination components for each of the four identified Hot Spots. The selected concepts are:

Channelization

In most situations, pedestrians will take the shortest distance route to their destination. When trespass consists of pedestrians using the corridor as a short-cut route, an assessment of the regional pedestrian system must be undertaken.

When no reasonable route between an origin and destination exists, a pedestrian pathway adjacent the corridor with a barrier and at-grade or grade-separated crossing should be considered. Pedestrian crossings designed with warning systems such as crossing gates, lights and bells similar to highway-rail grade crossings can be an optimal solution for both the trespassers and the railroad. In instances with high trespass occurrences, grade-separated crossings may be warranted.

The channelization considered for the CFRC consists of construction of a sidewalk parallel to the right-of-way with a barrier or fence between the sidewalk and tracks that lead the trespasser to a fully automatic pedestrian crossing (pedestrian gate, possible swing gate, flashing lights, and bells). This concept realizes the necessity of persons that need to travel to and from specific locations on either side of the tracks and would have a more extended trip if they took the nearby streets and arterial roadways.

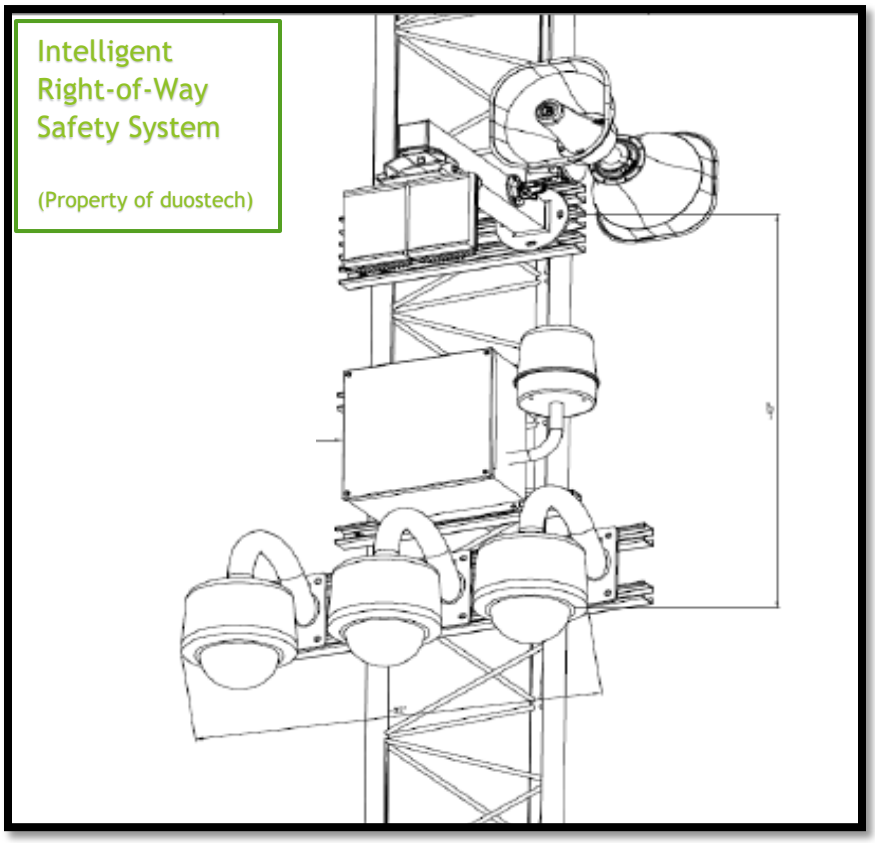
As part of the design analysis, local land use criteria was analyzed to determine buffer and setback requirements. Where appropriate, CFRC, abutting land owners, and local agencies are working together to enter into lease agreements for those properties that are in non-conformance with these criteria resulting in rail corridor encroachment or facilitating trespass.

Intelligent Right-of-Way Safety System

This system uses video and closed-circuit television (CCTV) monitoring and data gathering using artificial intelligence. It has accurate human detection and keeps a record of the number of Incidents. The system has a network-based distributive alert system that can be overlaid onto an existing supervisory system to the CFRC dispatchers or law enforcement network system such as Mutualink.[17] The system being considered by SunRail is provided by Duos Technologies Inc.

[17] Mutualink is a system that shares live video feed from SunRail cameras with law enforcement.

(duostech) and can be seen in detail in Appendix A-4. An example of the proposed system can be seen below:



Rail Lighting Warning System

Leveraging existing LED technologies, HNTB proposes for consideration, the concept of retrofitting the rail system with a supplemental lighting system that would provide an indication of oncoming train traffic. Proposed as a fixture to the physical rail system of the corridor, a lighting strip would be installed on the field side of the web of the rail and will traverse the entire length of the Hot Spot. The LEDs will change colors to alert the trespasser of an approaching train.

Integrated sequencing of light patterns, colors, and intensities are programmable and may be adjusted to suit a variety of site-specific needs. For example, using the standard traffic signal indicator as the model, a green light indication may be used to indicate clear to cross, yellow would indicate oncoming train traffic, and red would indicate impending train traffic. Timing, sequence, color indication, etc. are elements to the system that would require detailed configuration and accompanying policy adoption should this concept be taken further.

This concept is a repurposing of proven technology and techniques used to manage traffic and transportation and reconciles known shortcomings of previously tested strategies (e.g. fences being cut). As a passive non-vital supplemental system to CFRC's robust management and

control structure, this new concept comes with the new approach of providing limited permissions to anyone crossing on the railroad system.

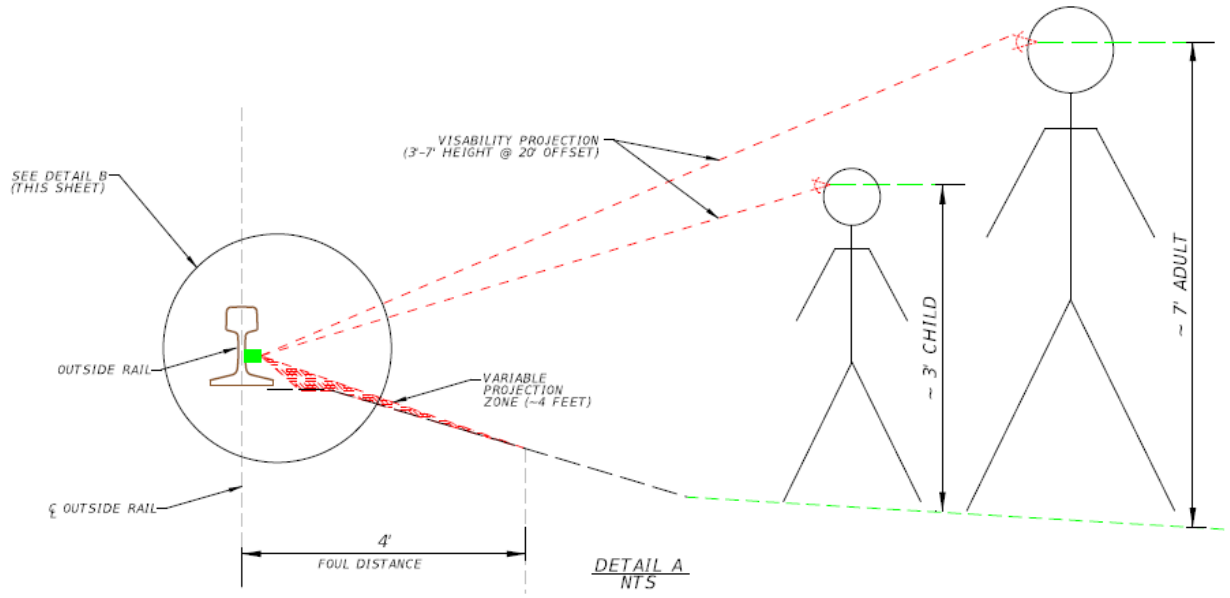


Figure 21: Rail Lighting Warning System

Physical Deterrent

The physical deterrents used in the concept plans include standard FDOT Type B 6' chain link fence and a more robust hardened fencing. The hardened fencing consists of anti-climbing and anti-cutting fence material and possible overhead lighting. It is restricted to remote areas, and where loitering and criminal activity may be occurring, and vandalism of standard fencing is occurring. The Tuf-Grid welded fence, by Merchants Metals, was used in this report for concept plan cost estimation and is described in Appendix A-1.

Potential Trespassing Prevention Methods

Trespassing and suicide prevention is a significant area of research around the world. Several mitigation methods have been implemented on other systems and have potential applications on the CFRC. The Trespassing Team researched these systems and are in Appendix A-3.

Revamped No Trespassing Signs

As highlighted in the last section, existing CFRC No Trespassing signs are simple black text on a white sign and are placed mainly at grade crossings with very few signs along the right-of-way. In the first Trespassing Task Force meeting, it was noted by law enforcement that if the signing is not obvious, trespassers can claim that they were not aware they were committing an illegal act. If SunRail were to commence enforcement of the trespassing statute, they would need signage that states the statute to convey the severity of trespassing. The sign to the right is used along the Florida East Coast Railroad in South Florida. The sign conveys its message in two languages and by using color and symbols, the sign is more noticeable. Below it references Florida State Statue 810.09 which pertains to trespass on property other than structure or conveyance. It explains that if the notice is clearly given by posting, trespass is a misdemeanor of the first degree. 775.083 states that this can be punishable with up to a $1000 fine.

04

CFRC Hot Spot Analysis, Proposed Engineering Controls, Design Concepts and Cost Estimates

Prairie Lake Cove Hot Spot

The Prairie Lake Cove Hot Spot is seen below in Figure 22. The map details the extent of the Hot Spot, and the adjacent land uses, local street network, historical trespassing Incidents, and where evidence of trespassing was discovered in the field. Information for each past incident can be found in Table 1.

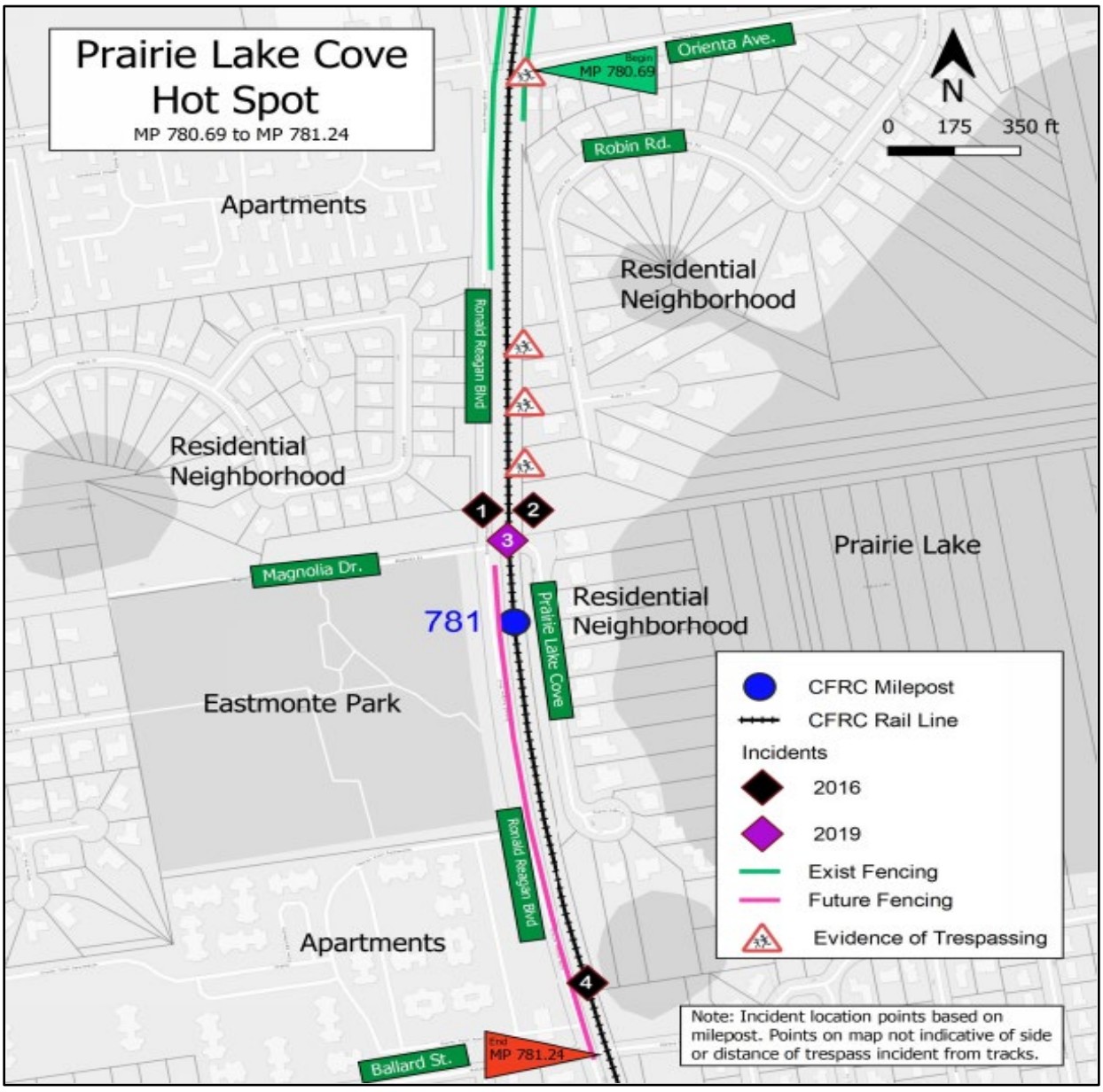


Figure 22: Prairie Lake Cove Hot Spot

Table 1: Historical Incidents in the Prairie Lake Cove Hot Spot

#	Date	Time	Category	Description	Gender	Race	Age
1	7/13/2016	20:30	Observe	Train Crew - Train reported man playing chicken	Male	White	Unknown
2	1/20/2016	11:57	Observe	Trespasser report of two people walking on ROW	Unknown	Black	Unknown
3	8/9/2019	23:01	Observe	Train Crew - Train reported man playing chicken	Male	Hispanic	Unknown
4	7/14/2016	11:15	Observe	Track Inspector - Man walking south on track	Male	White	25

Origin – Destination Analyses

The Prairie Lake Cove Hot Spot, located in Altamonte Springs, is directly north of the Prairie Lake Cove grade crossing and about 0.30 miles south of the SR 436 grade crossing. The location can be seen on a map in Figure 22. This section of the CFRC is directly bordered to the east by residential neighborhoods which have several vacant lots and to the west by Ronald Regan Boulevard. Land uses on the west side of Ronald Reagan Boulevard include residential areas, apartment complexes, and Eastmonte Park. Eastmonte Park is one of the City of Altamonte Springs's main centers for recreation boasting amenities such as baseball fields, basketball courts, tennis courts, and a playground. The combination of residential communities on one side of the tracks and recreation opportunities, on the other, create a strong origin and destination draw. The distance for a person to walk from the Robin Road neighborhood to the park legally is about 1.25 miles and require walking along the busy SR 436 arterial. Walking through the woods behind one of the three vacant lots on the east side of the tracks and crossing the CFRC illegally shortens this walk to 0.10 miles. Several defined paths were identified in this area and are shown in the pictures below. The northernmost subdivision outlets to Orienta Avenue, a local east-west roadway with a sidewalk which dead-ends into the rail corridor. This location is now fenced. However, the addition of fencing does not address the strong origin/destination issue.

Evidence of Trespassing and Hot Spot Photos

Photos were taken at multiple locations throughout the Hot Spot, which showcases evidence of trespassers on the corridor or other characteristics of interest. The sites where the photos were taken are shown in Figure 23 below. Each numbered camera icon correlates to a photo location showcased in the following pages.

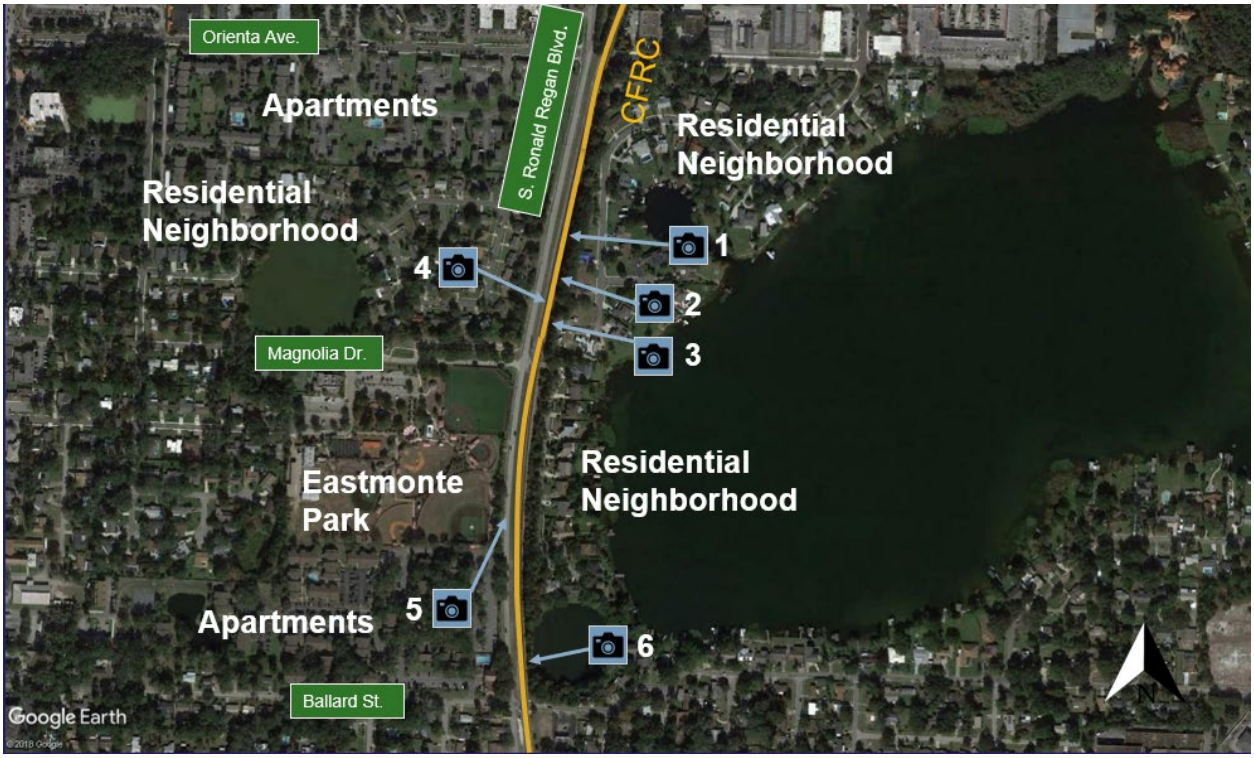
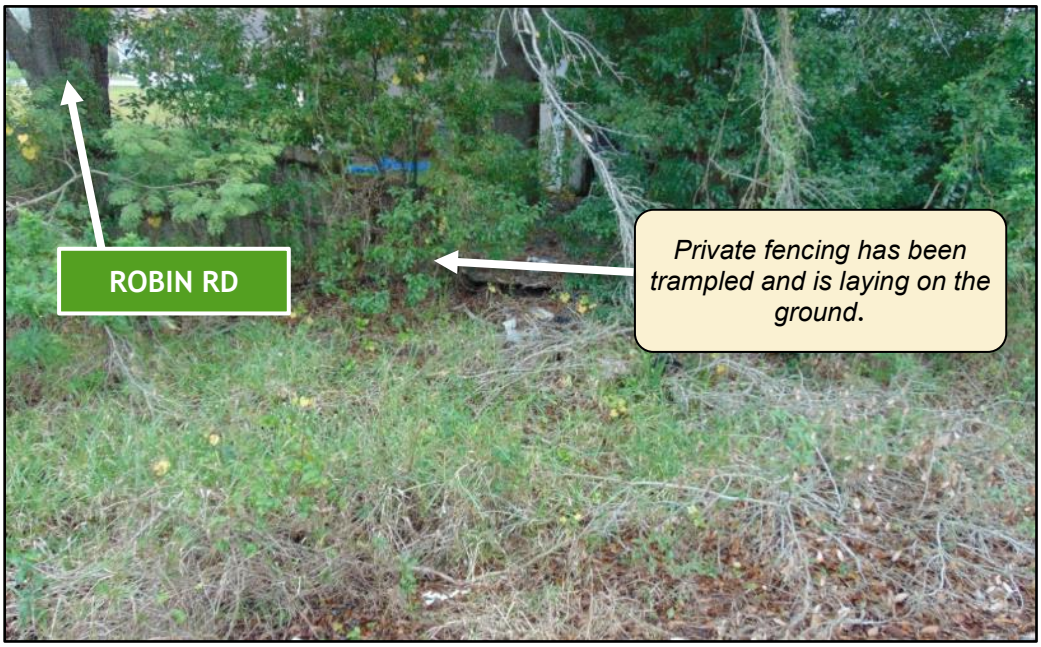


Figure 23: Location of Field Photos Taken at Prairie Lake Cove Hot Spot

Photo locations 1 – 3 show trampled and cut vegetation indicative of trespasser activity between the CFRC and three vacant lots in the residential neighborhoods along Robin Rd. Site 4 is directly opposite of these locations of the west side of the corridor. The photos at this location show the openness of the CFRC to S. Ronald Regan Blvd. and Eastmonte Park. On one field visit, a trespasser was observed and photographed walking from photo location 2 to photo location 4. SunRail has constructed fencing north of the area shown in these four photo locations on the east side of the tracks.

The Prairie Lake Springs subdivision to the south abuts the rail corridor; however, it is enclosed with a low brick wall with relatively dense vegetation between it and the rail (Photo location 5). It also has an at-grade crossing at its entrance where pedestrians can legally and safely cross the tracks to the park. Also shown in location 5 is the openness of the CFRC to S. Ronald Reagan Blvd. from Prairie Lake Cove to Ballard St. Delineators in this area are indicative of parking problems from overflow of Eastmonte Park. Photo location six is just north of Ballard St. and shows where there is significant evidence that trespassers have been walking along the east side of the corridor for a short distance to access a small lake for recreation. The six photo locations are shown on the following pages.

Photo Location #1



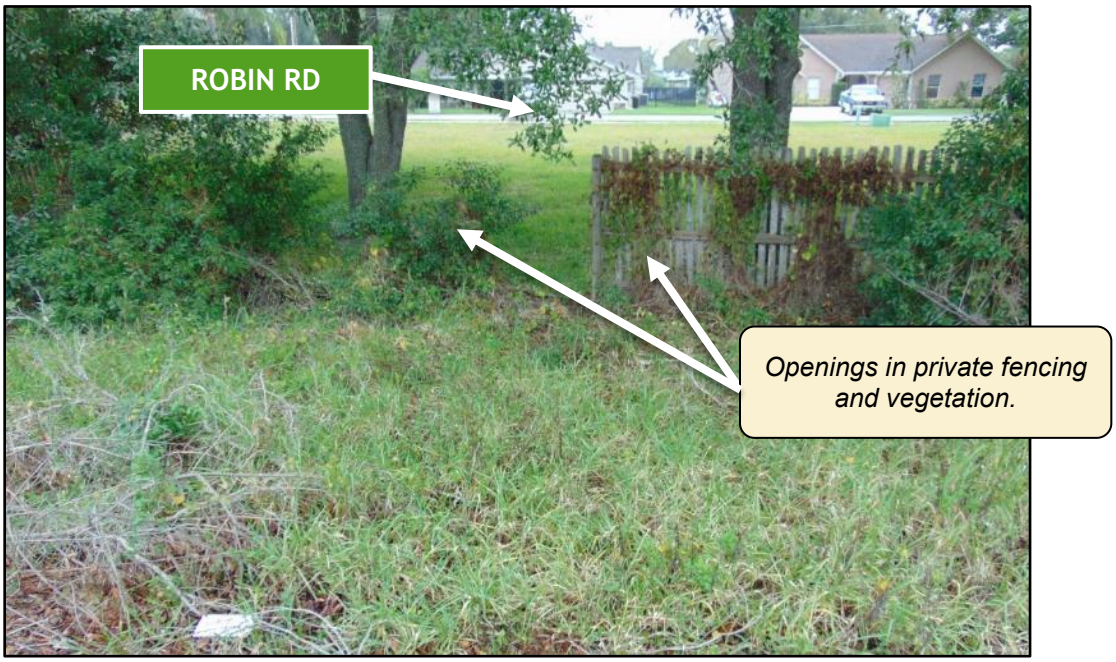


Photo Location #2

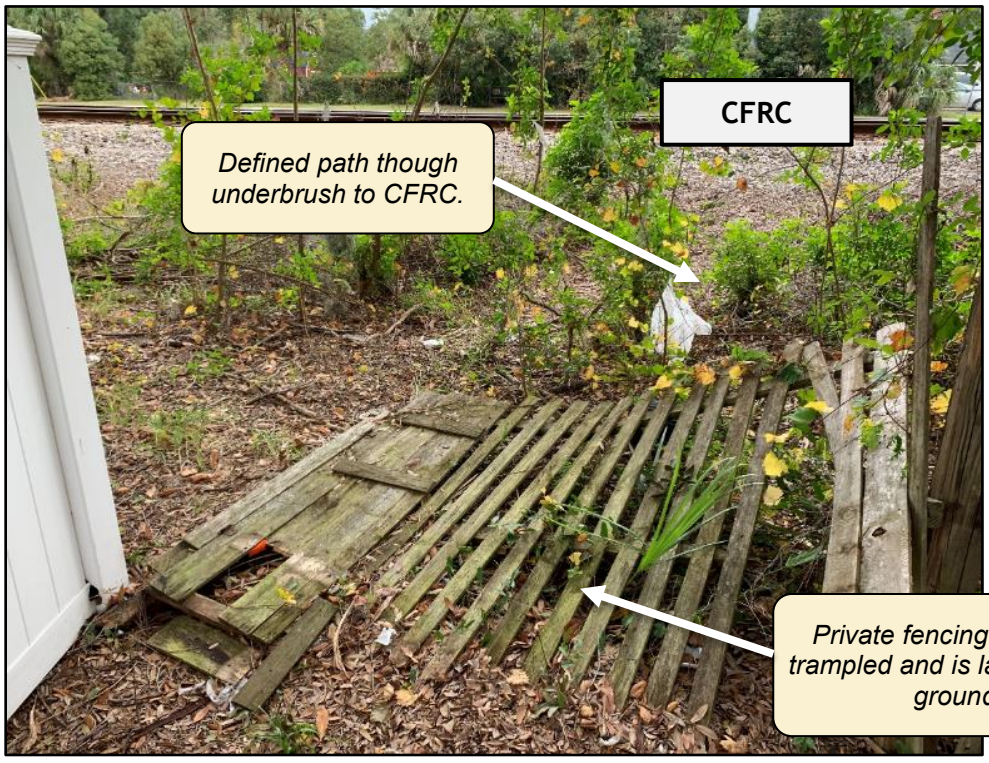


Photo Location #3

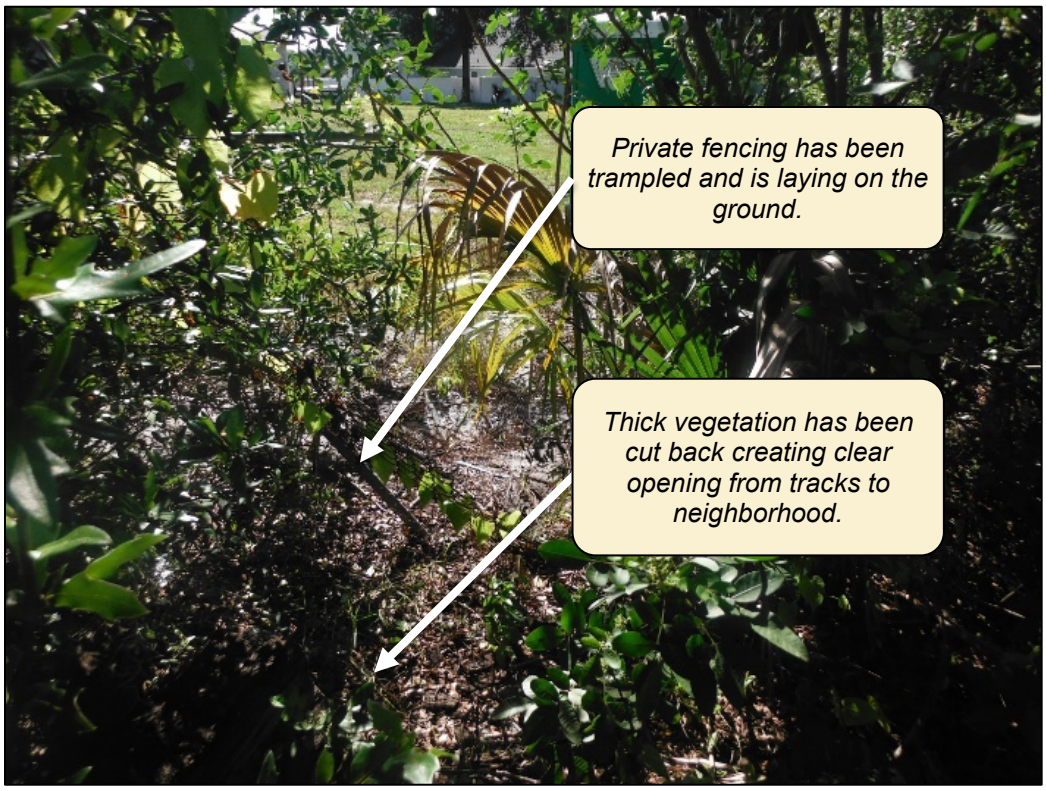


Photo Location #4

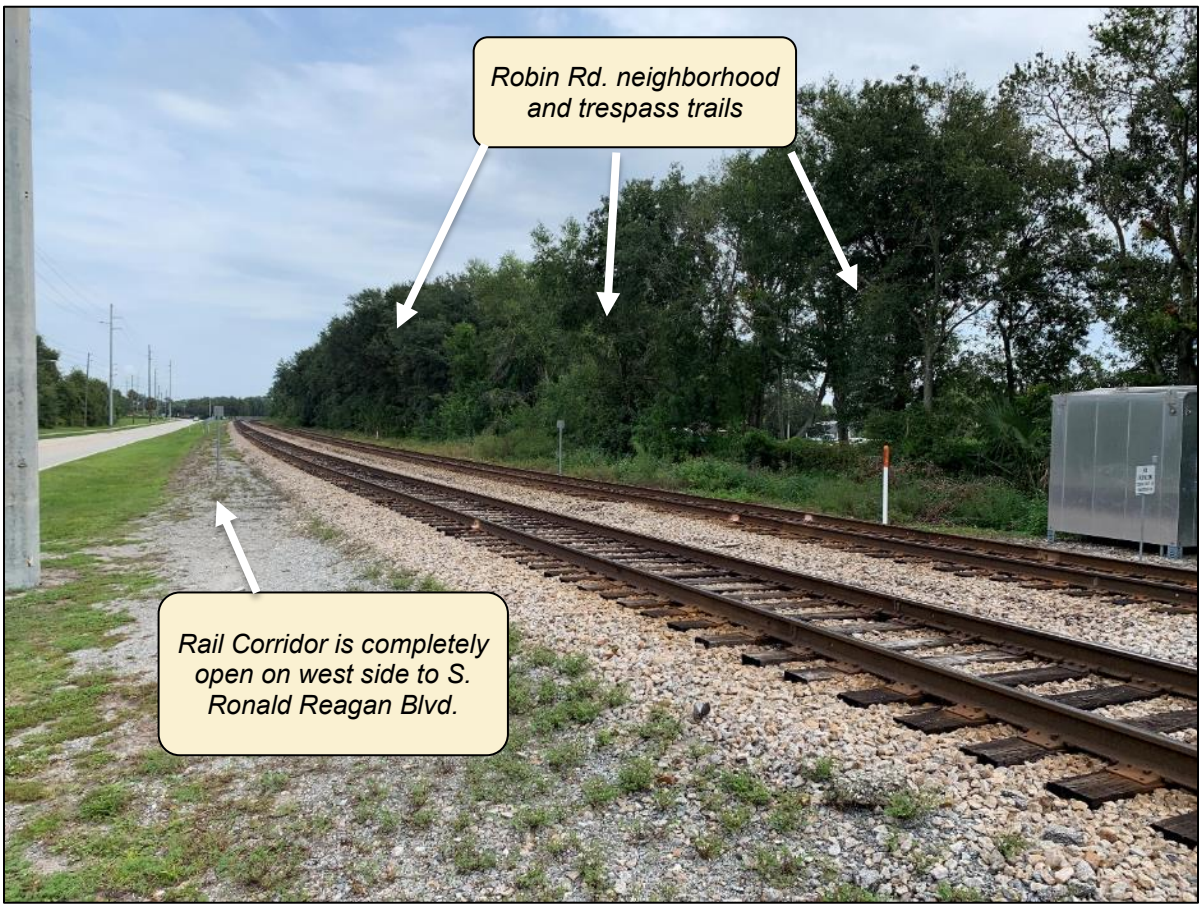


Photo Location #5

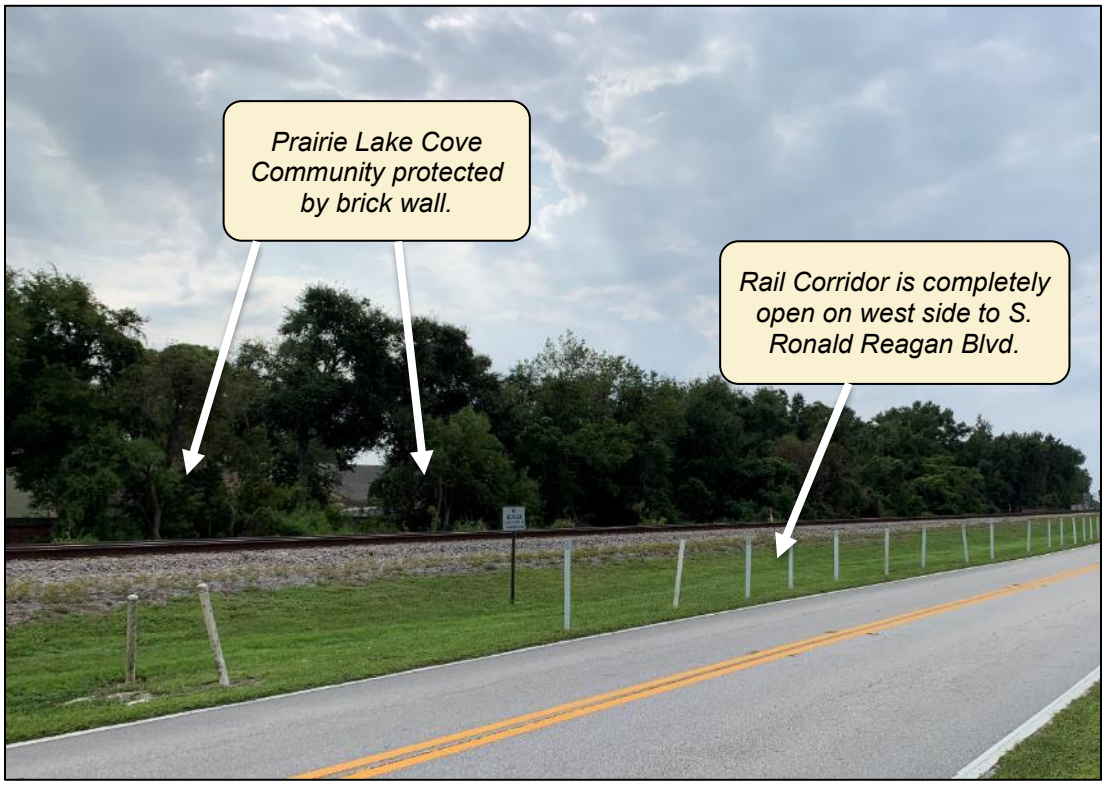
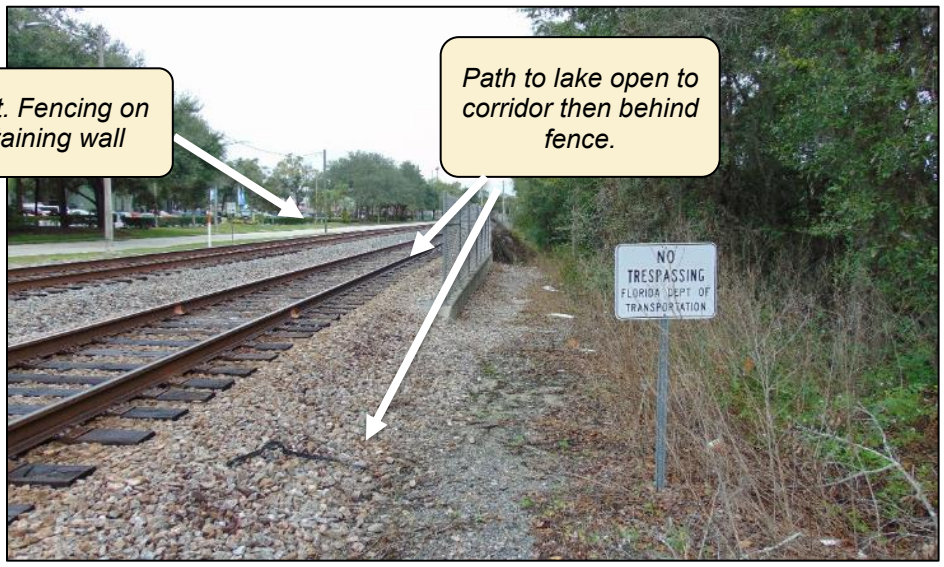


Photo Location #6



Prairie Lake Cove Mitigation Options and Cost Estimates

Channelization

As evidenced in the field reviews and data mining, trespassers are crossing the tracks between the Prairie Lake Cove crossing and the dead-end street called Orienta Avenue. The channelization provides a safe path for trespassers that guides them to the grade crossings at Prairie Lake Cove and Orienta Avenue. To guide them to either grade crossing, a sidewalk is proposed on the east side of the tracks with a 6' FDOT Type B chain link fence between the sidewalk and the tracks. The sidewalk and fence extend from Orienta Avenue to Prairie Lake Cove and provides channelization to guide pedestrians to the proposed crossing at Orienta Avenue and the existing grade crossing at Prairie Lake Cove.

Channelization				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Fencing, Type B, 5.1-6.0', Standard	1,904	LF	$24.09	$45,867.36
Miscellaneous Asphalt Pavement	4	TN	$160.76	$689.59
Detectable Warnings	156	SF	$28.70	$4,477.20
OMNI Crossing Panel	32	LF	$300.00	$9,600.00
Concrete Sidewalk and Driveways, 4"	880	SY	$38.50	$33,888.56
Clearing and Grubbing	0	AC	$16,135.80	$5,185.24
Regular Excavation	130	CY	$5.86	$759.52
Performance Turf, Sod	675	SY	$2.60	$1,755.29
Embankment	130	CY	$10.16	$1,316.85
Concrete Curb & Gutter, Type F	60	LF	$21.71	$1,302.60
Thermoplastic, Std, White, Solid, 12"	149	LF	$2.59	$385.91
Thermoplastic, Std, White, Solid, 24"	151	LF	$4.48	$676.48
Pedestrian Gate	3	EA	$50,000.00	$150,000.00
			Subtotal	$255,904.59
			Maintenance of Traffic (20%)	$51,180.92
			RR Flagman	$15,000.00
			Mobilization (20%)	$61,417.10
			Contingency (20%)	$76,700.52
			Total	**$460,203.14**

Intelligent Right-of-WaySafety System

The Hot Spot would be monitored from Orienta to Ballard Street 24 hours per day. The system will be activated when it detects a person or object and will send an alert to the CFRC Dispatchers who are located at the Operations Control Center. Law Enforcement will then be notified through Mutual Link or by telephone. The following events would be identified:

- Trespassers
- Intrusion onto right-of-way such as a vehicle stuck on the tracks

Camera monitoring along this section also counts all trespassers and can differentiate between authorized is provided as a concept for consideration to supplement the existing data set for trespassing events. The open characteristics abutting the residential neighborhoods and recreational facilities enables trespass behavior to go unnoticed. Supplemental camera monitoring systems are proposed to enhance data collection and notify local law enforcement as specific strategies to mitigate local trespass behavior.

Intelligent Right-of-Way Safety System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
ITS CCTV Camera, F&I, Dome Encl-Np	8	EA	$5,572.12	$44,576.96
Pull & Splice Box, F&I, 13" x 24" (Electrical)	9	EA	$774.28	$6,968.52
Pull & Splice Box, F&I, 24" x 36" (Fiber Cable - Includes Slack)	9	EA	$1,290.91	$11,618.19
ITS Cabinet - F&I, Base, 334	9	EA	$7,811.93	$70,307.37
Wireless Communication Device, F&I, ETHE	8	EA	$4,500.00	$36,000.00
Conduit, F&I, Directional Bore	2,900	LF	$19.16	$55,564.00
			Subtotal	$225,035.04
			Maintenance of Traffic (20%)	$45,007.01
			RR Flagman	$15,000.00
			Mobilization (20%)	$54,008.41
			Contingency (20%)	$67,810.09
			Total	**$406,860.55**

Physical Deterrent

A 6’ FDOT Type B chain link fence is also an option between Prairie Lake Cove and Orienta Avenue on the east side of the tracks. Hardened fencing was not considered because of natural surveillance that occurs in the area.

Physical Deterrent Fence				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Fencing, Type B, 5.1-6.0', Standard	1,904	LF	$24.09	$45,867.36
Clearing and Grubbing	0	AC	$16,135.80	$3,526.47
			Subtotal	$49,393.83
			Maintenance of Traffic (20%)	$9,878.77
			RR Flagman	$10,000.00
			Mobilization (20%)	$11,854.52
			Contingency (20%)	$16,225.42
			Total	**$97,352.53**

Rail Lighting Warning System

Rail Lighting Warning System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Track Lighting*	2,732	LF	$50.00	$136,600.00
ITS Cabinet - F&I, Base, 334	1	EA	$7,811.93	$7,811.93
Managed Field Ethernet Switch, F&I	1	EA	$4,326.27	$4,326.27
Controller	1	EA	$8,000.00	$8,000.00
			Subtotal	$156,738.20
			Maintenance of Traffic (20%)	$31,347.64
			RR Flagman	$15,000.00
			Mobilization (20%)	$37,617.17
			Contingency (20%)	$48,140.60
			Total	**$288,843.61**
*Estimated cost. No historical cost available.				

Porsche and Oak Hot Spots

The Porsche and Oak Hot Spots are seen below in Figure 24. In the map, you will see the extent of each Hot Spot, the adjacent land uses, local street network, historical trespassing Incidents, and where evidence of trespassing was discovered in the field. Information for each past incident can be found in Table 2.

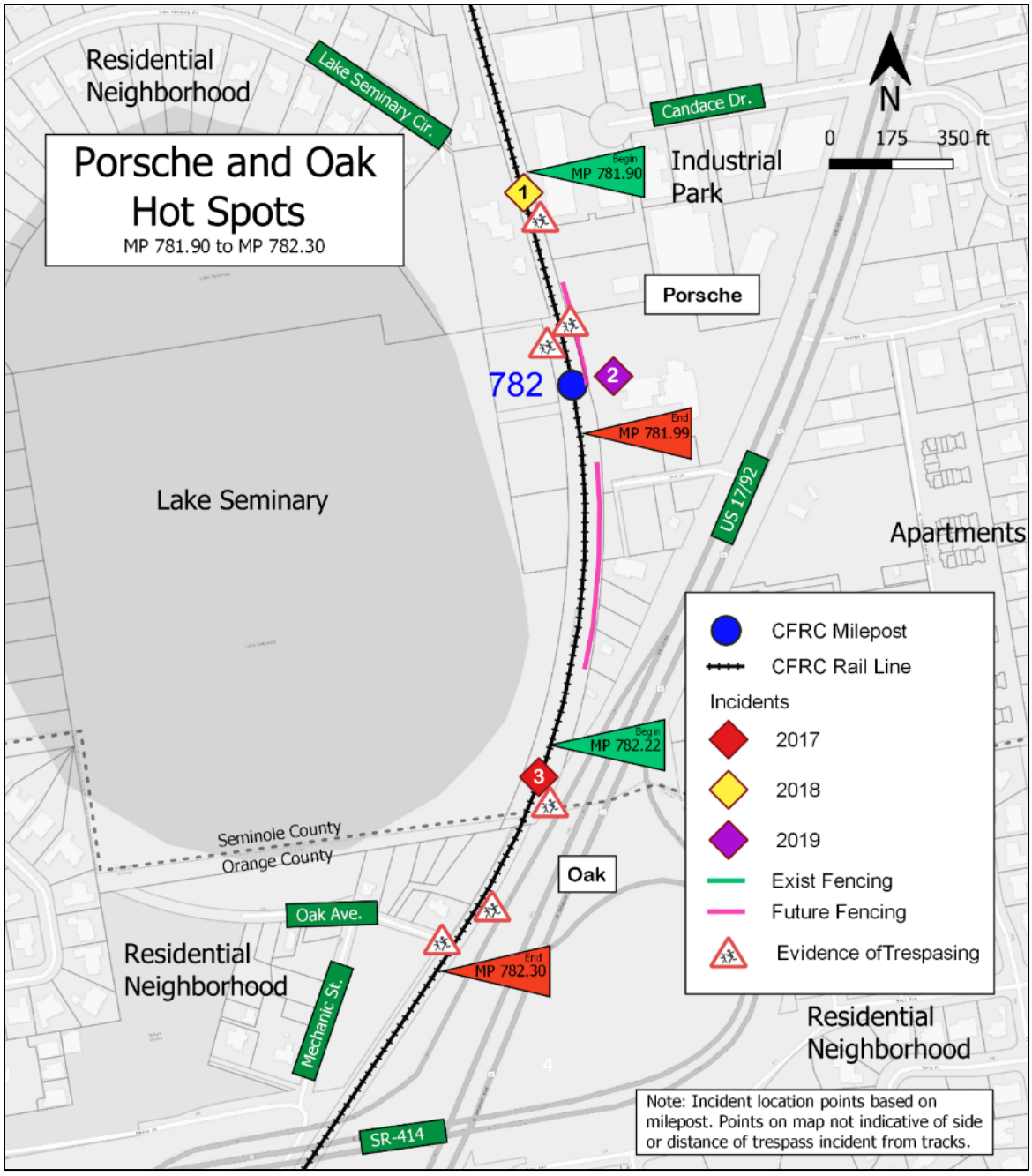


Figure 24: Porsche and Oak Hot Spots

Table 2: Historical Incidents in the Porsche and Oak Hot Spots

#	Date	Time	Category	Description	Gender	Race	Age
1	3/30/2018	10:00	Observe	Train close call with Individual	Unknown	Unknown	Unknown
2	2/19/2019	10:28	Observe	Report of possible trespasser near scrap rail pile. Person not found.	Unknown	Unknown	Unknown
3	9/18/2017	16:39	Observe	Train Crew - Woman walking south along tracks	Female	Unknown	Unknown

Porsche Hot Spot

Origin – Destination Analyses

The Porsche Hot Spot, located in Maitland, FL, is about 0.45 miles north of the SR 414 overpass. The location can be seen on a map in Figure 24. This section of the CFRC is directly bordered to the east by the Porsche Orlando car dealership and an industrial park. To the west are residential neighborhoods and a heavily wooded area along the shores of Lake Seminary. Similar to the Prairie Lake Cove Hot Spot, this area has a small residential community with a dead-end road. There is no reasonable pedestrian access to destinations on the west side of the corridor. For a person to walk from the neighborhood to the businesses along N. Orlando Ave. legally, it is just over two miles. Walking through the woods along Lake Seminary and across the corridor illegally shortens this walk to only 0.25 miles. There is significant evidence in the heavily wooded area between the CFRC and Lake Seminary of loitering and homeless activity. The wooded area is characterized by many small paths and openings in the vegetation. In these areas, left items such as chairs, backpacks, and trash were found scattered throughout the underbrush. In the first Trespassing task force meeting, local authorities confirmed the observations stating that there was high homeless activity in the area. The remote nature of these trespass locations and absence of a reasonable alternate route informs the mitigation measures. to deter vandalism.

Evidence of Trespassing and Hot Spot Photos

Photos were taken at multiple locations throughout the Hot Spot and showcase evidence of trespassers on the corridor or other characteristics of interest. The sites where the images were taken are shown in Figure 25 below. Each numbered camera icon correlates to a photo location showcased in the following pages.

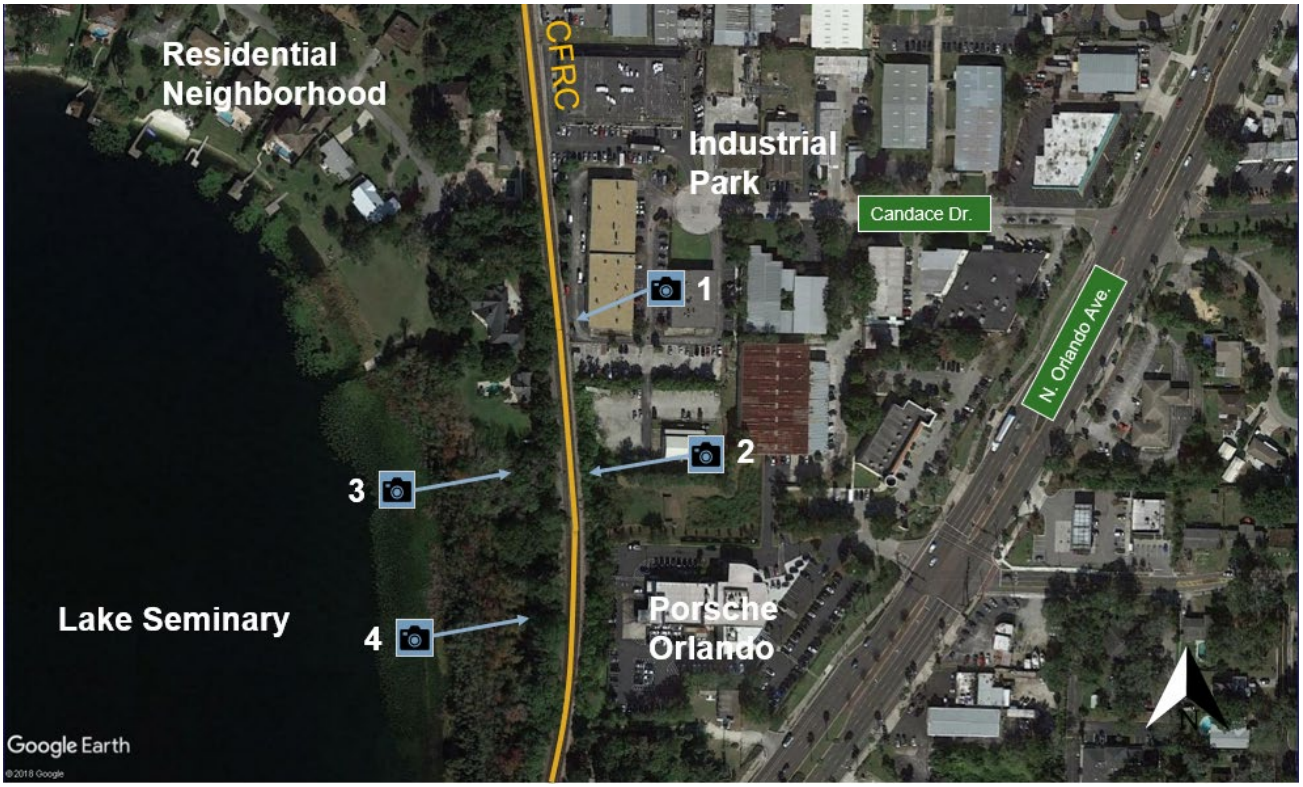


Figure 25: Location of Field Photos Taken at Porsche Hot Spot

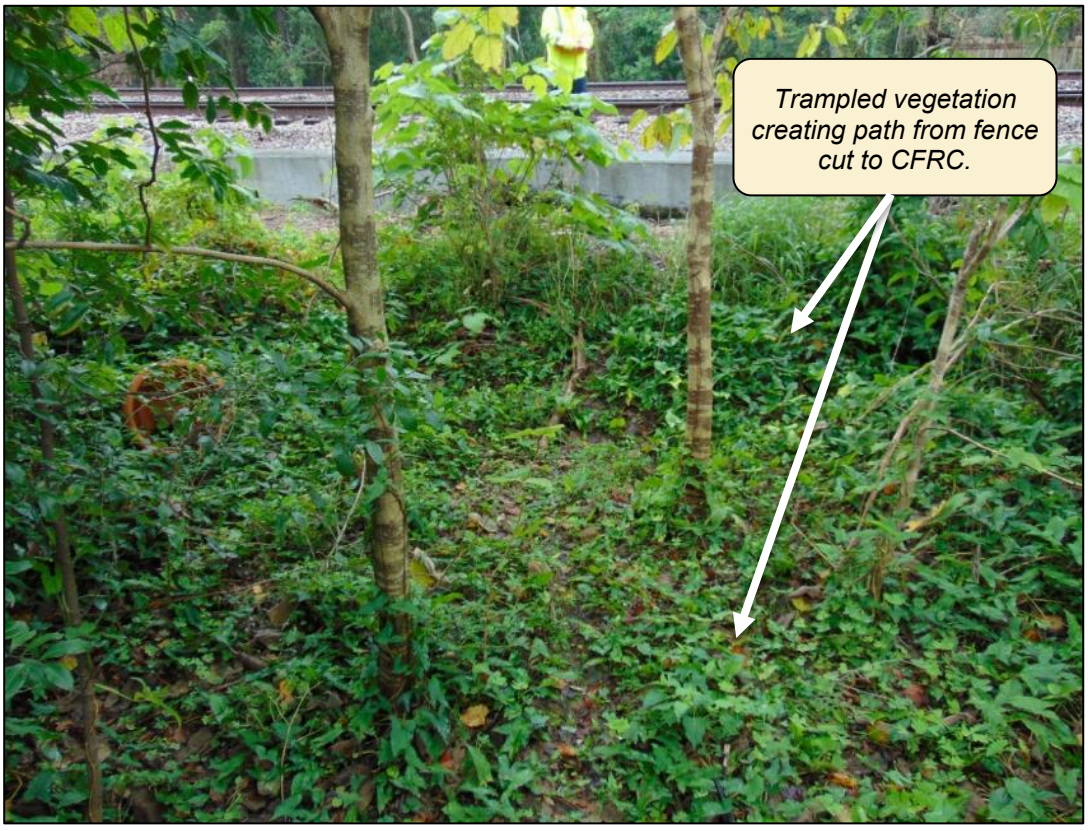
On the north end of this Hot Spot (Photo Location 1), the industrial properties located on Candace Drive are not fenced providing easy access to the rail corridor.

Additionally, several of these industrial properties have materials, dumpsters and vehicle use areas that appear to encroach on the rail right-of-way.

Further south in Photo Location 2, a cut in the fence was discovered directly behind the Porsche Orlando car dealership. The fence cut is located at the northwest corner of the Porsche retention pond and defined paths can be seen leading from the fence cut to the CFRC. Directly across from the cut in location 2, Photo Location 3 shows openings into the woods from the CFRC and into the residential community on Lake Seminary Cir. Throughout this wooded area, there are scattered trash and miscellaneous objects. Photo Location 4 showcases this with scattered bottles, chairs, and an abandoned backpack. The four photo locations are shown on the following pages.

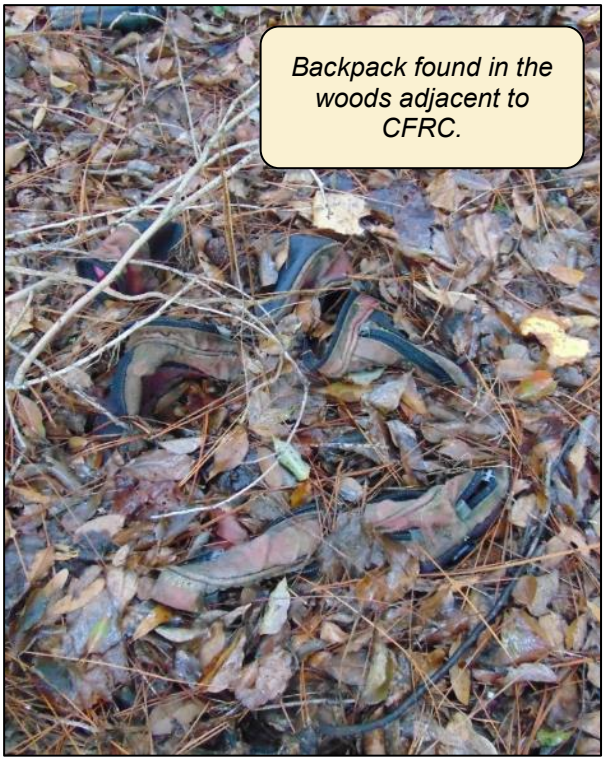
Porsche Photo Location #1

Porsche Photo Location #2



Porsche Photo Location #3

Porsche Photo Location #4



Backpack found in the woods adjacent to CFRC.

Several chairs found in vicinity indicative of loitering and homeless encampments.

Bottles scattered throughout the woods between CFRC and Lake Seminary.

Porsche Mitigation Options and Cost Estimates

Channelization

Since the CFRC and adjacent property interface is remote and subject to vandalism (cutting fencing), any proposed barriers need to be sufficiently robust to deter breaching. While it is not known for certain, it is hypothesized that many of the trespassers have a destination/origin in the residential subdivision and industrial properties. At the Task Force meeting on December 11, 2019, Law Enforcement informed the group that homeless encampments and loitering is occurring in the brush and trees west of the tracks.

Although not recommended, an at-grade crossing with supplemental channelization was considered to guide trespassers to the proposed crossing shown between the industrial facilities and the residential community. The concept proposes fencing throughout the section to ensure channelization to a controlled crossing. Candace Drive is the nearest public access right-of-way east of the CFRC within the Pilot Area. Lake Seminary Circle is the nearest public access right-of-way west of the CFRC within the Pilot Area. Although a direct path between both public corridors is not available, the proposed crossing is the shortest distance and requires the least amount of easement or right-of-way procurement.

Channelization				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Tuf-Grid Hardened Fence, 6' W/ 2' Top, F&I*	1,100	LF	$75.41	$82,950.00
Miscellaneous Asphalt Pavement	2	TN	$160.76	$252.53
Detectable Warnings	44	SF	$28.70	$1,262.80
OMNI Crossing Panel	16	LF	$300.00	$4,800.00
Concrete Sidewalk and Driveways, 4"	671	SY	$38.50	$25,816.39
Clearing and Grubbing	0.29	AC	$16,135.80	$4,692.94
Regular Excavation	93	CY	$5.86	$545.79
Performance Turf, Sod	447	SY	$2.60	$1,162.49
Embankment	93	CY	$10.16	$946.29
Gravity Wall - Traffic Loading	67	CY	$623.01	$41,467.55
Gravity Wall - Non-traffic Loading	24	CY	$623.01	$14,802.72
Pipe Guiderail (Aluminum)	316	LF	$40.13	$12,681.08
Pedestrian Gate	2	EA	$50,000.00	$100,000.00
			Subtotal	$291,380.57
			Maintenance of Traffic (20%)	$58,276.11
			RR Flagman	$15,000.00
			Mobilization (20%)	$69,931.34
			Contingency (20%)	$86,917.60
			Total	**$521,505.63**
*Estimated cost. No historical cost available.				

Intelligent Right-of-Way Safety System

The system will be activated when it detects a person or object and will send an alert to the CFRC Dispatchers who are located at the Operations Control Center. This alert will then be sent to Law Enforcement by Mutual Link or by telephone.

Camera monitoring along this section is provided as a concept for consideration to supplement the existing data set for trespassing events and to curtail the homeless considerations. The concealed nature of this area enables trespass behavior to go unnoticed. Supplemental camera monitoring systems are proposed to enhance data collection and notify local law enforcement as specific strategies to mitigate local trespass behavior.

Intelligent Right-of-Way Safety System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Conduit, F&I, Directional Bore	846	LF	$19.16	$16,209.36
Concrete CCTV Pole, Fur & Ins W/ Low	4	EA	$20,854.03	$83,416.12
ITS CCTV Camera, F&I, Dome Encl-Np	5	EA	$5,572.12	$27,860.60
Pull & Splice Box, F&I, 13" x 24" (Electrical)	7	EA	$774.28	$5,419.96
Pull & Splice Box, F&I, 24" x 36" (Fiber Cable - Includes Slack)	7	EA	$1,290.91	$9,036.37
ITS Cabinet - F&I, Base, 334	5	EA	$7,811.93	$39,059.65
Wireless Communication Device, F&I, ETHE	5	EA	$4,500.00	$22,500.00
			Subtotal	$203,502.06
			Maintenance of Traffic (20%)	$40,700.41
			RR Flagman	$15,000.00
			Mobilization (20%)	$48,840.49
			Contingency (20%)	$61,608.59
			Total	**$369,651.56**

Physical Deterrent

Hardened Fencing is also an option on both the east and west side of the tracks. Since the rail/property interface is remote and therefore subject to vandalism (cutting fencing), any proposed barriers need to be sufficiently robust to deter breaching. Right-of-way constraints in this area do not provide for the 18’ minimum offset per CFRC agreements on the east side of the corridor. Fencing cannot be provided in these circumstances but can be installed on the west side. While it is not known for certain, it is hypothesized that many of the trespassers have a destination/origin from the industrial properties to the lake. The lake properties are privately owned and therefore, the use of the lake by employees working in the industrial park or homeless populations is considered trespassing.

Physical Deterrent Fence				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Tuf-Grid Hardened Fence, 6' W/ 2' Top, F&I*	1,100	LF	$75.41	$82,950.00
Clearing and Grubbing	0.13	AC	$16,135.80	$2,037.35
			Subtotal	$84,987.35
			Maintenance of Traffic (20%)	$16,997.47
			RR Flagman	$10,000.00
			Mobilization (20%)	$20,396.96
			Contingency (20%)	$26,476.36
			Total	**$158,858.14**
*Estimated cost. No historical cost available.				

Rail Lighting Warning System

Rail Lighting Warning System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Track Lighting*	2,000	#N/A	#N/A	$100,000.00
ITS Cabinet - F&I, Base, 334	1.00	EA	$7,811.93	$7,811.93
Managed Field Ethernet Switch, F&I	1	EA	$4,326.27	$4,326.27
Controller	1.00	EA	$8,000.00	$8,000.00
			Subtotal	$120,138.20
			Maintenance of Traffic (20%)	$24,027.64
			RR Flagman	$15,000.00
			Mobilization (20%)	$28,833.17
			Contingency (20%)	$37,599.80
			Total	**$225,598.81**
*Estimated cost. No historical cost available.				

Oak Hot Spot

Origin – Destination Analyses

The Oak Hot Spot, located in Maitland, FL, is about 0.15 miles north of the SR 414 overpass. The location can be seen on a map in Figure 24. This section of the CFRC is directly bordered to the east by the on-ramp from southbound Orlando Avenue (US 17/92) to westbound Maitland Blvd. (SR 414) and to the west by residential neighborhoods along Oak Ave. This area is similar to the others in that it has a residential neighborhood on one side of the tracks and more convenient access by way of the CFRC to destinations on the east side of Orlando Avenue. While trespassing in this area only saves 0.40 miles of walking, pedestrians can cross the corridor at grade instead of at the overpass where they would have to ascend and descend stairs. Similar to the Porsche

location, the remote nature and absence of a reasonable alternative route informs the mitigation solution.

Evidence of Trespassing and Hot Spot Photos

Photos were taken at multiple locations throughout the Hot Spot and showcase evidence of trespassers on the corridor or other characteristics of interest. The sites that the photos were taken are shown in Figure 26 below. Each numbered camera icon correlates to a photo location showcased in the following pages.

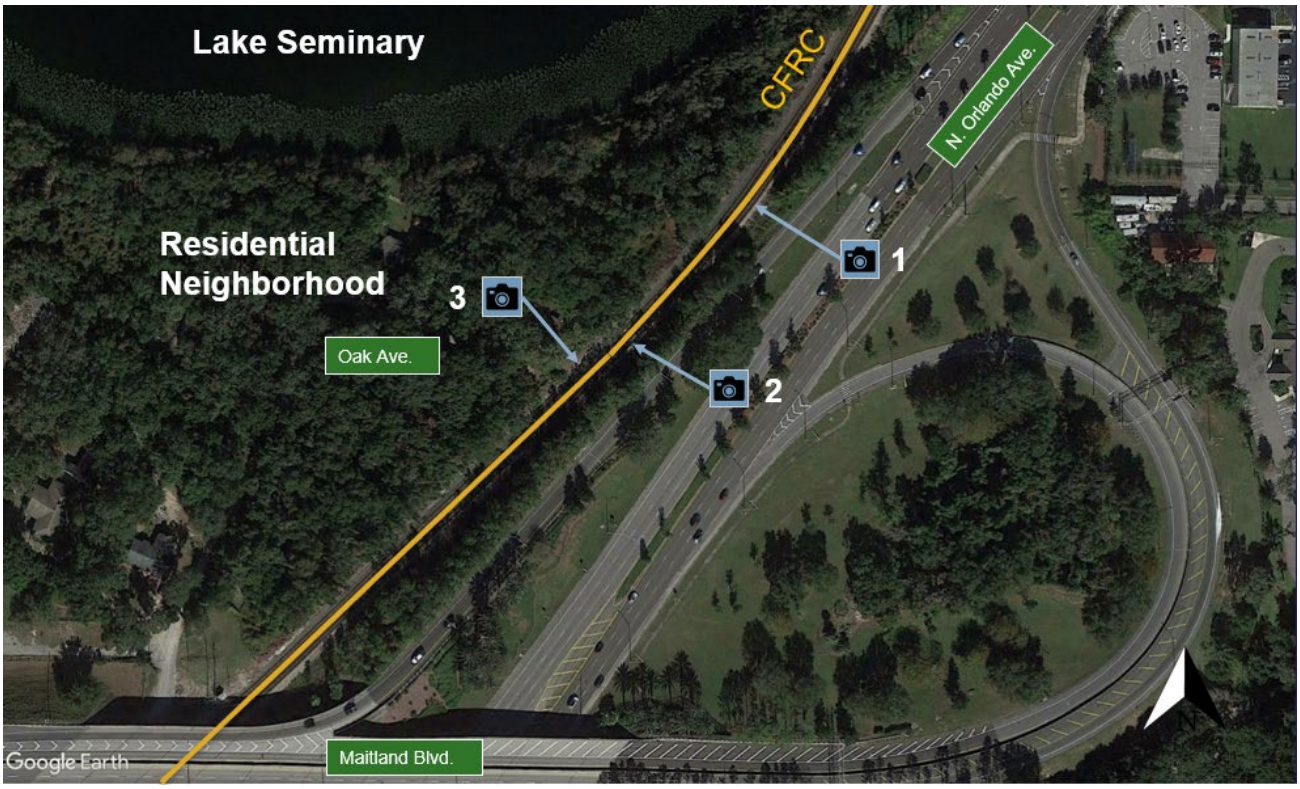
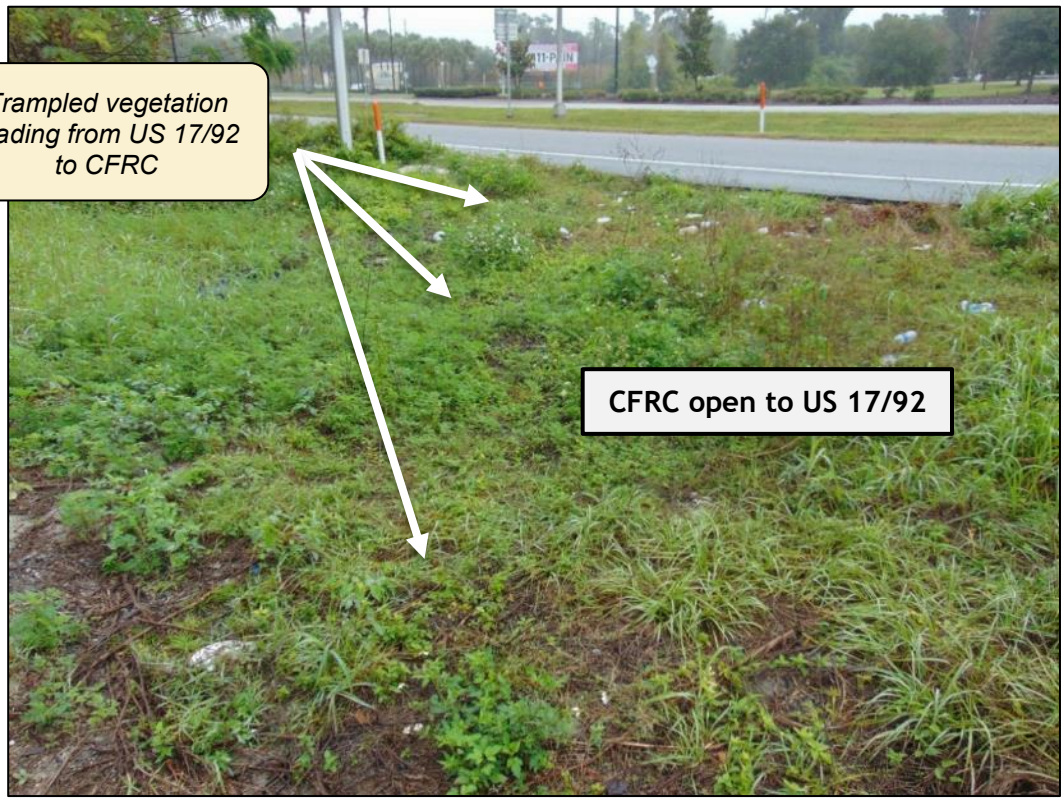


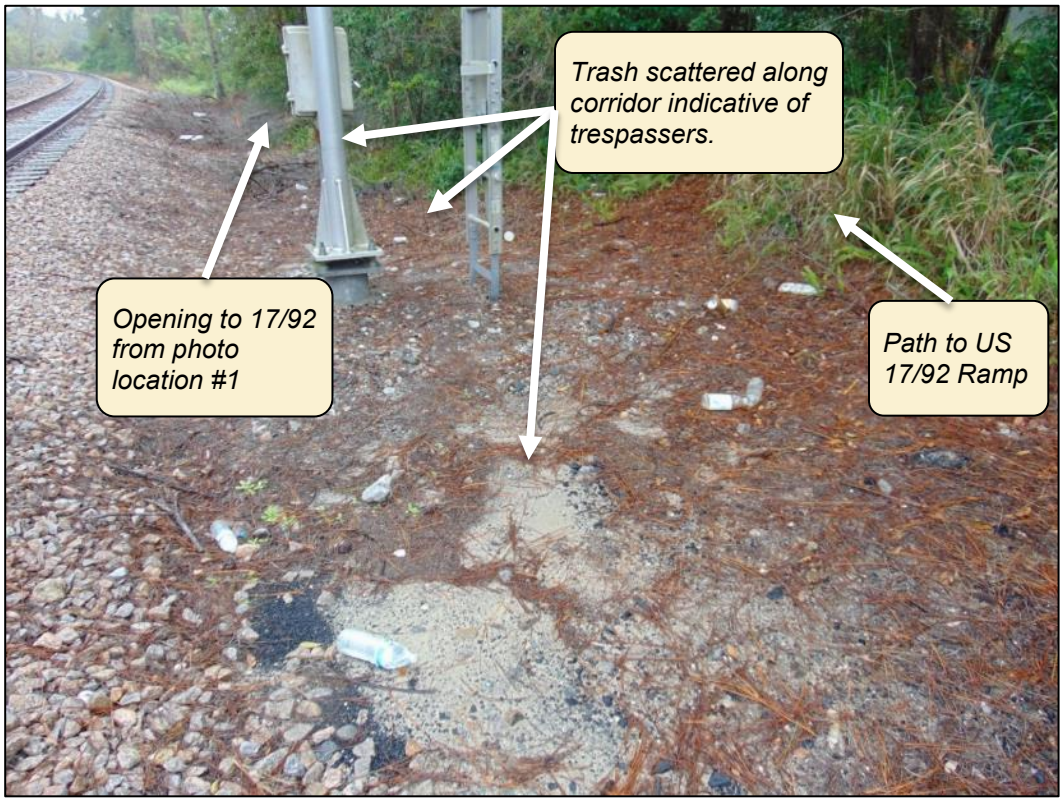
Figure 26: Location of Field Photos Taken at Oak Hot Spot

At the north end of this Hot Spot, Photo Location 1, the corridor is entirely open to the Maitland Blvd. (SR-414) on-ramp. There is evidence of trampled vegetation through this area, leading from destinations north along Orlando Ave. to the CFRC southbound. This reinforces the hypothesis of trespassers cutting from communities north along Orlando Ave. and those west on Maitland Blvd. Just south of this open area, there is lots of trash littered along the corridor. Photo Location 2 shows a path through the woods from the Maitland Blvd. on-ramp to the corridor by a signal. This trail is most likely used by SunRail signal maintainers but is also hypothesized to be a popular trespasser route due to trash in the area and a trail directly opposite of the corridor leading to Oak Ave. Photo location 3 shows the trampled vegetation creating a trail from the CFRC to Oak Ave. The three photo locations are shown on the following pages.

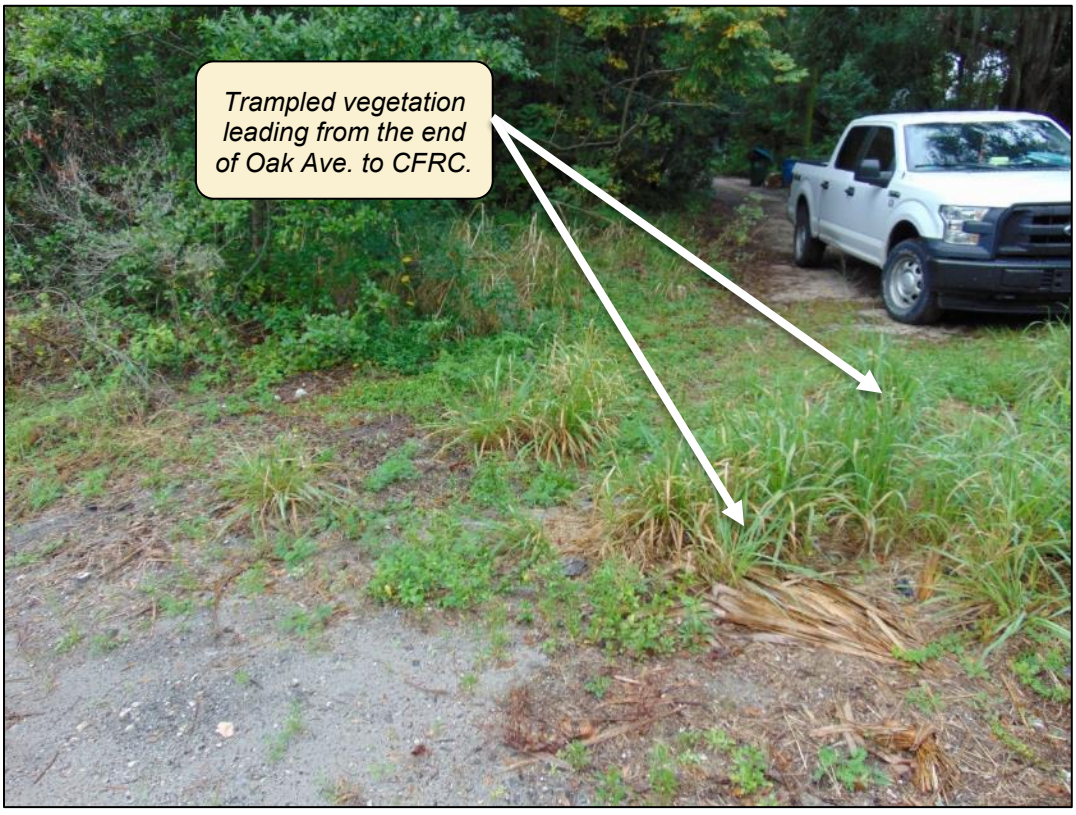
Oak Photo Location #1



Oak Photo Location #2



Oak Photo Location #3



Oak Mitigation Options and Cost Estimates

Given the remote nature of this trespass site and the lack of a reasonable alternative pedestrian route, video surveillance and a channelized pedestrian crossing could be provided along with a pedestrian trail located within the rail corridor. This would solve the hypothesized 'shortest route' root cause for the trespass in this area. The sidewalk on the west side of Orlando Avenue, which stops short of Maitland Blvd., would need to be extended south to connect with the proposed pedestrian crossing.

Channelization

Although not recommended, an at-grade crossing with supplemental channelization was considered to guide trespassers to a proposed pedestrian crossing. This proposed crossing is the most efficient route connection between existing sidewalk and the observed trespassing trails thus requiring the least amount of easement or right-of-way procurement. Existing sidewalk terminates approximately 1200 feet north of the hotspot area. Spartan Drive, 700 feet north of the sidewalk termini, is the nearest existing pedestrian crossing to the east side of Orlando Avenue. Channelization to the proposed crossing aims to safely guide pedestrians onto a proposed trail within the CFRC right-of-way. The trail then connects the hotspot to the proposed crossing and finally onto the existing sidewalk system. The concept proposes fencing throughout the section to ensure channelization to a controlled crossing. It is also recommended that the local agency complete the pedestrian connection along Orlando Avenue from the terminated sidewalk to Maitland Blvd.

Channelization				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Tuf-Grid Hardened Fence, 6' W/ 2' Top, F&I*	2,862	LF	$75.41	$215,820.82
Miscellaneous Asphalt Pavement	3	TN	$160.76	$456.49
Detectable Warnings	40	SF	$28.70	$1,148.00
OMNI Crossing Panel	16	LF	$300.00	$4,800.00
Concrete Sidewalk and Driveways, 4"	1,348	SY	$38.50	$51,893.72
Clearing and Grubbing	0.68	AC	$16,135.80	$11,013.17
Regular Excavation	158	CY	$5.86	$926.26
Performance Turf, Sod	549	SY	$2.60	$1,427.11
Embankment	158	CY	$10.16	$1,605.94
Pedestrian Gate	2	EA	$50,000.00	$100,000.00
			Subtotal	$389,091.50
			Maintenance of Traffic (20%)	$77,818.30
			RR Flagman	$15,000.00
			Mobilization (20%)	$93,381.96
			Contingency (20%)	$115,058.35
			Total	**$690,350.12**
*Estimated cost. No historical cost available.				

Intelligent Right-of-Way Safety System

Camera monitoring along this section is provided as a concept for consideration to detect trespassing events and to take appropriate action. The concealed nature of this area enables trespass behavior and is difficult to observe with any other means than that of automated monitoring. Supplemental camera monitoring systems are proposed to enhance data collection and notify local law enforcement as specific strategies to mitigate local trespass behavior.

Intelligent Right-of-Way Safety System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Conduit, F&I, Directional Bore	668	LF	$19.16	$12,798.88
Concrete CCTV Pole, Fur & Ins W/ Low	4	EA	$20,854.03	$83,416.12
ITS CCTV Camera, F&I, Dome Encl-Np	4	EA	$5,572.12	$22,288.48
Pull & Splice Box, F&I, 13" x 24" (Electrical)	6	EA	$774.28	$4,645.68
Pull & Splice Box, F&I, 24" x 36" (Fiber Cable - Includes Slack)	6	EA	$1,290.91	$7,745.46
ITS Cabinet - F&I, Base, 334	5	EA	$7,811.93	$39,059.65
Wireless Communication Device, F&I, ETHE	4	EA	$4,500.00	$18,000.00
			Subtotal	$187,954.27
			Maintenance of Traffic (20%)	$37,590.85
			RR Flagman	$15,000.00
			Mobilization (20%)	$45,109.02
			Contingency (20%)	$57,130.83
			Total	**$342,784.98**

Physical Deterrent

Hardened Fencing is also an option on both the east and west side of the tracks. Since the rail/property interface is remote and therefore subject to vandalism (cutting fencing), any proposed barriers need to be sufficiently robust to deter breaching.

Physical Deterrent Fence				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Tuf-Grid Hardened Fence, 6' W/ 2' Top, F&I*	2,830	LF	$75.41	$213,407.73
Clearing and Grubbing	0.32	AC	$16,135.80	$5,241.54
			Subtotal	$218,649.27
			Maintenance of Traffic (20%)	$43,729.85
			RR Flagman	$10,000.00
			Mobilization (20%)	$52,475.82
			Contingency (20%)	$64,970.99
			Total	**$389,825.93**
*Estimated cost. No historical cost available.				

Rail Lighting Warning System

Rail Lighting Warning System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Track Lighting*	3,000	LF	$50.00	$150,000.00
ITS Cabinet - F&I, Base, 334	1	EA	$7,811.93	$7,811.93
Managed Field Ethernet Switch, F&I	1	EA	$4,326.27	$4,326.27
Controller	1	EA	$8,000.00	$8,000.00
			Subtotal	$170,138.20
			Maintenance of Traffic (20%)	$34,027.64
			RR Flagman	$15,000.00
			Mobilization (20%)	$40,833.17
			Contingency (20%)	$51,999.80
			Total	**$311,998.81**
*Estimated cost. No historical cost available.				

Lake Lily Hot Spot

The Lake Lily Hot Spot is seen below in Figure 27. In the map, you will see the extent of the Hot Spots, the adjacent land uses, local street network, historical trespassing Incidents, and where evidence of trespassing was discovered in the field. Information for each past incident can be found in Table 3.

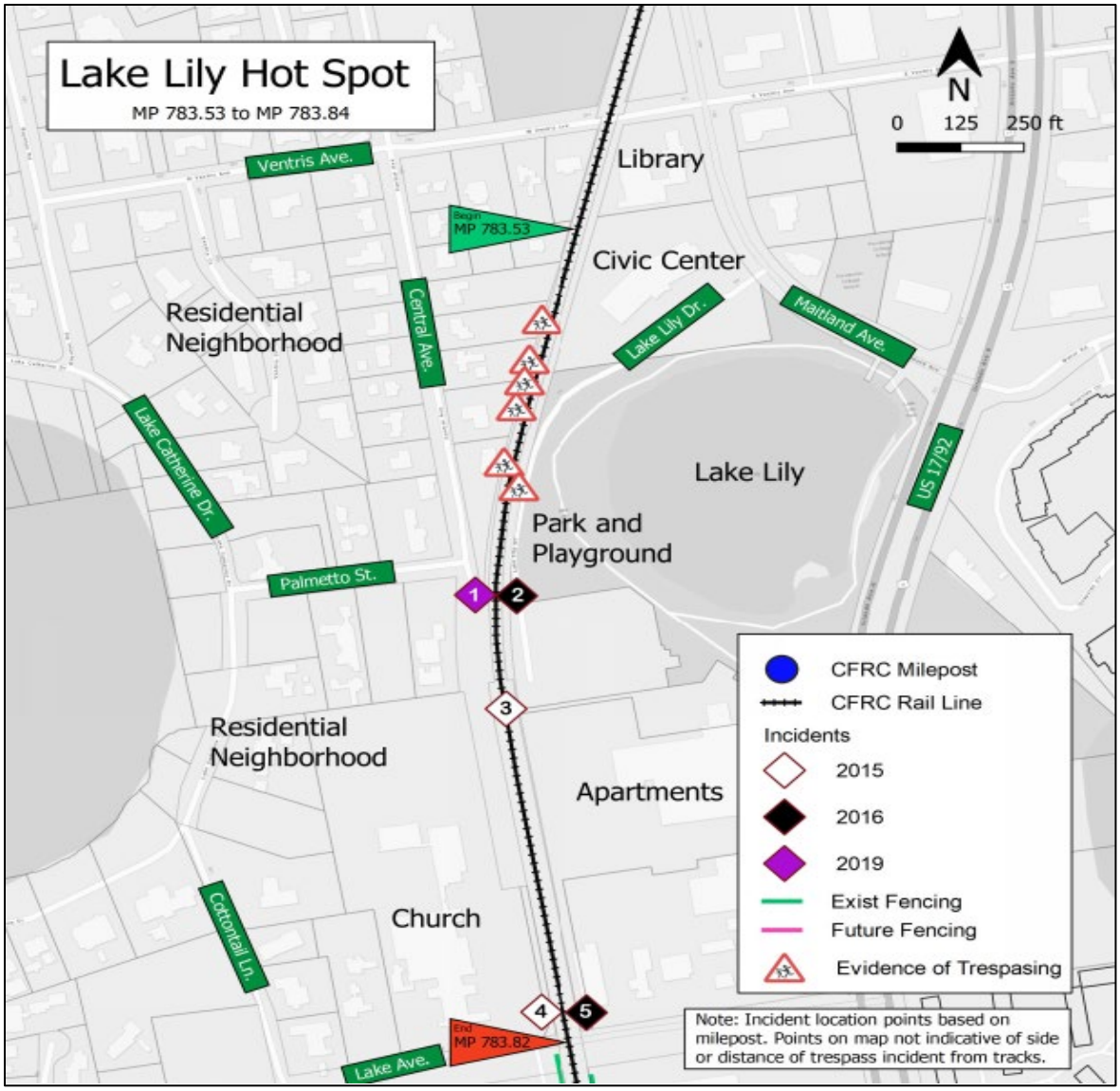


Figure 27: Lake Lily Hot Spot

Table 3: Historical Incidents in the Lake Lily Hot Spot

#	Date	Time	Category	Description	Gender	Race	Age
1	5/10/2019	9:41	Fatality	Maitland PD - Reported train on person strike	Male	Black	22
2	11/21/2016	19:30	Observe	Train Crew - Two boys walking on ROW south	Male	White	13
3	3/26/2015	10:32	Near Miss	Trespasser emerged from behind signal shed	Male	Unknown	Unknown
4	2/25/2015	22:35	Suicide	CSX train struck and killed trespasser on main track	Male	Unknown	29
5	2/8/2016	10:15	Observe	Trespasser reported walking on tracks	Unknown	Unknown	Unknown

Origin – Destination Analyses

The Lake Lily Hot Spot, located in Maitland, FL, is about 0.07 miles south of the Ventris Ave. grade crossing and directly north of the Lake Ave. pedestrian crossing. The location can be seen on the map in Figure 27. This section of the CFRC is directly bordered to the east by Lake Lily Park, Maitland's showcase park with gardens, museums, walking trails, picnic areas, and a playground around a verdant lakeshore, and the Maitland Civic Center. To the west is a residential neighborhood with homes backing right up to the CFRC corridor. There is an existing signalized pedestrian crossing located just south of Palmetto Street which provides a direct connection from the neighborhood to Lake Lilly Park. Despite having a sidewalk connection to a pedestrian grade crossing into the park, residents have built fences behind their properties with gates opening directly on to the tracks. There is also an area where trespassers have walked between abutting properties onto the tracks to get into the park. Trespassing here only saves about a tenth of a mile in walking and people can easily be detoured to the pedestrian crossing only a block away. The gates and paths found at this location are shown in the photos below.

Evidence of Trespassing and Hot Spot Photos

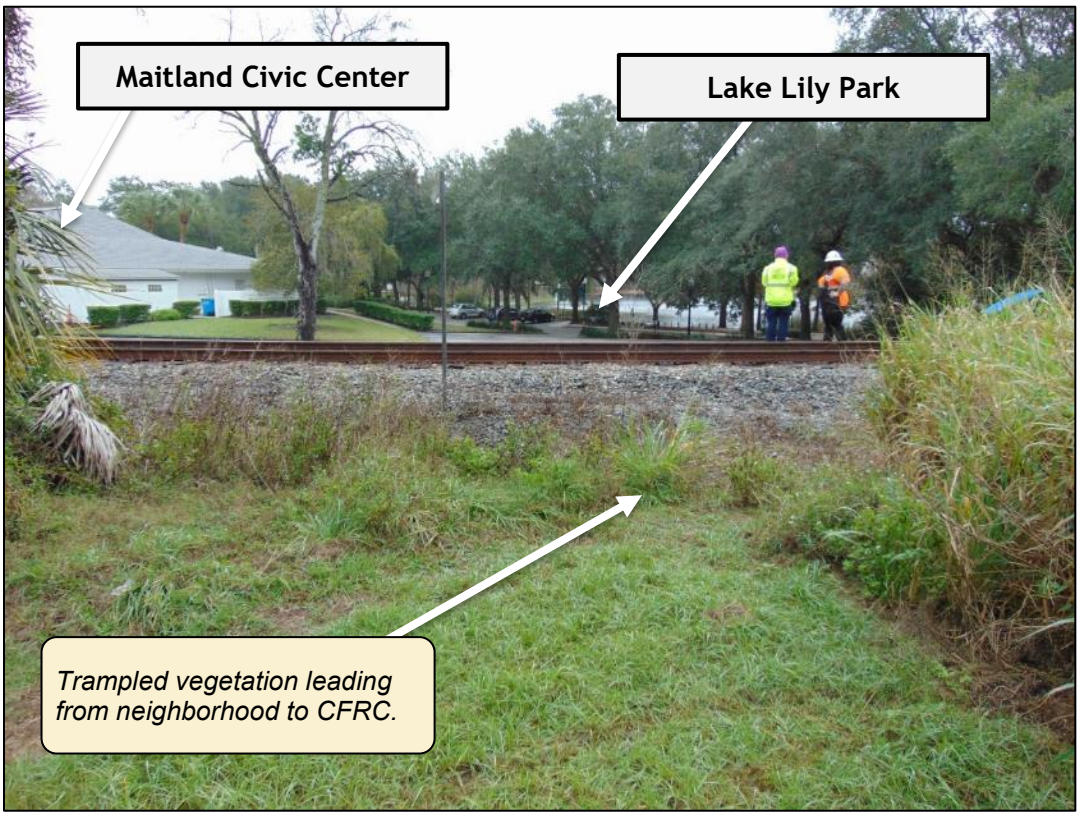
Photos were taken at multiple locations throughout the Hot Spot and showcase evidence of trespassers on the corridor or other characteristics of interest. The locations that the photos were taken are shown in Figure 28 below. Each numbered camera icon correlates to a photo location showcased in the following pages.

Figure 28: Location of Field Photos Taken at Lake Lily Hot Spot

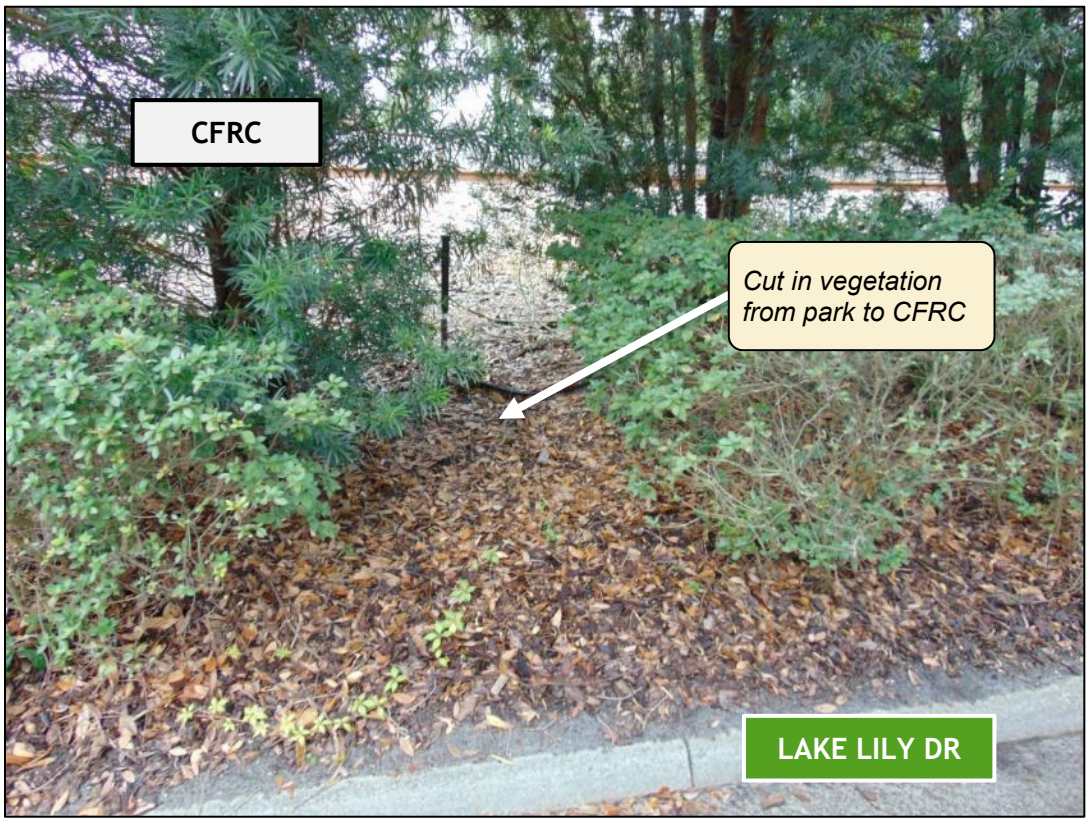
Photo Location 1 shows the proximity and openness of the CFRC to the parking lots behind the Maitland Civic Center and Public Library. It was discovered in this location that bicycle racks for the public library were provided directly adjacent to the tracks without any physical barrier. Directly opposite the corridor of the parking lots, Photo Location 2 shows trampled vegetation leading into a small field that leads directly into a residential neighborhood. On the Lake Lily Park side of the tracks further south, landscaping has been trampled creating several defined paths between the park and the CFRC. These paths are shown in Photo Location 3. Directly across from these paths, on the west side of the track, there is evidence of access to the corridor from many residential lots. Some that are fenced include gates that open onto the tracks and others have trampled paths in the vegetation from their yards to the corridor. Both scenarios are shown in Photo Location 4. Just south of where all the trails and gates are located, is a legal at-grade pedestrian crossing from the neighborhoods on the west side of the CFRC into Lake Lily Park. This facility is shown in Photo location 5. From the pedestrian crossing south to Lake Ave., there is a multi-use trail running parallel to the tracks. This trail is close in proximity to the tracks and heavily traveled yet a physical barrier is not provided to keep people off the corridor. The path and its relation to the tracks is shown in Photo Location 6. The six photo locations are shown on the following pages.

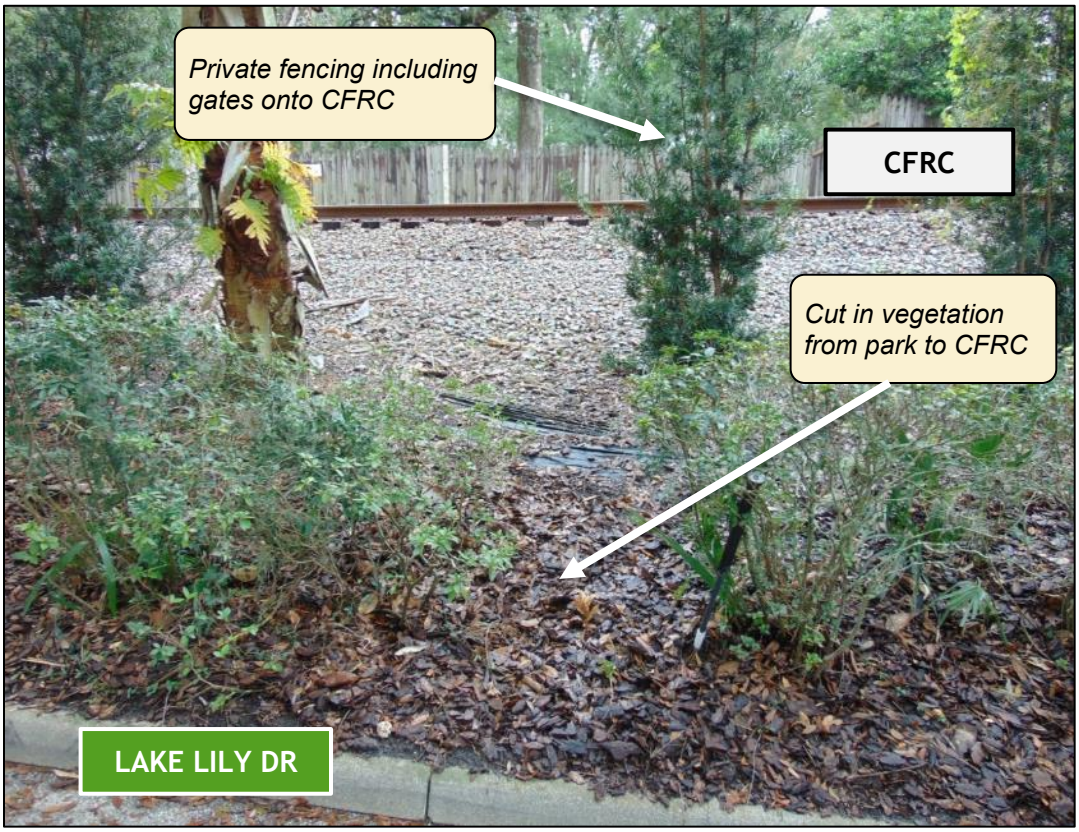
Lake Lily Photo Location #1

Lake Lily Photo Location #2

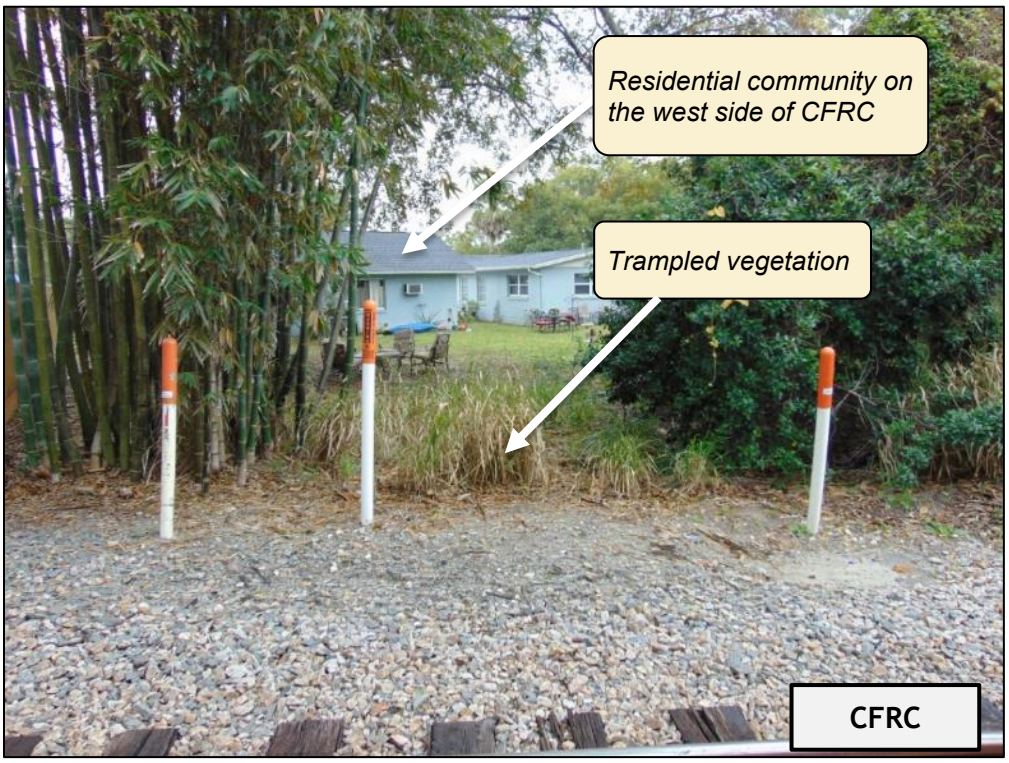


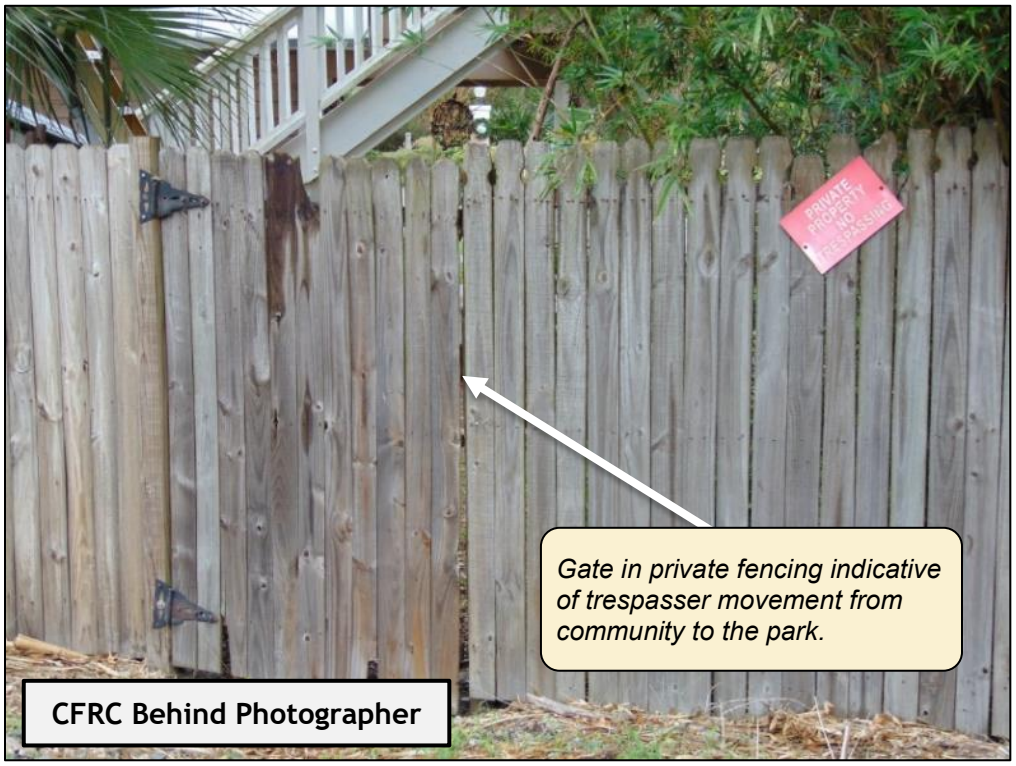
Lake Lily Photo Location #3





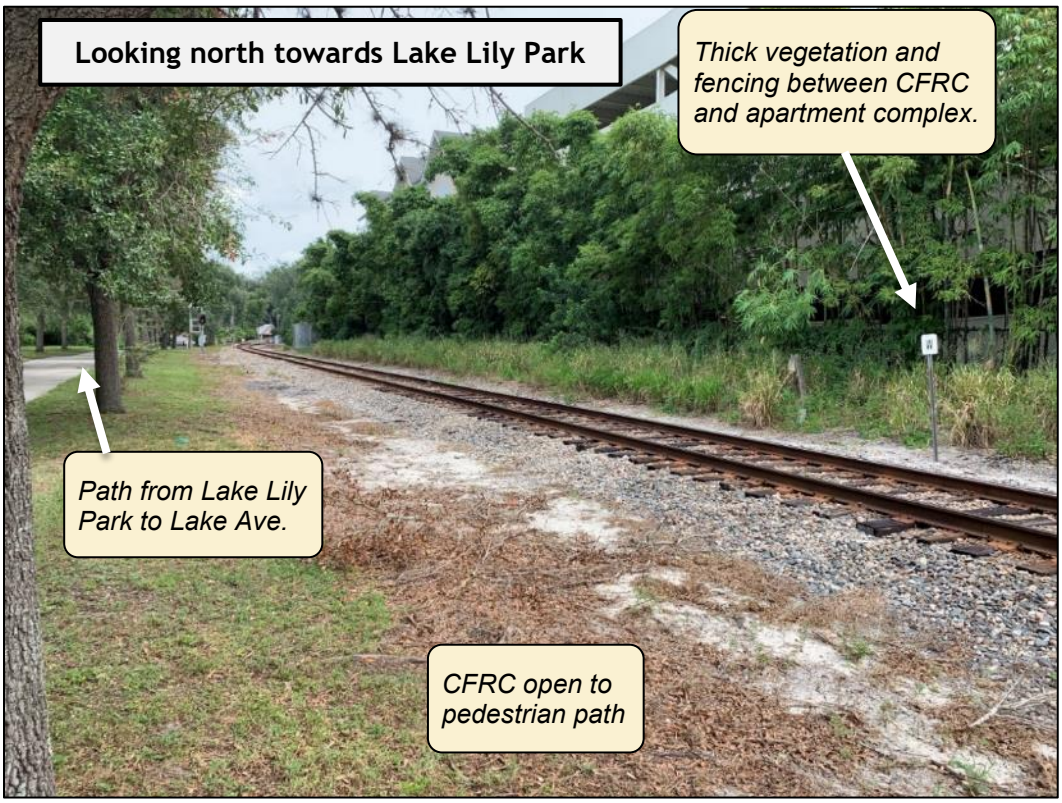
Lake Lily Photo Location #4





Lake Lily Photo Location #5

Lake Lily Photo Location #6



Lake Lily Mitigation Options and Cost Estimates

Channelization

While there is an existing pedestrian crossing, it is in a state of disrepair. Fencing also needs to be installed to channelize pedestrians to the existing crossing. The installation of channelization elements will further supplement the recommended enforcement of abutting property owners to mitigate their illegal access. A grade-separated crossing was developed in early concept stages but halted during development as it became evident that such a solution is cost prohibitive.

Channelization				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Fencing, Type B, 5.1-6.0', Standard	1,930	LF	$24.09	$46,493.70
Bollards	4	EA	$292.57	$1,170.28
Detectable Warnings	97	SF	$28.70	$2,783.90
OMNI Crossing Panel	16	LF	$300.00	$4,800.00
Concrete Sidewalk and Driveways, 4"	96	SY	$38.50	$3,700.28
Clearing and Grubbing	0.02	AC	$16,135.80	$400.43
Regular Excavation	10	CY	$5.86	$58.65
Performance Turf, Sod	24	SY	$2.60	$62.40
Embankment	10	CY	$10.16	$101.69
Pedestrian Gate	2	EA	$50,000.00	$100,000.00
			Subtotal	$159,571.34
			Maintenance of Traffic (20%)	$31,914.27
			RR Flagman	$15,000.00
			Mobilization (20%)	$38,297.12
			Contingency (20%)	$48,956.55
			Total	**$293,739.27**

Intelligent Right-of-Way Safety System

Camera monitoring and detection using artificial intelligence along this section is provided as a concept for consideration to detect trespassing events and to take appropriate action.

Intelligent Right-of-Way Safety System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Conduit, F&I, Directional Bore	1,400	LF	$19.16	$26,824.00
Concrete CCTV Pole, Fur & Ins W/ Low	4	EA	$20,854.03	$83,416.12
ITS CCTV Camera, F&I, Dome Encl-Np	4	EA	$5,572.12	$22,288.48
Pull & Splice Box, F&I, 13" x 24" (Electrical)	6	EA	$774.28	$4,645.68
Pull & Splice Box, F&I, 24" x 36" (Fiber Cable - Includes Slack)	6	EA	$1,290.91	$7,745.46
ITS Cabinet - F&I, Base, 334	5	EA	$7,811.93	$39,059.65
Wireless Communication Device, F&I, ETHE	4	EA	$4,500.00	$18,000.00
			Subtotal	$201,979.39

Intelligent Right-of-Way Safety System	
Maintenance of Traffic (20%)	$40,395.88
RR Flagman	$15,000.00
Mobilization (20%)	$48,475.05
Contingency (20%)	$61,170.06
Total	**$367,020.39**

Physical Deterrent

The Lake Lily area is rapidly urbanizing with numerous multi-family housing units being developed. There are several urban trails which parallel and abut the rail corridor and an at-grade pedestrian crossing connecting these trails. Given the abundance of reasonable routes between destinations and origins, it is recommended that a 6' FDOT Type B chain link fence be installed on the east and west side of the tracks. Hardened fencing is not required because of the abundance of natural surveillance from people in the area.

Physical Deterrent Fence				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Fencing, Type B, 5.1-6.0', Standard	1,980	LF	$24.09	$47,698.20
Clearing and Grubbing	0.23	AC	$16,135.80	$3,667.23
			Subtotal	$51,365.43
			Maintenance of Traffic (20%)	$10,273.09
			RR Flagman	$10,000.00
			Mobilization (20%)	$12,327.70
			Contingency (20%)	$16,793.24
			Total	**$100,759.46**

Rail Lighting Warning System

Rail Lighting Warning System				
Item	**Quantity**	**Units**	**Unit Cost**	**Total**
Track Lighting*	2,000	LF	$50.00	$100,000.00
ITS Cabinet - F&I, Base, 334	1	EA	$7,811.93	$7,811.93
Managed Field Ethernet Switch, F&I	1	EA	$4,326.27	$4,326.27
Controller	1	EA	$8,000.00	$8,000.00
			Subtotal	$120,138.20
			Maintenance of Traffic (20%)	$24,027.64
			RR Flagman	$15,000.00
			Mobilization (20%)	$28,833.17
			Contingency (20%)	$37,599.80
			Total	**$225,598.81**
*Estimated cost. No historical cost available.				

Summary of Costs and Selected Alternative

For each Hot Spot, taking into account the most effective solution to reduce trespassing, a preferred alternative was selected.

Table 4: Summary of Costs by Hot Spot (Preferred Alternatives Highlighted)

Hot Spot	Alternatives	Cost ($)
Prairie Lake Cove	Channelization	$460,203
	Intelligent Right-of-Way Safety System	$406,861
	Rail Lighting Warning System	$288,844
	Physical Deterrent	$97,353
Porsche	Channelization	$521,506
	Intelligent Right-of-Way Safety System	$369,652
	Rail Lighting Warning System	$225,599
	Physical Deterrent (west side only)	$158,858
Oak	Channelization	$690,350
	Intelligent Right-of-Way Safety System	$342,785
	Rail Lighting Warning System	$311,999
	Physical Deterrent	$389,826
Lake Lily	Channelization (includes new ped gates at existing Ped Xing)	$293,739
	Intelligent Right-of-Way Safety System	$367,020
	Rail Lighting Warning System	$225,599
	Physical Deterrent	$100,759

05

Benefit Cost Analysis

Benefit Cost Analysis Summary

Summary of Costs

The costs of the design mitigation measures in 2019 dollars are estimated at $1,513,419.00 (see Table 5).

Table 5: Summary of Costs (in 2019$)

Hot Spot	Preferred Alternative	Costs ($)
Prairie Lake Cove	Channelization	$460,203
Porsche	Intelligent Right-of-Way Safety System or Physical Deterrent on the west side	$369,651
Oak	Intelligent Right-of-Way Safety System or Physical Deterrent	$389,826
Lake Lily	Channelization Improvement	$293,739
Total Cost		**$1,513,419**

Benefits

The primary benefit is the reduction in the number of injuries and deaths for the CFRC and FDOT. The benefit of preventing a fatality is measured by what is conventionally called the Value of a Statistical Life (VSL), defined as the additional cost that individuals are willing to bear for improvements in safety (reductions in risk) that, in the aggregate, reduce the expected number of fatalities by one.[18] The current FDOT value of $10,670,000 is used for this analysis[19]. Injury costs are based on the guidance in the US DOT memorandum, 2016 Revised Value of a Statistical Life Guidance.

Table 6: Value of Reduced Fatalities and Injuries[20]

MAIS Level[21]	Severity	Fraction of VSL	Unit Value
MAIS 1	Minor	0.003	$32,000
MAIS 2	Moderate	0.047	$501,500
MAIS 3	Serious	0.105	$1,120,400
MAIS 4	Severe	0.266	$2,838,200
MAIS 5	Critical	0.593	$6,327,300
Fatal	Not Survivable	1.000	$10,670,000

The monetized safety benefits of the project were calculated based on changes in the number of trespassing Casualties, and unit cost of Casualties by type. The annual totals of Casualties were

[18] USDOT Memorandum, 2016 Revised Value of a Statistical Life Guidance
[19] 2020 FDOT Design Manual, Table 122.6.2

[20] Information provided and prepared by HDR, Inc.
[21] Maximum Abbreviated Injury Scale (trauma severity measurement)

based on the average of Casualties by type (strikes/injuries, and fatalities and suicides) experienced along the corridor between 2014 and 2017. The unit cost of Casualties was based on the values included in the US DOT BCA Guidance for fatalities (applied to trespassing fatalities and suicides) and injuries (trespassing strikes). The trespassing Casualty reduction factor related to these preferred alternatives was assumed at 20 percent. Although no exact program was found in the literature, similar programs related to pedestrian safety, engineering controls and law enforcement enhancement initiatives indicate that reduction of over 20 percent can be expected and served as a proxy guiding the assumption's development[22]. Table 7 summarizes the resulting safety benefits, which are projected to be valued at about $9 million annually.

Table 7: Projected Trespassing Casualty Cost Savings by Type (in millions $)

Type	Annual
Injuries	$0.4
Fatalities	$8.5
TOTAL	**$8.9**

Other benefits can also be expected to result from such implementation. For instance, travel time savings will occur from reduced trespassing Casualties which will benefit the passengers and crew on board, the affected trains as well as the motorists waiting less time at grade crossings along the trespassing-affected crossing points.

Benefit Cost Analysis Results

The safety benefits that result from the design improvements with the assumption of a 20 percent reduction in trespassing Casualties would result in a benefit cost ratio of 6.0 (see Table 8).

Overall, these results indicate that this improvement strategy looks promising economically because the benefits easily outweigh the costs by about 6 to 1. This data does not include ongoing costs which did not require time value of money calculations (present value).

Table 8: Benefit Cost Analysis Results (in millions $)

Benefit and Cost Metrics	2019 $ (rounded)
Benefits	$9.0
Costs	$1.5
Total Benefits less Total Costs	**$7.5**
Benefit Cost Ratio	**6.0**

Statewide Expansion

A larger SRRT program is envisioned to be deployed across the rail network throughout Florida which would yield both economic benefits and safety benfits to all of Florida's residents and visitors.

[22] FHWA, Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes: https://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_tctpepc/ and based on HDR, Inc. information.

06

Stakeholder Rail Trespass Task Force and Trespass Awareness and Outreach

Stakeholder Rail Trespass Task Force

Key stakeholders convened on December 11, 2019, to validate the origin and destination issues of each Hot Spot as well as gain their insights into the reasons for trespassing at these locations; to prepare a standard operating procedure for law enforcement response when an automated camera alert is transmitted to the CFRC Dispatcher; and to develop a targeted public awareness and outreach plan based on data mining and the origin – destination analytics.

The Task Force membership consists of the following groups:

- Law Enforcement
  - Florida Highway Patrol (FHP)
  - Seminole County Sheriff
  - City of Kissimmee
- Parks and Recreation Department
  - Altamonte Springs Recreation
  - Maitland Parks and Recreation
- Housing
  - Prairie Lake Area Homeowners Assn.
  - Altamonte Villa Apartments
- Porsche Orlando
- Maitland Public Library
- Coalition for the Homeless of Central Florida
- Commuter Railroads
  - New Mexico Rail Runner
  - SFRTA
- Tenant Railroads
  - CSX
  - Amtrak

Rail Trespass Task Force Meeting - December 11, 2019

Cooperative Relationship with Stakeholders:

Law enforcement agencies, tenant railroads, and local stakeholders are working together with the CFRC through its various committees and meetings to evaluate contributing factors, analyze root causes and develop trespass mitigation strategies. This is evidenced by the support of CFRC's law enforcement partner (FHP) and Seminole County Sheriff's Office involved in this initiative.

The Rail Trespassing Task Force was able to bring together subject matter experts to share information, collaborate, identify, and prioritize specific recommended actions related to education, engineering, and enforcement (Three Es).

Law enforcement, tenant railroads, fellow commuter rail systems and local groups were able to validate and identify**:**

1. Trespasser locations
2. Contributing Factors
3. Root causes
4. Proposed mitigation strategies

New ideas were solicited from the workshop attendees on prospective new or expanded mitigations, initiatives, strategies and programs. The participants developed more than 15 ideas during the first breakout session. The group brainstormed many potential ideas for each Hot Spot. The ideas are as follows:

1. The lighting system will not work for persons who are intoxicated. It might be good for general public because it shows due diligence to keep people safe.
2. Look into a lighting system that illuminates the higher portions of the track at night. If you think about what is putting someone up to no good along rail, it's the darkness. Instead, deter people. It provides one more barrier and is a deterrent. The lights could be where Hot Spots are. It also makes it easier for law enforcement to see better and access trespassers.
3. Make sure there are points of access so that law enforcement can easily get to the trespasser without having to go to a further access point.
4. Link up the alert system so that the alerts go to the Regional Traffic Management Center, and then it gets pushed out through Mutualink. The important thing is getting notification to law enforcement.
5. There are legal concerns that agencies have with recording. Only issue data sets that would capture the trespasser.
6. Law enforcement is also looking for signage posted in increments along the right-of-way. The issue is if you access the tracks and it's not near a sign, the excuse could be that they didn't know they were trespassing.
7. FHP asked the question about working with media. They posed the question about coordinating with the media to help create the story and get the message out.
8. The group asked about fencing and proposed putting up a fence that will be maintained by FDOT.
9. FHP said that a lot of people don't like to get involved with police, so it can be helpful to put up a sign that says if you see trespassing, report it anonymously. This encourages

people to come forward without having to give their name. It allows people to report crimes, people sleeping on tracks, etc. Stations in New York City featured boxes for people to fill out a form and report what they saw. In the CFRC, there would need to be a designated group who pick up the forms.

10. One of the officers said that there has been an uptick in reporting crimes via social media as opposed to physical forms or calling.
11. Natural barriers: Rail Runner uses cactus and pointy plants.
12. At-grade solution: Rail Runner installed a pedestrian crossing from a housing area to a post office, restaurants, stores.
13. Rail Runner asked law enforcement to park at stations and have a presence.
14. Walking trails beside the right-of-way have been effective.
15. Posting pedestrian signs that say “LOOK” have also been effective.

The Task Force stated that they will evaluate these ideas and incorporate them into their plans and corrective actions, where appropriate. They will inform the stakeholders at the next meeting in February 2020 as to the status of their ideas.

Trespass Awareness Outreach and Countermeasures Plan

Law Enforcement Agencies and Neighborhood Watch Groups

Safety initiatives produce the best results when they successfully implement the “3 Es”: Engineering, Education, and Enforcement. Local police agencies need to be included in this effort because of their unique role to act as a deterrent to rail trespassing by enforcing the law and their status as a vital stakeholder in any community. Including local police departments, sheriff offices and neighborhood watch or citizen patrol groups throughout the Pilot Area will provide law enforcement with the necessary information and support to significantly reduce rail trespassing.

The SRRT Pilot Program requires a targeted outreach and collaborative approach with local agencies. The first action in the law enforcement outreach effort is to verify the CFRC’s database of police departments and neighborhood watch contacts located within the CFRC. A list of the recommended agencies to be included in the outreach effort of the CFRC is provided at the end of this section. The goal is to be as inclusive with this outreach as possible. However, at minimum, it is recommended to include agencies whose jurisdictions fall within a county or three miles of the CFRC. The most important agencies to include are ones which jurisdiction encompasses a known origin destination pathway of trespassing. These known origin destination pairs are included in the survey efforts of the Pilot Area.

Law Enforcement Agencies and Neighborhood Watch Groups Outreach Strategy

1. CFRC currently engages law enforcement at Community Traffic Safety Team (CTST) meetings. During these meetings it will be necessary to enhance awareness by imparting the following:
    a. Reinforce the importance of reducing rail trespassing – the message, "it is illegal and dangerous."
    b. Provide information on previous and ongoing initiatives underway across the state of Florida to reduce rail trespassing.
    c. Provide trespassing survey results – locations of trespassing pathways, identified origin/destinations of trespassing pathways, and data & locations of previous trespassing Incidents.
    d. Provide information on applicable fines, warnings or court appearances for rail trespassing.
    e. Recruit law enforcement personnel to participate in upcoming safety initiatives – example, rail safety week.
    f. Encourage law enforcement agencies to utilize their social media accounts (Twitter, Facebook, Instagram, etc.) to post content that reinforces the message "dangerous and illegal."
    g. Solicit feedback from law enforcement to confirm or add locations of trespassing and incorporate into working database.
    h. Encourage members of law enforcement to speak to neighborhood watch groups and become Operation Lifesaver certified.
    i. Provide the Trespass Letters to police departments so that the ability to enforce trespassing exists.
2. An additional outreach effort is to organize "ride-alongs" with law enforcement and CFRC. A "ride-along" would entail a law enforcement officer accompanying a SunRail train crew during a regularly scheduled trip. The purpose of these ride-alongs is to provide law enforcement with additional insight and appreciation of the rail corridor, trespassing paths and its trespassing enforcement challenges. To arrange these ride-alongs, the outreach officer will need to:
    a. Gain approval from the CFRC to allow police officers to accompany the SunRail train crew.
    b. Recruit officers – through CTST, Rail Trespassing Task Force meetings or directly with established contacts – to participate in these ride-alongs.
3. An outreach officer will also need to directly engage neighborhood watch and citizens on patrol groups whose areas are in close proximity to the CFRC.
    a. Prepare educational content and present to members of the group.
    b. Develop and distribute safety tip cards to distribute to members of the group.
    c. Subscribe members to an e-newsletter with applicable content.

Examples of Law Enforcement Agencies in the CFRC

Altamonte Springs Police Department, Lake Mary Police Department, Longwood Police Department, Maitland Police Department, Orlando Police Department, Sanford Police

Department, Winter Park Police Department, Seminole County Sheriff's Office and Orange County Sheriff's Office

Railroads, Public Transit Authorities, and Other Transportation Providers

The fact that different modes of transportation often feed each other (passengers take a bus, or a ride share to the train station), working with other transportation providers is a good way to make sure commuters see the no-trespassing message repeatedly, and remember it.

Railroads, Public Transit Authorities, and Other Transportation Providers Outreach Strategy

1. Develop a trespassing safety brand and messages: an overall consistent message and look, and the messages should focus on these priorities:
    a. Being on the railroad tracks is illegal and dangerous (discourage bad behavior).
    b. Cross only at marked, legal crossings (encourage good behavior).
    c. Video surveillance active (discourage bad behavior).
2. Create and place signage: An outreach officer will work with a vendor or vendors who can print various sized bus and train signage, plus outdoor signage in a reflective medium on metal for maximum visibility and durability. Signage will be distributed to the various transportation partners:
    a. Rail: The outreach team will seek public service announcement (PSA) placement on SunRail and Amtrak. PSAs are normally free or at a reduced rate from advertisements in the same space.
    b. Bus: The outreach team will also seek PSA placement of printed signs on local passenger bus service such as LYNX, Votran and Greyhound buses. Programs including LYNX's annual public service bus may offer opportunities to place similar messaging on the outside of buses that can reach a broader audience.
    c. Outdoors: The outreach team will work with FDOT and local municipalities to place outdoor signage at railroad crossings and high-trespass areas to reinforce the danger and illegality of trespassing; other signs will be placed near video equipment alerting the public of its use and purpose.
3. Engage Uber and Lyft in messaging: There are multiple opportunities with Uber and Lyft (and future ride-sharing startups) to message rail safety and share the no-trespassing message.
4. Engage taxi drivers: Taxi drivers, like Uber and Lyft drivers, present an opportunity to educate both the driver and the passenger about railroad safety and the dangers of trespassing.
    a. Riders: The outreach team will engage the companies about adding functionality to their client app that provides a PSA message when a passenger begins or ends their ride within a certain radius of railroad tracks. For example, in the CFRC, AdFocus (https://theadfocus.com/projects-item/taxi-advertising/) provides taxi-based advertising opportunities. Messaging both inside the cars can address the urgency of staying off and away from railroad tracks as a pedestrian.

b. Drivers: The outreach team will engage with the companies about adding functionality to their driver navigation apps that will alert drivers when they are near a railroad crossing and remind them that it is illegal and dangerous to stop on railroad tracks. This functionality could also be pitched to Google Maps, Waze and other driving (and walking) direction applications.
c. The team will offer train-the-trainer opportunities and materials during which an outreach officer will present information on the importance informing passengers whom they drop off near railroad tracks to cross only at designated crossings.

Local Agency, City/County Planning and Engineering Departments

Local agencies have a responsibility for the health, safety and welfare of their citizens and should be included as an instrumental player in mitigating railroad trespass. Enforcement of existing zoning laws such as incompatible use buffers, fencing requirements, as well as providing complete and convenient bicycle and pedestrian routes for origin - destinations should all be evaluated as potential countermeasures for rail trespass.

Homeless Shelters & Community Activist Organizations

Homeless camps often pop up near train tracks, making it all too easy for persons to cross or walk on tracks illegally. Reaching out to the homeless community is a critical part of this program since this population is at such a high risk of trespassing on train tracks. To help combat this, it is important to coordinate with those groups who have direct access to the homeless and low-income populations who camp along the corridor. These groups would include community activist organizations like homeless advocacy groups, homeless shelters, and faith-based organizations, as well as health agencies/departments (Orange County Health Department, City of Orlando "Green Team"). Coordinating outreach efforts with these entities would help increase awareness and reinforce that rail trespassing is illegal and dangerous.

Homeless Shelters & Community Activist Organizations Outreach Strategy

1. Homeless shelters: These organizations are key to getting the message to homeless persons about the dangers of trespassing on railroad tracks. Homeless persons who seek nighttime refuge at shelters are often on the move during the daytime. During those hours when they are in transit, they could be at risk of trespassing on tracks. For those who do go to a shelter, there are a variety of ways to share the message about the safety and illegal aspects of track trespassing.
2. Homeless advocacy groups: These agencies often interact with the homeless population in various ways, whether it's through food pantries, food kitchens, donation centers, etc. Through their interactions, they could help educate homeless persons on trespassing dangers.
3. Churches: Faith-based groups along the corridor who volunteer to help the homeless are ideal partners in this endeavor. In their effort to help minister to the homeless, they could create volunteer groups who help reinforce the message about trespassing.

a. Posters: Provide posters that can easily be hung.
b. Task force: Include representatives from homeless shelters and CAOs to participate in the rail trespassing task force.
c. Presentation/outreach: Offer educational presentations.
d. Handouts: Provide informational handouts to the staffs so that they can share with people who come in.

Examples of Homeless Shelters and Community Activist Organization Stakeholders on the CFRC

Salvation Army, Coalition for the Homeless, Operation Lifesaver, Maitland Presbyterian Church and Asbury United Methodist Church

Homeowner Associations and Property Management Companies

For residents along the CFRC it can be enticing to cross tracks at non-designated crossings, especially if this means a quicker route. This can be the case especially for people who travel by foot to get to work or go shopping and are looking for the easiest route to take. Additionally, children may be inclined to cross tracks to get to playgrounds or school, which could lead to train strikes. Working with homeowners' associations, apartment management companies and property management companies will contribute to educating residents on the dangers and illegalities of railroad trespassing.

Homeowner Associations and Property Management Company Outreach Strategy

1. Homeowner Associations (HOA), apartment management companies and property management companies: Getting these organizations to educate and notify residents of the dangers related to rail trespassing is important in the effort to deter trespassing.
    a. Presentations: During meetings, this topic can be addressed either through presentations or informational materials distributed to attendees.
    b. Social media: Provide social media posts that these companies and associations can post on their group Facebook pages and other social media pages.
    c. Printed material: Have common areas where posters or other printed materials can be posted to remind residents to stay off the tracks.
    d. E-Newsletter: subscribe the HOA members to an e-newsletter with applicable content (outlined in E-Newsletter section) to continue the educational aspect of the SRRT Program and keep subscribers up-to-date with pertinent rail information.
2. Neighborhoods without central organizations:
    a. Engage in good neighbor outreach – distribute fact sheets and other educational content door-to-door.

Examples of HOA and Property Management Stakeholders along the CFRC

The Village at Lake Lily, The Adeline, Maitland City Centre, The Parker at Maitland Station, Charter Pointe Apartments, The Pointe at Merritt Street and West Cove Condominiums.

Schools and Clubs

Breaking the cycle of trespassing begins with educating groups who have a big impact in their respective communities. One of the most important ways of accomplishing this is through the education of children. While the analytics in this report noted that persons between the age group of 30 to 69 have the highest number of trespassing Casualties, educating children regarding the dangers of trespassing will lessen the likelihood of trespassing later in life. Outreach officers can also become officially trained Operation Lifesaver Inc. (OLI) volunteers and contact the state coordinator when OLI materials are needed.

Schools and Clubs Outreach Strategy

1. Elementary Schools and Middle Schools: Educating kids is ideal because the earlier the message can be ingrained, the better the long-term outcome is as they get older.
2. High Schools: Present directly to schools. Parent Teach Associations to educate and increase awareness. Also, provide fact sheets for additional reinforcement and distribution.
3. Extended Care Programs
    a. Present directly to students, as well as to Parent Teacher Associations to educate and increase awareness.
    b. Distribute fun, engaging educational materials.
    c. Morning announcements, morning news show (videos).
    d. Provide content for schools to post on social media.
    e. Distribute fun, engaging educational materials.
    f. Provide posters for the school.
    g. Poster & Video contests.
    h. Provide posters for the school, “Trespassing is Dangerous” and “Trespass and You Could Be Arrested.”
    i. High Schools only: Create a campaign that can be implemented at the school to illustrate the effects of losing fellow students to railroad Incidents. An example of this would be similar to a school “ghost out”, which involves mock situations of students being gone as a result of careless behavior.
4. Colleges
    a. Utilize college & university databases to push email/text notifications, “Trespassing is Dangerous” and “Trespassing is Illegal.”
    b. Freshman/New Student Orientation on Rail Safety.
    c. Presence at Health Fairs to plug rail safety.
    d. Clubs, Classes and Organizations – Photography, Videography, etc.
5. Driver’s Education Schools
    a. Provide educational materials that explain the safety risks of stopping too close to train tracks.

b. Meet with educators and encourage this message to be used in lessons.
c. Identify Drivers Education schools and meet with them to add to their curriculum.

Examples of Stakeholder Schools & Clubs in the CFRC

East Altamonte Boys & Girls Club, Seminole County Public Schools, Orange County Public Schools, Rollins College, Seminole State College, Valencia College, University of Central Florida, Full Sail University, Boy & Girl Scouts, Cub Scouts, Brownies, etc.

Photographers, Videographers and Other Visual Artists

Railroad tracks have always had a great appeal to visual artists. The so-called leading lines of the tracks heading off to the horizon, the draw of the adventure and romance of travel by rail, and the often-urban surroundings through which tracks run all contribute to the appeal of creating visuals on or around railroad tracks. The larger danger of railroad photography comes from the social sharing of photos. When a successful photographer shares a visually stunning portrait taken on tracks, other photographers will attempt to mimic or duplicate that image, compounding the danger.

Fortunately, the largest professional photographer organization in the nation, Professional Photographers of America (PPA), advocates against photography on railroad tracks (https://www.ppa.com/articles/photographers-spread-the-word). On a local level, professional and hobbyist organizations and educational institutions provide an opportunity to interact with and educate visual artists about the illegality and dangers of railroad photography and videography.

Photographers, Videographers and Other Visual Artists Outreach Strategy

1. Professionals, hobbyists and amateurs: The first target audience is professional photographers, videographers, filmmakers and others. This group can help influence others (hobbyists, amateurs, students) because of their standing in the community, and their role as educators and ambassadors. Outreach to this audience will take place through professional organizations. For example, in the CFRC: Professional Photographers of Central Florida (PPCF), Florida Professional Photographers (FPP) and its annual FOCUS event. The next group to reach will be the amateur and hobbyist (usually part-time or occasional professionals) photographers and videographers. This group is best reached through local camera clubs. For example, in the CFRC, the Orlando Camera Club.
    a. The outreach team will develop photography/videography specific materials, including a PowerPoint presentation, handouts and posters, to be presented and distributed to photographers and others at professional events. The key messages will include the dangers to the photographer and model/client (and subsequent liability), and the risk of fine for trespassing.
    b. An outreach officer will schedule speaking opportunities at the various professional organizations' gatherings to share information and answer questions from the community.

c. An outreach officer will visit area photography studios and camera stores (in the CFRC, Harmon Photo and Colonial Photo and Hobby) to place posters and other educational material discouraging railroad photography. This effort will reach beyond just professionals, as the camera stores usually have classes for photographers; and camera stores and studios often host educational and networking opportunities for photographers of all skill levels.
d. The outreach team will create materials that can be easily shared via social media, and distribute those materials to the target groups, encouraging them to share it with their audiences.
e. Students: High school and college photography and videography students will be reached through their school programs. Reaching them with the railroad safety message during their education can create a generation of safer visual artists, and make the students advocates for railroad safety as they enter the ranks of professionals. The same materials developed for the professionals can also be used with the student audience: PowerPoint presentations, handouts and posters.

Chambers of Commerce and Local Businesses

Businesses along the CFRC are in a unique position to inform people about the dangers and illegalities of railroad trespassing, especially those adjacent to the tracks. Some local businesses have parking lots that abut the tracks, while others are a destination for trespassers. A trespasser incident — whether an individual or a vehicle — can mean the loss of a customer or a business disruption, both of which can impact a business' bottom line. For this reason, businesses have a vested interest in distributing the anti-trespassing message. They also have the advantage of being able to engage directly with their customers or facilitate direct engagement between their customers and the outreach team. Restaurants along the corridor provide an ideal space to showcase materials, and staff can be trained to engage people verbally.

Area chambers of commerce provide an entrée into the local business community, and a partner in distributing materials and reminding the business community of the importance of railroad safety. A partnership with chambers of commerce will allow the outreach team to take advantage of the chambers' existing communication efforts to businesses.

Chambers of Commerce and Local Businesses Outreach Strategy

1. Local retail businesses: Getting business owners and/or managers to educate and notify staff, customers and passersby is important in the effort to deter trespassing. Businesses are on prime real estate along the tracks that allows for messaging to be displayed and visible to people near tracks.
2. Restaurants and bars: These are a good partnership because they often have spaces for posting materials. More importantly, these are good places for one-on-one interactions for getting the message out to people who may be drinking alcohol and are at a greater risk of being involved in a railroad trespassing incident.
3. Chambers of Commerce: These organizations are a good partnership because they serve a critical role in strengthening, supporting and advocating for and to businesses.

Chambers can assist in educating, notifying and reminding businesses of the dangers related to rail trespassing.

a. Printed material: Posters or other printed materials can be posted to remind customers/passersby to stay off the tracks. Posters can be placed in employee breakrooms, kitchens, or other gathering areas. Many businesses have the capability of displaying posters in restrooms, too. Posters can also be placed in windows, glass doors and other locations visible to customers.
b. Yard signs: Signs that can be staked in the ground are another way to display the messaging in a highly visible way, especially for those businesses that abut the tracks. This can be especially helpful at businesses and restaurants with parking adjacent to the tracks.
c. Social media: Provide social media posts that the groups can post on their Facebook and other social media pages.
d. Newsletter subscription: An outreach officer will invite the groups to subscribe to the CFRC safety electronic newsletter (e-newsletter) to receive updates and content the chambers can then share with their members, either through forwarding the e-newsletter or repurposing the content.
e. Handouts: Printed handouts that can be inserted and presented with the check.
f. Educational presentations: Present to the groups, and train them to speak confidently about the dangers and illegalities when interacting with customers.

Examples of Businesses and Chambers of Commerce within the CFRC

Orlando Regional Chamber of Commerce, Seminole County Regional Chamber of Commerce, Winter Park Chamber of Commerce, The Greater Sanford Regional Chamber of Commerce, Hispanic Chamber of Commerce, Teak Neighborhood Grill, The Copper Rocket, First Watch – Maitland, Razor Edge Barbershop, Maitland Public Library, Wells Fargo – Maitland, Maitland Senior Center, Fidelity Funding Mortgage, Florida Literacy Coalition, Houndstooth Kitchen & Eatery, Subway, Bank of America – Maitland, Maitland Orthodontic Specialists, SunTrust Maitland, 7-11, Nemours Children's Primary Care and Kappy's Subs

Electronic Newsletter (e-newsletter)

One way to keep people informed and engaged in the trespassing effort is through an e-newsletter. A well-written and visually appealing e-newsletter will help keep the railroad safety message in front of people, reminding them about the importance of safe behavior around the tracks. An e-newsletter also makes it easy for recipients to share with their contacts. Archiving the articles online provides the added benefit of allowing people to share individual articles via social media, increasing the reach of the content and helping secure additional subscribers.

Electronic Newsletter Outreach Strategy

1. The outreach team will create an e-newsletter template that is branded consistently with all other outreach products, including all print materials.
2. The e-newsletter will be sent to subscribers quarterly. Subscribers will come from:

   a. All task force members, Community Traffic Safety Teams (CTST), CFRC/SunRail Fire Life Safety Committee and anyone who works for the CFRC.
   b. Members of public safety agencies not involved in the task force.
   c. Local elected and appointed officials.
   d. Outreach efforts to various local audiences.
   e. E-newsletters forwarded to friends, contacts, members, etc.
3. Each newsletter will contain three or four stories, plus calls to action, including "Forward to a Friend," "Schedule a Presentation" and others.
   a. Local article about outreach efforts or success stories, for example, new signage placed along the corridor, successful partnership with a local HOA, high-visibility enforcement effort results, etc.
   b. A human-interest story, especially personal profiles of people who work on the tracks: engineers/conductors, dispatchers, maintenance workers, etc. giving first-person accounts of why railroad safety is important and humanizing the railroads and trains.
   c. A local/national news roundup that share stories from other areas about rail trespassing efforts, injuries or deaths due to railroad trespassing, etc.
   d. Additional stories as needed.
4. The e-newsletter will be CAN-SPAM compliant, allowing anyone to unsubscribe at any time.

Rail Trespassing Task Force Group Meetings

The outreach team will also schedule, organize and facilitate a regularly occurring Rail Trespassing Task Force Meeting that may either be separate or be part of CFRC's quarterly Fire Life Safety Committee meetings.

For example, along the CFRC, the Altamonte Springs Police Department, Lake Mary Police Department, Longwood Police Department, Maitland Police Department, Orlando Police Department, Sanford Police Department, Winter Park Police Department, Kissimmee Police Department, Seminole County Sheriff's Office, Orange County Sheriff's Office, Osceola County Sheriff's Office, and Florida Highway Patrol are typically invited to represent law enforcement agencies. SunRail, CSX, and Amtrak will also be included in the task force meetings.

Recruiting a group of vested and committed stakeholders from community activist organizations, homeowner associations, other railroads, local businesses, schools and clubs will produce a diversified task force to reinforce the educational aspect of the Pilot Program and accelerate the reduction in rail trespassing.

Rail Trespassing Task Force Group Outreach Strategy

1. During and leading up to the Rail Trespassing Task Force Group meetings, the outreach officer will need to:
   a. Officially invite required (railroads and law enforcement) and key stakeholders in the designated rail corridor to appoint a representative(s) of their organization to commit and be an active participant during the task force meetings.

   i. Follow-up with necessary methods (phone calls, emails, or in person meetings) to get a committed representative(s) confirmed to attend and participate.

b. Prepare an agenda which supports the goal of reducing rail trespassing in the designated corridor and reinforces the importance of reducing rail trespassing.
c. Provide information on previous and ongoing initiatives underway (domestically and internationally) to reduce rail trespassing – for example, initiative in Miami to fine trespassers in conjunction with court appearances.
d. Share rail trespassing survey results to highlight known locations of trespassing pathways, the origin and destination of trespassing pathways, and data and locations of previous trespassing Incidents.
   i. Establish a direct line of communication between law enforcement and the dispatch so response times are significantly reduced to hasten enforcement efforts.
e. Provide all stakeholders – most importantly law enforcement – with content to post to their social media accounts (Twitter, Facebook, Instagram, Nextdoor, etc.) which reinforces the message “dangerous and illegal.”
f. Solicit feedback from all representatives and attending stakeholders to confirm or add locations of trespassing and incorporate into a working database.
g. Reassess ongoing efforts to determine best practices or unnecessary efforts going forward.
h. Follow-up with task force members to share meeting minutes, to-do list, action items and any pertinent information necessary to ensure the task force meetings remain robust.
i. Subscribe the task force members to an e-newsletter with applicable content (outlined in e-newsletter section) to continue the educational aspect of the task force and keep members up-to-date with pertinent rail information.

Press Releases and Media Kits

The efforts of the Trespassing Task Force will produce positive results, cross certain milestones, and enhance the general safety and well-being of the communities it is implemented in. All these benefits will garner well deserved media attention, which will help enhance the CFRC’s overall outreach efforts. The outreach officer will need to produce and distribute press releases when appropriate to ensure those milestones are recognized by news outlets.

Press Releases and Media Kits Outreach Strategy

1. The outreach officer will need to prepare the following:
   a. Rail Trespassing Task Force Kick-Off Meeting and ongoing meetings: One example of an event that merits a press release is after task force meeting has been scheduled and confirmed with the appropriate representatives.
   b. A press release outlining the significance of bringing the various and diverse groups together for the first time to participate in this common safety initiative will

assist in the educational outreach because media outlets will showcase the meeting as well as its purpose – to reduce rail trespassing.

2. When necessary, the outreach officer will need to produce media kits to assist the media with accurate information dissemination across the various outlets. This will ensure accurate reporting, accelerate the timeline of stories being published, and further bolster the overall outreach efforts of the Trespassing Task Force.

07

Recommendations

Use of Drones for Trespass Investigation

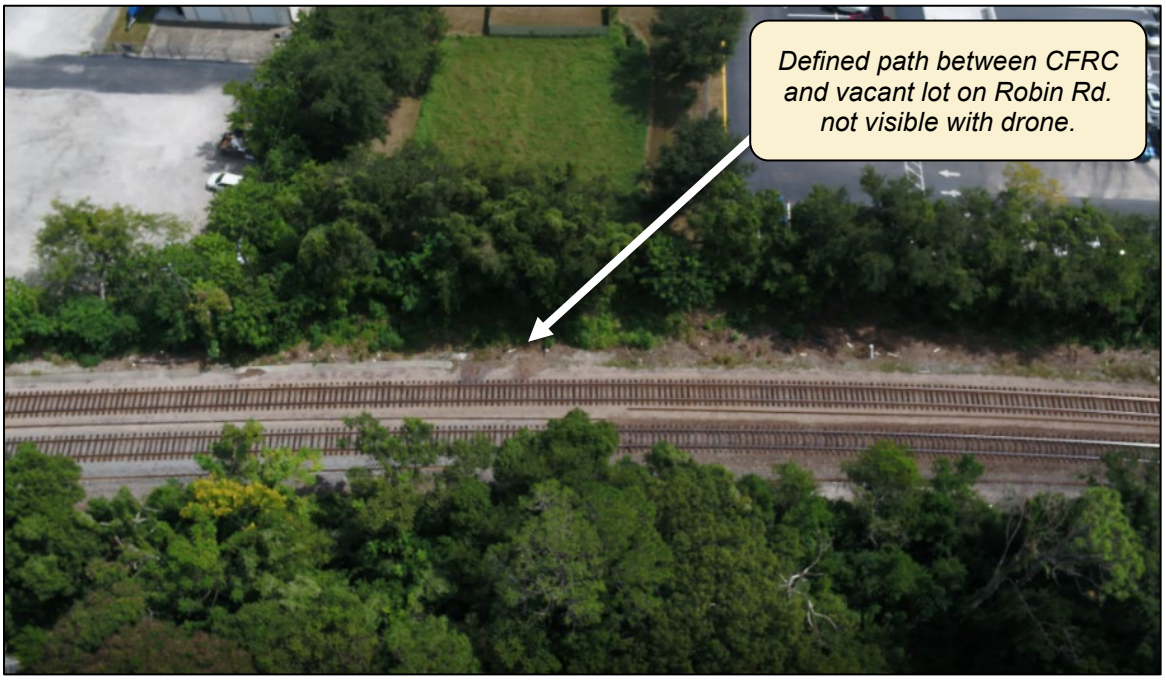
Drones have the benefit of being highly flexible and mobile. Traditional surveys along a railroad right-of-way can take multiple days. A drone can survey and take video while not requiring dedicated track time. When a train is approaching, the drone can land and wait for the train to pass to avoid any potential danger.

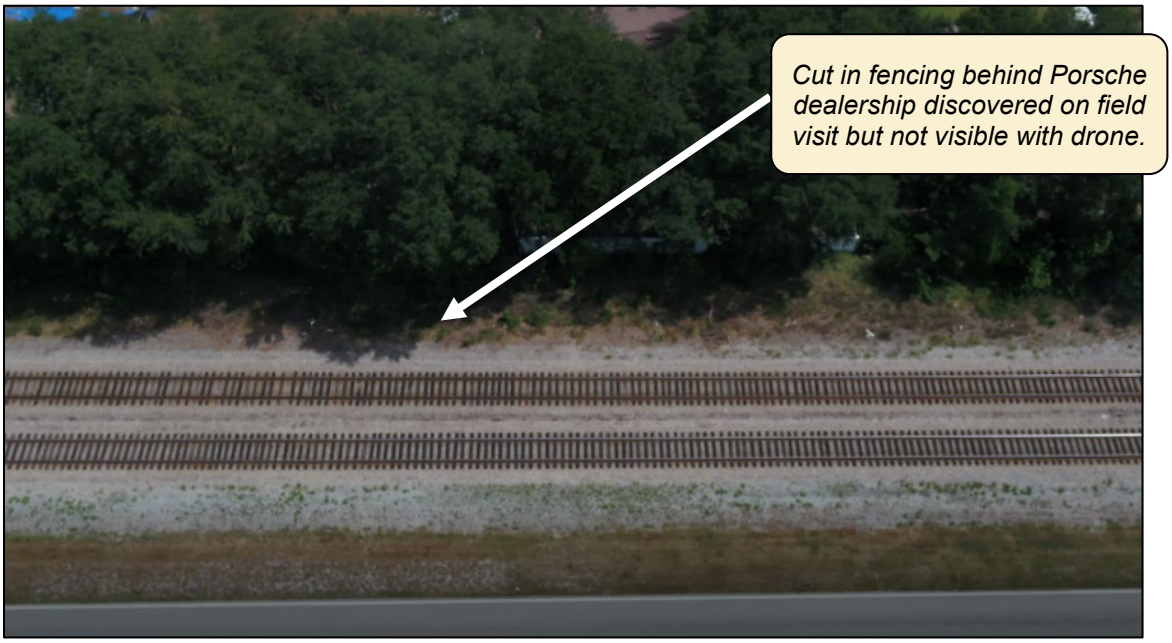
However, there are several limitations to the drone survey. Using drones on a railroad right-of-way needs approval from the Federal Aviation Administration (FAA) and local authorities. FAA regulations require drone teams to include one pilot and one observer. Every few hours, drones are landed for battery replacement. The drones used at night require infrared systems, lights, and night-time waivers from local authorities.

The lessons learned from the drone flight determined that:

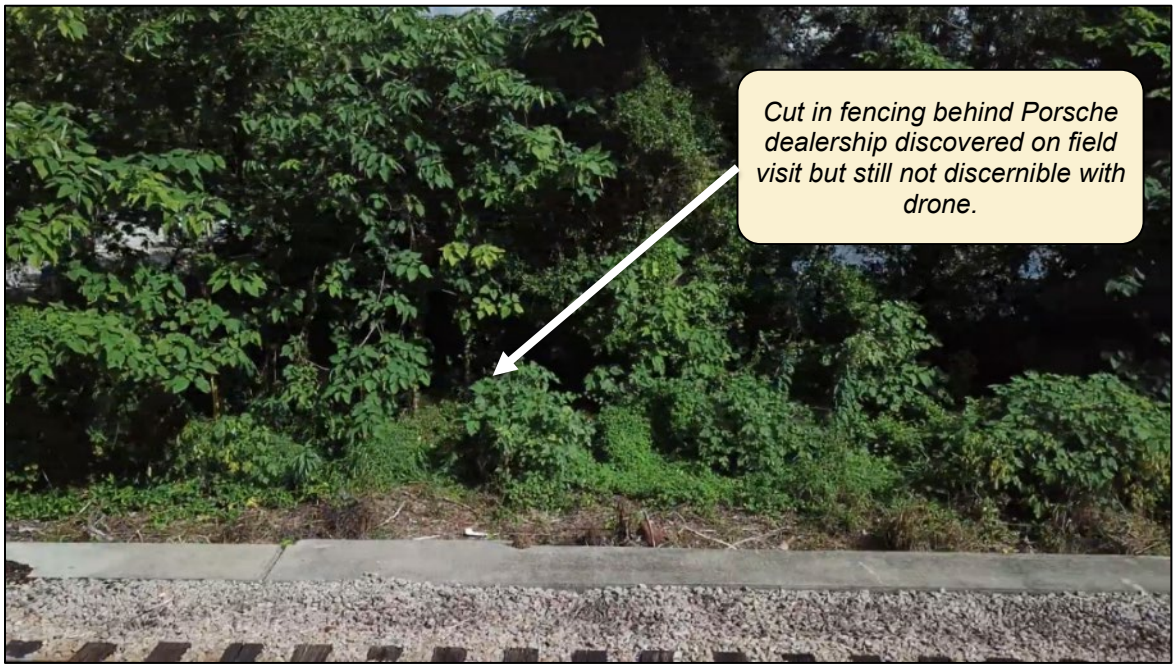
- Elevation affects ability to analyze for trespassing indicators and requires “Boots on the Ground” verification;
- Time of day, weather, and geography affect quality and accessibility;
- Level of effort needs extensive mission planning; and
- Safety regulation approvals with the FAA need to be considered.

Examples of imagery from the first drone run (high elevation):





Examples of imagery from the second drone run (low elevation):



Findings and Recommendations on the CFRC

The following findings and recommendations should be implemented as a result of the Pilot Program:

Topic	Finding	Recommendation	Responsibility
Data	CFRC Data is sparce regarding race and toxicology.	CFRC to commence tracking of race and toxicology results for trespassing Incidents.	CFRC/SunRail Safety
Law Enforcement Strategies	Law Enforcement would like to focus on trespassing outreach and then conduct enforcement.	CFRC to partner with Law Enforcement on outreach in the Pilot Area. Since CFRC does not have its own Police Force, the enforcement program will be evaluated and measured as to its effectiveness and submitted to FDOT. FRA and OLI Law Enforcement training aids will be implemented.	Trespass Team and CFRC/SunRail
Conceptual Designs	Conceptual designs to a pilot.	Consider taking most feasible conceptual design to a pilot. This work will be shared with FRA and TRB.	Trespass Team
Outreach	Homeless Institutions require focused campaign.	Focus on adult outreach.	Trespass Team and CFRC/SunRail
Task Force Findings	Evaluate input from task force members.	Implement recommendations from Task Force and incorporate into conceptual plans and outreach.	Trespass Team
Local Codes	Evaluate local codes for adjacent landowners to the CFRC.	Work with city and county zoning departments to prepare requirements for landowners to include buffers and other deterrents from the CFRC.	CFRC/SunRail Safety
Signage	Existing “No Trespassing” signage lacks visuals, bilingual text and reference to state statute for trespassing violations.	Install new Trespassing signage that includes visuals, bilingual text and reference to state statute for trespassing violations.	CFRC/SunRail
Trepassing on Private Property	Illegal use of adjoining properties.	It is recommended that the owners be notified of the illegitimate use of their properties by rail trespassers and be asked to police their properties accordingly.	HNTB Landscaping Specialist

Topic	Finding	Recommendation	Responsibility
Enforcement Needs Improvement	Failure to prosecute trespassers by local judicial process.	Implement system to to prosecute trespassers by local judicial process.	FDOT Legal
Community Planning Needs Improvement	Origin-destination issues not acknowledged during the planning process when constructing development.	Work with urban planners to address pedestrian connectivity around the CFRC.	HNTB Landscaping Specialist
Trespasser Reporting	Ability for neighbors, the public and customers to report trespassers to the CFRC Dispatchers needs improvement. Suggested by law enforcement in the Rail Trespass Task Force meeting.	Create a module in the existing SunRail computer app to report trespassing activity.	CFRC/SunRail Safety

08

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